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Diagnosing ADHD during active substance use: Feasible or flawed?

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ABSTRACT

Background: Attention Deficit Hyperactivity Disorder (ADHD) is highly prevalent in patients with a substance use disorder (SUD). Because of possible problems with validity, diagnostic assessment of ADHD is usually postponed until after a period of abstinence, which may jeopardize adequate and timely treatment. The aim of this study is to investigate how a diagnostic assessment of ADHD in patients who are actively using substances compares to the results of a second assessment after a period of full or partial abstinence.

Methods: Prospective test-retest study in a SUD treatment center among 127 treatment seeking adult SUD patients with a comorbid diagnosis of adult ADHD. Conners' Adult ADHD Diagnostic Interview for DSM-IV was administered at intake and after four SUD treatment sessions.

Results: The mean time interval between intake and retest assessment was 78 days (SD = 32; range 31–248). At the second ADHD assessment, substance use had decreased to about 50% of baseline consumption. Of the 127 patients with an initial diagnosis of ADHD, 121 patients (95.3%) still fulfilled DSM-IV adult ADHD criteria at re-diagnosis. Subtyping of ADHD was less stable (Cohen's Kappa = 0.53). Agreement on the number of childhood and adult ADHD symptoms between both assessments was good (intraclass correlation coefficient of 0.69 and 0.65, respectively). Sensitivity analyses in subgroups of patients who were fully abstinent during the second assessment yielded very similar results.

Conclusions: These findings strongly suggest that a pragmatic approach, in which patients are evaluated for ADHD even when they are not (yet) abstinent, is feasible and justifiable.

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is highly prevalent in treatment seeking patients with a substance use disorder (SUD). A meta-analysis estimated the mean prevalence of ADHD in treatment seeking SUD patients at 23.1% (van Emmerik-van Oortmerssen et al., 2012). An international multi-center study among 3558 treatment seeking SUD patients found that ADHD prevalence was associated with country and type of substance, with a higher ADHD prevalence in subjects using drugs compared to alcohol (Van de Glind et al., 2014). In general, SUD patients with ADHD constitute a subgroup with more serious problems; e.g., they use more substances and are more frequently hospitalized (Arias et al., 2008). ADHD in SUD patients is also related to other comorbidities, such as borderline personality disorder, antisocial personality disorder and mood disorders (van Emmerik-van Oortmerssen et al., 2014; Wilens et al., 2005) anxiety disorders (Wilens et al., 2005) and childhood trauma (Konstenius et al., 2017).

Since common genetic (Arcos-Burgos et al., 2012) and neurobiological (Frodl, 2010) characteristics may be at the root of both SUD and ADHD, one could argue that treatments of both disorders could be combined. This is especially important because symptoms of untreated ADHD such as poor concentration and impulsivity interfere with substance treatment engagement and may lead to poorer substance treatment outcomes (Ercan et al., 2003). Similar to integrated treatments for other comorbidities (e.g., Seeking Safety (Najavits and Hien, 2013) or COPE (Back, 2010) for integrated treatment of SUD and PTSD), an integrated CBT treatment for patients with co-occurring ADHD and SUD has recently been developed (van Emmerik-van Oortmerssen et al., 2013).

When patients are to be allocated to integrated treatments, a practical problem emerges. In SUD patients, the diagnostic assessment of ADHD is complicated by the effects of drug intoxication or withdrawal

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which may either cause or suppress ADHD symptoms such as agitation, impulsive behaviors, concentration difficulties or restlessness (Fatseas et al., 2012). This is why some authors advise to perform an ADHD assessment only after a period of abstinence (Milin et al., 1997). Others argue that prolonged abstinence is often not feasible and advocate a careful examination of symptoms during past periods of abstinence or prior to the onset of the substance use (Mariani and Levin, 2007). There are studies suggesting that psychiatric symptoms in general and ADHD symptoms more specifically may vary as a function of substance use, with evidence of both increases and decreases of symptoms during reduced substance use. In a study monitoring psychiatric symptoms during SUD treatment, 13% of the patients reported a worsening of psychiatric symptoms during SUD treatment (Ilgen and Moos, 2006). More specifically, in a trial investigating the efficacy of atomoxetine in adults with ADHD and SUD, post-hoc analyses revealed that relapse to alcohol abuse correlated significantly with worsening of ADHD symptoms, but only in the placebo group (Wilens et al., 2011). However, empirical evidence regarding the optimal timing of the evaluation of ADHD is lacking. In clinical practice, a period of abstinence is often preferred and the ADHD assessment is generally postponed until well after the start of the SUD treatment. However, given the recommendations to treat both disorders integrated and simultaneously, ADHD should ideally be identified in an earlier stage (Matthys et al., 2013).

To the best of our knowledge, there are no studies to date comparing the results of a diagnostic assessment of ADHD during active substance use and after a period of reduced consumption or abstinence. The current study therefore aims to clarify this issue, addressing three questions:

- Is a diagnosis of adult ADHD obtained at intake during active substance use confirmed after a period of abstinence?
- Is the number of adult ADHD symptoms stable over both assessments?
- Is the ADHD subtype stable over both assessments?

2. Methods

2.1. Participants

All participants were adult outpatients of the Jellinek Addiction Treatment Center, located in Amsterdam, the Netherlands. They all met DSM-IV criteria for a SUD established with the Composite International Diagnostic Interview (CIDI vs 2.1) (World Health Organization, 1997). All participants were recruited to take part in a randomized controlled trial (RCT) concerning the efficacy of a new integrated cognitive behavioral treatment for comorbid SUD and ADHD (van Emmerik-van Oortmerssen et al., 2013). They were all screened for the presence of ADHD with the ASRS-v1.1 (Kessler et al., 2005), and patients with a positive screen received a diagnostic assessment for ADHD (see below for measure). Patients with a diagnosis of DSM-IV ADHD, persisting in adulthood, were included in the RCT and in the current test-retest study. For the vast majority of participants, ADHD was first diagnosed in the current study, and many of them had not considered ADHD as a possible explanation for their symptoms earlier. As DSM5 became available only during the course of the study, DSM-IV criteria were maintained for the sake of consistency. Patients with a comorbid borderline personality disorder or a severe psychiatric disorder such as psychosis were excluded in the RCT, and only patients allocated to outpatient treatment were included. After four sessions of SUD treatment directed at abstinence and just before the start of the first treatment module directed at the treatment of the comorbid ADHD, all patients participating in the RCT were again assessed for the current presence of ADHD (the retest assessment). Between intake and retest, treatment was directed at SUD; ADHD was not targeted in this phase of treatment and the special integrated treatment of SUD and ADHD was only started if the ADHD diagnosis was confirmed during retest. Of the 184 patients who were diagnosed with SUD and ADHD at intake and started SUD treatment (July 2011–January 2016), 129 patients (70.1%) completed the four SUD therapy sessions and were successfully contacted for the retest. The other patients dropped out of the trial and also of the current study. The patients who dropped out had a lower educational level, had alcohol use problems instead of drug use disorder more often, and reported less substance use (van Emmerik-van Oortmerssen et al., 2017). Due to missing data of two patients, the total number of patients who participated in this study was 127.

The RCT from which the data of this study were drawn, has been reviewed and approved by the ethics committee of the Academic Medical Centre in Amsterdam. All participants signed informed consent.

2.2. Measures

The Conners' Adult ADHD Diagnostic Interview for DSM-IV (CAADID) (Epstein et al., 2000) was used for the ADHD diagnostic assessment at intake and at retest. This instrument was administered by a psychologist or a medical doctor specially trained in the administration of the CAADID; in each patient, the intake and retest assessments were performed by different interviewers. In the CAADID, information regarding all DSM-IV criteria for ADHD is systematically collected. In evaluating the criterion whether symptoms are better explained by another disorder, no additional formal questionnaires were used, but a clinical judgment was made. At both assessments, special attention was paid to examining ADHD symptoms in periods of no substance use, if possible, in order to distinguish between substance-induced symptoms and ADHD. Although guidelines on ADHD assessment (National Institute for Health and Care Excellence, 2008) emphasize the importance of collecting collateral information of a parent or other informant, we did not systematically include this information in the current study. This was mainly for practical reasons as many SUD patients have troubled, infrequent or non-existing relationships with their families. The Time Line Follow Back method (TLFB) (Sobell and Sobell, 2012) was used to collect information on substance use in the two months before intake and retest. From this instrument, we composed a variable 'Excessive substance use', defined as four or more standard drinks per day (women) or at least six standard drinks per day (men) in the case of alcohol, more than 1 joint per day in the case of cannabis, and/or any use of illicit drugs other than cannabis. In this way, we aimed to create a pragmatic variable which could be used for different substances at the same time. To avoid that e.g., using one standard drink of alcohol rendered the same value in this variable as using one whole gram of cocaine, we set different thresholds for defining excessive alcohol, cannabis, or other drug use according to severity.

2.3. Data analysis

The significance of the difference between substance use at intake and at retest was calculated using the non-parametric Wilcoxon signed-rank test. The percentage of confirmed ADHD cases at retest was used as a measure of stability of the ADHD diagnosis at intake. An intraclass correlation coefficient (ICC) was calculated to compare the total number of ADHD symptoms at intake and at retest. Finally, Cohen's kappa (κ) was used as a measure for the stability of ADHD subtypes.

All statistical analyses were conducted with SPSS v22.

3. Results

Of the 127 participants, the majority were male (85.0%), employed (71.7%) and single (62.2%), with a mean age at intake of 34.7 years (SD 8.8). The mean time interval between intake and retest assessment was 78 days (SD = 32, range 31–248). Only 11 patients (8.7%) used any ADHD medication at intake because they had received an ADHD

Table 1
Substance use at intake and retest (N = 127).

Primary substance of abuse (%)	At intake	At retest
Alcohol	46.5%	
Cannabis	26.8%	
Stimulants	23.6%	
other	3.1%	
Substance use in past 60 days (mean number of days, SD)	36.9 (21.1)	20.5 (18.3)*
Excessive substance use[a] in past 60 days (mean number of days, SD)	31.4 (21.8)	15.5 (17.0)*
Excessive substance use [a] in past week (mean number of days, SD)	2.9 (2.7)	0.9 (1.7)*

Data are given for primary substance only.

[a] Excessive use: For alcohol: at least four standard drinking units per day (women) or at least six standard drinking units per day (men). In the case of cannabis: more than 1 joint per day. In the case of other drugs: any use.

* $p < 0.001$, Wilcoxon signed-rank test for non-parametric data, comparing substance use at intake and at retest.

diagnosis earlier in their history and had started medication elsewhere; this medication situation was unchanged between intake and retest except for one patient who started medication.

At intake, alcohol was the most frequent primary substance of abuse (46.5%) followed by cannabis (26.8%), stimulants (23.6%) and other illicit drugs (3.1%). Table 1 presents information on substance use at intake and retest. At retest, days of excessive substance use in the last 60 days had decreased by about 50% and the mean number of days of excessive substance use in the past week had dropped from 2.9 at intake to 0.9 at retest. The differences between substance use at intake and at retest were statistically significant ($p < 0.001$). At retest, 72 patients (56.7%) reported being abstinent from their primary substance of abuse for at least one week; three of them had already been abstinent from their primary substance of abuse at intake as well, the remaining 69 patients (54.3%) were considered active substance users at intake and abstinent at retest and were analyzed separately in one of the four sensitivity analyses looking at ADHD stability. As 81.1% of the patients used more than one substance at intake, it is important to take any other substances into consideration as well. At retest, 40 patients (31.5%) reported being abstinent from all substances over the last week; they all reported active substance use at intake and were used in the second sensitivity analysis. 25 patients (19.7%) reported zero days of excessive use of the main substance of abuse in the past 60 days; 23 of them (18.1%) reported active use of their primary substance at intake and were analyzed in a third sensitivity analysis. Only 14 patients (11.0%) reported zero days of excessive use of any substance in the past 60 days. They all reported active use of at least one substance at intake, and were also analyzed in a sensitivity analysis.

Of the 127 SUD patients with adult ADHD at intake, 121 (95.3%) still fulfilled criteria of adult ADHD at retest. Of the six patients who did not meet ADHD criteria at retest, three patients did not endorse sufficient symptoms in childhood, one patient did not endorse sufficient symptoms in adulthood, one did not reach symptom threshold in childhood and adulthood, and for one patient, ADHD symptoms were better explained by the presence of another disorder. Intraclass correlation coefficients (ICCs) for the total number of ADHD symptoms between intake and retest assessment were 0.69 for adult ADHD and 0.65 for childhood ADHD symptoms, indicating good agreement over time. However, ADHD subtypes were less stable over time (see Table 2): in 33 of the 121 patients (27.3%) with a diagnosis of adult ADHD at intake and at retest, the adult subtype changed between intake and retest assessment resulting in a κ of 0.53, indicating moderate stability over time. For the childhood ADHD subtype, stability was very similar with a κ of 0.51.

Sensitivity analyses were conducted in four subgroups of patients who had become abstinent between intake and retest. Although we aimed for all patients to become abstinent, in practice only a minority achieved this goal. Of the 69 patients who had become abstinent for their primary substance for at least one week, three did no longer meet ADHD criteria (95.7% diagnostic stability). The subtype of ADHD in adulthood changed in 27.3% of these patients between intake and retest ($\kappa = 0.51$). Of the 40 patients who had become abstinent for all substances for at least one week, only one did no longer meet ADHD criteria (97.5% diagnostic stability). The subtype of ADHD in adulthood changed in 18.0% of these patients between intake and retest ($\kappa = 0.66$). Of the 23 patients who had become abstinent for their primary substance for 60 days, two did no longer meet ADHD criteria (91.3% diagnostic stability). The subtype of ADHD in adulthood changed in 23.8% of these patients between intake and retest ($\kappa = 0.58$). Of the 14 patients who had been abstinent for all substances for 60 days, all 14 still met ADHD diagnostic criteria at retest. The ADHD subtype in adulthood changed in 21.4% of these patients ($\kappa = 0.63$). Stability of ADHD symptoms in these subgroups, as reflected by the ICC, was very similar to those in the total study population (Table 3).

4. Discussion

The current study shows that a diagnosis of adult ADHD made at intake in treatment seeking SUD patients who are actively using substances, is a valid indicator for the presence of ADHD at a second diagnostic interview performed after an extended period of reduced substance use or abstinence. We found high diagnostic stability (95.3%) and high symptom stability (ICC > 0.65) over time but ADHD subtypes were less stable across assessments in this population.

These findings should be evaluated against the background of previous findings on the stability of ADHD and the design of the current study. Unfortunately, there is only one study, in a non-SUD adult population, that has looked at the interrater reliability of the CAADID. Epstein and Kollins (2006) investigated the test-retest reliability in 30 ADHD patients who were assessed by two different trained interviewers with a time interval of three to four weeks and found acceptable agreement for childhood and adult ADHD ($\kappa = 0.69$ and $\kappa = 0.67$, respectively) with a higher agreement for adulthood ADHD if criterion B (age of onset) was excluded ($\kappa = 0.80$). It should be noted, however, that in the Epstein and Kollins study only 15 of the 30 patients initially met diagnostic criteria for adulthood ADHD and that in the current study retest interviewers knew that all patients had a diagnosis of adulthood ADHD at intake. Therefore, it is of interest to also look in more detail at the test-retest reliability of the number of ADHD symptoms in the current study, which was also good in our study. In our opinion, this is an important second indicator of stability of diagnosis over time.

The stability of the ADHD diagnosis over time and across substance use that we found implicates that there is no need to postpone the ADHD assessment in substance abusing patients. The advantage of assessing ADHD in an early phase of SUD treatment is that the treatment of ADHD can start earlier as well, which is important because patients might drop out along the way and miss the opportunity of ADHD treatment if it is withheld until a later stage of SUD treatment.

Despite the fact that different ADHD subtypes are defined in the DSM-IV, the validity of these subtypes in childhood and adulthood is controversial. In DSM-5, subtypes were removed and presentation styles have been included instead. Future studies should pay special attention to the stability of these presentation styles. Although there is some evidence supporting the validity of a distinction between the inattentive and combined subtypes (Adams et al., 2008; Woo and Rey, 2005), other studies claim that there is no compelling evidence that ADHD subtypes are different with regard to their neuropsychological profiles (Bernfeld, 2012). Willcutt et al. (2012) performed a meta-analytic review of 546 studies in samples of children, adolescents and adults to assess DSM-IV symptom dimensions and subtypes, and

Table 2
ADHD subtypes (adulthood) at intake and retest in patients with ADHD confirmed at retest (n = 121).

		ADHD subtype (adulthood) at retest			
ADHD subtype (adulthood)		Inattentive subtype	Hyperactive/impulsive subtype	Combined subtype	Total number
at intake	Inattentive subtype	50 (41.3%)	2 (1.7%)	5 (4.1%)	57 (47.1%)
	Hyperactive/impulsive subtype	6 (5.0%)	3 (2.5%)	6 (5.0%)	15 (12.4%)
	Combined subtype	9 (7.4%)	5 (4.1%)	35 (28.9%)	49 (40.5%)
	Total number	65 (53.7%)	10 (8.3%)	46 (38.0%)	121 (100%)

Note: Kappa for adulthood ADHD subtype = 0.53; Kappa for childhood ADHD subtype (not in the table) = 0.51.

Table 3
Intraclass correlation coefficient of the number of ADHD symptoms, comparing intake and retest, in adulthood and childhood (N = 127), and in abstinent subgroups.

	Intra class correlation	95% confidence interval
All patients (n = 127)		
Adulthood ADHD symptoms	0.69	0.59–0.77
Childhood ADHD symptoms	0.65	0.54–0.74
Abstinent subgroup primary substance of abuse 1 week (n = 69)		
Adulthood ADHD symptoms	0.74	0.61–0.83
Childhood ADHD symptoms	0.63	0.46–0.75
Abstinent subgroup all substances 1 week (n = 40)		
Adulthood ADHD symptoms	0.76	0.58–0.86
Childhood ADHD symptoms	0.66	0.44–0.81
Abstinent subgroup primary substance of abuse 60 days (n = 23)		
Adulthood ADHD symptoms	0.67	0.37–0.85
Childhood ADHD symptoms	0.67	0.37–0.85
Abstinent subgroup all substances 60 days (n = 14)		
Adulthood ADHD symptoms	0.69	0.27–0.89
Childhood ADHD symptoms	0.81	0.52–0.94

Note: Single measures analyses are reported. Two-way mixed effects model where people effects are random and measures effects are fixed.

concluded that there is only weak evidence for the validity of the hyperactive/impulsive subtype after first grade. They also found minimal support for the distinction between the inattentive and combined subtypes in studies of etiological influences, academic and cognitive functioning and treatment response. However, none of the included studies reported test-retest reliability estimates for the ADHD subtypes over periods of less than one year. Data on the stability in time of ADHD subtypes are scarce and have focused on the transition from childhood to adulthood; in general, they show marked longitudinal instability of ADHD subtypes (Willcutt et al., 2012) (based on five studies in the meta-analysis, with follow-ups from five to nine years) with a greater persistence of inattentive than hyperactive/impulsive childhood symptoms of ADHD in adulthood (Kessler et al., 2010). In a study by Srebnicki et al. (2013) on a six-year follow up of 101 children with ADHD, a considerable change in subtype was also observed.

Considering these literature findings, our finding that the ADHD subtype changed between intake and retest in 27% of the patients, may therefore not necessarily reflect an actual change of ADHD-like symptoms caused by (changes in) substance use, but can also be accounted for by inter-rater differences or by instability of the ADHD subtypes per se, both of which have been reported in non-SUD populations. This hypothesis is corroborated by the fact that sensitivity analyses in an abstinent subgroup provided similar test-retest results.

The current study has both strengths and limitations. The most important strengths are the relatively large sample size and the careful assessment of ADHD in this representative population of treatment seeking SUD patients in regular SUD care. The study also has limitations. First, most patients were not fully abstinent at retest. However, in a series of sensitivity analyses we found that test-retest findings were very similar for patients who were and those who were not fully abstinent of the primary substance of abuse or even of all substances. Second, in some patients, despite the mean interval of 78 days between the intake and retest assessment, there was some overlap between the last 60 days before retest and the last 60 days before intake that were used to assess substance use. This applies to 42 patients, who had their retest assessment within 60 days after intake, which resulted in some overlap of the two assessments ranging from one day to a maximum of 29 days. However, there generally was a substantial change in substance use between intake and retest, and the current stability data clearly indicate that an ADHD diagnosis can reliably be made during a period of active substance abuse. Furthermore, it also illustrates that full abstinence is not easily reached, also in treatment seeking SUD patients which underlines the clinical relevance of our findings. Third, no informant data were available due to practical reasons. This is an important limitation since self- report can be unreliable. For example, a study by Sibley et al. (2012) demonstrated that young adults without ADHD tended to overreport current symptoms while young adults with ADHD tended to underreport their symptoms. It is unclear to what extent this may have affected our test-retest reliability results, but our conclusions should be viewed with caution. Fourth, as mentioned in the methods section, DSM-IV criteria were used for diagnosing ADHD. However, in DSM-5 some important changes were introduced: (1) the age of onset criterion was changed from 'prior to the age of 7 years' to 'prior to the age of 12 years old'; and (2) the threshold for the number of symptoms in adulthood was changed from 6 to 5. It cannot be excluded that these changes have affected our results. However, in a previous paper we have shown that the prevalence of DSM-IV and DSM-5 ADHD in treatment-seeking SUD patients was very similar (Van de Glind et al., 2014). Finally, in the current study only the stability of the presence, not the absence, of ADHD at intake was examined and therefore no conclusions can be drawn on the stability of the absence of ADHD in actively substance abusing SUD patients. However, in a recent study, it was shown that screening for ADHD in SUD treatment-seeking patients with the ASRS-v1 (the screener that was also used in our recruitment procedure) two weeks before and at the time of the diagnostic assessment of ADHD with the CAADID, resulted in very similar sensitivities of the ASRS-v1 (0.84 and 0.88, respectively) with only 3.4% false negatives of the screener two weeks before the diagnostic assessment with the CAADID (Van de Glind et al., 2013). Although no information was provided about the changes in substance use between both time points and although it is not clear how many patients had become abstinent, these results suggest that the risk of missing an ADHD diagnosis due to the suppression of ADHD symptoms during substance use is probably very small. We therefore think that our data are a good approximation of the real diagnostic stability of ADHD in treatment-seeking SUD patients. It is unclear, however, whether these data are generalizable to non-treatment-seeking SUD patients. However, in the earlier mentioned meta-analysis (van Emmerik-van Oortmerssen et al., 2012) ADHD prevalence was not affected by treatment-seeking status and we have no clear indications that the process of diagnostic assessment would be different in a community sample. In fact, it is likely that none-treatment seeking people with a SUD are generally less severely afflicted and that change in substance use over time is less pronounced than in treatment seeking SUD patients. Therefore, we expect that test-retest reliability of the ADHD diagnosis in this population might even be higher than in our treatment seeking study population.

Further research on this topic could include a similar design but

with inclusion of patients without ADHD at baseline, with evaluators at retest who are blind to ADHD diagnostic status at baseline, and with inclusion of other informants to obtain more reliable information. Additional data on the stability of an ADHD diagnosis in ADHD patients without SUD is warranted as well.

We conclude that ADHD can be reliably diagnosed during active substance use and that doubts about the diagnostic stability should not be used as a justification to postpone diagnostic assessment and thereby prevent an early integrated treatment of SUD and ADHD. A second conclusion is that this study also found that ADHD subtypes are less stable over a short period of time, which is in line with findings from studies in non-SUD populations that have done re-assessments over much longer time intervals.

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The data presented here were collected within the framework of a randomized controlled trial (RCT) to test the efficacy of the integrated treatment for adult treatment seeking SUD patients with comorbid ADHD. The RCT was supported by Fonds NutsOhra, project number 1001-036. The funding body had no role in study design, in the collection, analysis and interpretation of the data, in the writing of the report, and in the decision to submit the article for publication.

Contributors

KVE, RS, WvdB and EV designed the study. KvE and FK managed data collection. Analyses were performed by KvE and MK. KvE, RS and WvdB led the drafting of the manuscript. EV and FK revised the manuscript. All authors contributed to and approved of the final version of this manuscript.

Conflict of interest

No conflict declared.

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References

Adams, Z.W., Derefinko, J., Milich, R., Fillmore, M.T., 2008. Inhibitory functioning across ADHD subtypes: recent findings, clinical implications, and future directions. Dev. Disabil. Res. Rev. 14, 268–275.

Arcos-Burgos, M., Vélez, J.I., Solomon, B.D., Muenke, M., 2012. A common genetic network underlies substance use disorders and disruptive or externalizing disorders. Hum. Genet. 131, 917–929.

Arias, A.J., Gelernter, J., Chan, G., Weiss, R.D., Brady, K.T., Farrer, L., Kranzler, H.R., 2008. Correlates of co-occurring ADHD in drug-dependent subjects: prevalence and features of substance dependence and psychiatric disorders. Addict. Behav. 33, 1199–1207.

Back, S.E., 2010. Toward an improved model of treating co-occurring PTSD and substance use disorders. Am. J. Psychiatry 167, 11–13.

Bernfeld, J., 2012. ADHD and factor analysis: are there really three distinct subtypes of ADHD? Appl. Neuropsychol. Child 1, 100–104.

Epstein, J.N., Kollins, S.H., 2006. Psychometric properties of an adult ADHD diagnostic interview. J. Atten. Disord. 9, 504–514.

Epstein, J.N., Johnson, D., Conners, C.K., 2000. Conners' Adult ADHD Diagnostic Interview for DSM-IV. Multi-Health Systems Inc, North Tanawanda, New York.

Ercan, E.S., Coskunol, H., Varan, A., Toksoz, K., 2003. Childhood attention deficit/hyperactivity disorder and alcohol dependence: a 1-year follow-up. Alcohol Alcohol. 38, 352–356.

Fatseas, M., Debrabant, R., Auriacombe, M., 2012. The diagnostic accuracy of attention-deficit/hyperactivity disorder in adults with substance use disorders. Curr. Opin. Psychiatry 25, 219–225.

Frodl, T., 2010. Comorbidity of ADHD and substance use disorder (SUD): a neuroimaging perspective. J. Atten. Disord. 14, 109–120.

Ilgen, M.A., Moos, R.H., 2006. Exacerbation of psychiatric symptoms during substance use disorder treatment. Psychiatr. Serv. 57, 1758–1764.

Kessler, R.C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M.J., Jin, R., Secnik, K., Spencer, T., Ustun, T.B., Walters, E.E., 2005. The world health organization adult ADHD self-report scale (ASRS): a short screening scale for use in the general population. Psychol. Med. 35, 245–256.

Kessler, R.C., Green, J.G., Adler, L.A., Barkley, R.A., Chatterji, S., Faraone, S.V., Finkelman, M., Greenhill, L.L., Gruber, M.J., Jewell, M., Russo, L.J., Sampson, N.A., van Brunt, D.L., 2010. Structure and diagnosis of adult attention-deficit/hyperactivity disorder: analysis of expanded symptom criteria from the Adult ADHD Clinical Diagnostic Scale. Arch. Gen. Psychiatry 67, 1168–1178.

Konstenius, M., Leifman, A., van Emmerik-van Oortmerssen, K., van de Glind, G., Franck, J., Moggi, F., Ramos-Quiroga, J.A., Levin, F.R., Carpentier, P.J., Skutle, A., Bu, E.T., Kaye, S., Demetrovics, Z., Bart, a.C., Auriacombe, M., Fatséas, M., Johnson, B., Faraone, S.V., Allsop, S., Carruthers, S., Schoevers, R.A., Verspreet, S., Dom, G., Koeter, M.W., van den Brink, W., 2017. Childhood trauma exposure in substance use disorder patients with and without ADHD. Addict. Behav. 65, 118–1124.

Mariani, J.J., Levin, F.R., 2007. Treatment strategies for co-occurring ADHD and substance use disorders. Am. J. Addict. 16 (Suppl. 1), 45–54.

Matthys, F., Joostens, P., van den Brink, W., Sabbe, B., 2013. Summary of the practice guideline for the diagnosis and treatment of ADHD in adolescents and adults with addictions. Ned. Tijdschr. Geneeskd. 157, A6025.

Milin, R., Loh, E., Chow, J., Wilson, A., 1997. Assessment of symptoms of attention-deficit hyperactivity disorder in adults with substance use disorders. Psychiatr. Serv. 48, 1378–1380 (1395).

Najavits, L.M., Hien, D., 2013. Helping vulnerable populations: a comprehensive review of the treatment outcome literature on substance use disorder and PTSD. J. Clin. Psychol. 69, 433–479.

National Institute for Health and Care Excellence, 2008. Clinical Guideline Attention Deficit Hyperactivity Disorder: Diagnosis and Management. [WWW Document] https://www.nice.org.uk/guidance/CG72 (Accessed 25 July 2017).

Sibley, M.H., Pelham Jr., W.E., Gnagy, E.M., Waxmonsky, J.G., Waschbusch, D.A., Derefinko, K.J., Garefino, A.C., Molina, B.S., Wymbs, B.T., Babinski, D.E., Kuriyan, A.B., 2012. When diagnosing ADHD in young adults emphasize informant reports, DSM items, and impairment. J. Consult. Clin. Psychol. 80, 1052–1061.

Sobell, L.C., Sobell, M.B., 2012. Timeline Follow-Back: a technique for assessing self-reported ethanol consumption. In: Allen, J., Litten, R.Z. (Eds.), Measuring Alcohol Consumption: Psychosocial and Biochemical Methods. Humana Press, Totowa, pp. 41–72.

Srebnicki, T., Kolakowski, A., Wolanczyk, T., 2013. Adolescent outcome of child ADHD in primary care setting: stability of diagnosis. J. Atten. Disord. 17, 655–659.

Wilens, T.E., Kwon, A., Tanguay, S., Chase, R., Moore, H., Faraone, S.V., Biederman, J., 2005. Characteristics of adults with attention deficit hyperactivity disorder plus substance use disorder: the role of psychiatric comorbidity. Am. J. Addict. 14, 319–327.

Wilens, T.E., Adler, L.A., Tanaka, Y., Xiao, F., D'Souza, D.N., Gutkin, S.W., Upadhyaya, H.P., 2011. Correlates of alcohol use in adults with ADHD and comorbid alcohol use disorders: exploratory analysis of a placebo-controlled trial of atomoxetine. Curr. Med. Res. Opin. 27, 2309–2320.

Willcutt, E.G., Nigg, J.T., Pennington, B.F., Solanto, M.V., Rohde, L.A., Tannock, R., Loo, S.K., Carlson, C.L., McBurnett, K., Lahey, B.B., 2012. Validity of DSM-IV attention deficit/hyperactivity disorder symptom dimensions and subtypes. J. Abnorm. Psychol. 121, 991–1010.

Woo, B.S., Rey, J.M., 2005. The validity of the DSM-IV subtypes of attention-deficit/hyperactivity disorder. Aust. N.Z. J. Psychiatry 39, 344–353.

World Health Organization, 1997. Composite International Diagnostic Interview (CIDI) (version 2.1). WHO-CIDI, Training en Referentie centrum, Psychiatrisch Centrum APC, Amsterdam.

van Emmerik-van Oortmerssen, K., van de Glind, G., van den Brink, W., Smit, F., Crunelle, C.L., Swets, M., Schoevers, R.A., 2012. Prevalence of attention-deficit hyperactivity disorder in substance use disorder patients: a meta-analysis and meta-regression analysis. Drug Alcohol Depend. 122, 11–19.

van Emmerik-van Oortmerssen, K., Vedel, E., Koeter, M.W., de Bruijn, K., Dekker, J.J.M., van den Brink, W., Schoevers, R.A., 2013. Investigating the efficacy of integrated cognitive behavioral therapy for adult treatment seeking substance use disorder patients with comorbid ADHD: Study protocol of a randomized controlled trial. BMC Psychiatry 13 (132).

van Emmerik-van Oortmerssen, K., van de Glind, G., Koeter, M.W., Allsop, S., Auriacombe, M., Barta, C., Bu, E.T., Burren, Y., Carpentier, P.J., Carruthers, S., Casas, M., Demetrovics, Z., Dom, G., Faraone, S.V., Fatseas, M., Franck, J., Johnson, B., Kapitány-Fövény, M., Kaye, S., Konstenius, M., Levin, F.R., Moggi, F., Møller, M., Ramos-Quiroga, J.A., Schillinger, A., Skutle, A., Verspreet, S., IASP research group, van den Brink, W., Schoevers, R.A., 2014. Psychiatric comorbidity in treatment-seeking substance use disorder patients with and without attention deficit hyperactivity disorder: results of the IASP study. Addiction 109, 262–272.

van Emmerik-van Oortmerssen, K., Vedel, E., Kramer, F.J., Blankers, M., Dekker, J.J.M., van den Brink, W., Schoevers, R.A., 2017. Integrated Cognitive Behavioral Therapy for ADHD in Adult Patients Who Also Have a Substance Use Disorder: Results of a Randomized Clinical Trial. submitted for publication.

Van de Glind, G., Konstenius, M., Koeter, M.W., van Emmerik-van Oortmerssen, K., Carpentier, P.J., Kaye, S., Degenhardt, L., Skutle, A., Franck, J., Bu, E.T., Moggi, F., Dom, G., Verspreet, S., Demetrovics, Z., Kapitány-Fövény, M., Fatséas, M., Auriacombe, M., Schillinger, A., Møller, M., Johnson, B., Faraone, S.V., Ramos-Quiroga, J.A., Casas, M., Allsop, S., Carruthers, S., Schoevers, R.A., Wallhed, S., Barta, C., Alleman, P., Levin, F.R., van den Brink, W., IASP Research Group, 2014. Variability in the prevalence of adult ADHD in treatment seeking substance use disorder patients: results from an international multi-center study exploring DSM-IV and DSM-5 criteria. Drug Alcohol Depend. 134, 158–166.

Van de Glind, G., Van den Brink, W., Koeter, M.W., Carpentier, P.J., van Emmerik-van Oortmerssen, K., Kaye, S., et al., 2013. Validity of the Adult ADHD Self-Report Scale (ASRS) as a screener for adult ADHD in treatment seeking substance use disorder patients. Drug Alcohol Depend. 132, 587–596.