ASSESSMENT OF PSYCHOPATHOLOGY AND PERSONALITY WITH THE MMPI-2 IN PATIENTS WITH ALCOHOL USE DISORDER (AUD): SHOULD WE NOT CORRECT FOR ASSOCIATED COGNITIVE DYSFUNCTIONS?

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Abstract

Objective: Treatment planning for patients with Alcohol Use Disorder (AUD) is often preceded by the assessment of psychopathology and personality with the Minnesota Multiphasic Personality Inventory (MMPI-2). However, in the acute phase of abstinence, both physical and cognitive problems can cause temporary elevations on multiple clinical scales of the MMPI-2 resulting in inadequate interpretation and treatment planning. Over the past years, several correction procedures were developed to correct for these problems in different neurological disorders, but until this date, there are no published data available on correction procedures for AUD patients.

Method: Extensive literature search in Pubmed, Medline, and Psychinfo for the period from 1975 through 2011 resulted in thirty-five studies on MMPI (-2) correction procedures typically developed for neurological patient groups.

Results: Review of the literature demonstrates that, given the similarity of cognitive deficits in patients with AUD and in those with Traumatic Brain Injury (TBI), the use of an MMPI-2 neurocorrective procedure may be helpful to avoid over-interpretation of psychopathology and personality profiles during the acute phase of abstinence and to formulate more adequate treatment planning.

Conclusions: Further empirical research should focus on the development and validation of such a neurocorrective procedure, that specifically addresses the alcohol-induced cognitive symptoms during the acute phase of withdrawal.

Key words: alcohol use disorder, alcohol dependence, cognitive dysfunctions, neurocognition, neurobehavioural correction, MMPI-2, psychopathology, personality.

Declaration of interest: none

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Introduction

It is common practice to assess emotional functioning in patients with Alcohol Use Disorders (AUD) and to use this information in the process of treatment design and planning. To this end, often, the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is applied. The MMPI-2 is internationally the most widely used self-report questionnaire for the assessment of personality and psychopathology (Butcher 2006). It is well known that individuals who enter substance abuse treatment centres, often experience emotional discomfort and distress as part of their multi-problem crisis. Such a crisis nearly always precedes admission to an addiction clinic (Becker 2003, Bartels et al. 2007, Schuckit 2009) and is associated with elevations on multiple clinical scales of the MMPI-2 (Forbey and Ben-Porath 2007).

During the process of abstinence, withdrawal of

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alcohol can lead to a variety of physical, emotional, and cognitive complaints. The physical symptoms disappear within days whereas the cognitive, emotional, and motivational deficits, caused by the neurotoxic effect of alcohol, tend to persist during several weeks after admission (e.g., Becker 2008).

Several reports of cognitive dysfunctions are found in patients with AUD, including deficits in memory, executive attention, planning, the processing of environmental feedback, working memory, and response inhibition (Goldstein et al. 2001, Scheurich 2005, Loeber et al. 2009). Also, a gradual decline of social and emotional functioning is described, for example in the studies on personality change by Bates, Barry, and Bowden (2002), and Scheurich (2005). This is in line with studies demonstrating the toxic effect of alcohol on brain functioning and adaptive behaviour in general (Allen et al. 1997, Moselhy et al. 2001, Crews et al. 2005, Davies et al. 2005, Kalivas and Volkow 2005, Oscar-Berman and Marinkovic 2007, Schuckit 2009).

To some extent, cognitive functions recover during abstinence (Mann et al. 1999, Martin et al. 2003, Sullivan and Pfefferbaum 2005, Manning et al. 2008). This recovery process can last up to several years (Bates et al. 2002, Fein et al. 2006). Withdrawal symptoms can influence the response pattern on self-report questionnaires in such a way that the level and pattern of scale-scores leads to clinical misinterpretation (Johnson-Greene et al. 2002). Dush and Keen (1995) found that over 30 days of abstinence, the overall elevation of MMPI clinical scales in AUD patients tended to decline and the profiles became less distinctive. This is in accordance with MMPI and MMPI-2 studies on patient groups with neurological deficits, where the influence of psychological disturbance leads to unreliable scores and wrong treatment indication (Alfano et al. 1993, Van Balen et al. 1997, Van Balen et al. 1999).

In order to deal with the influence of cognitive deficits on the MMPI, and later on the MMPI-2, several correction procedures were developed for different neurological disorders over the past years. These correction procedures are based on the identification of neurologically relevant items (NRI's), which refer to neurological symptoms, like attention problems, headache, nausea, physical discomfort, and loss of energy. These symptoms are also observed in AUD patients during abstinence (Becker 2008). Although there is a remarkable similarity between the neuropsychological profile of patients with chronic substance abuse and that of patients with mild traumatic brain injury (MTBI) (Lange et al. 2008), until this date, no studies on correction procedures in AUD patients were found, and no systematic research has been conducted to the use of MMPI-2 correction procedures in AUD patients during abstinence.

Therefore, the aim of this study is to review the clinical relevance of using correction procedures in AUD patients during the acute phase of abstinence. Given the long tradition of MMPI and MMPI-2 research in AUD patients, the most relevant findings on alcohol related profiles will be summarized first.

The MMPI -2 in the assessment of AUD patients

The MMPI-2 is a self-report questionnaire with 567 statements to be answered with True or False. The MMPI-2 can be administrated with individuals who are at least 18 years old and have at least a sixth grade level of reading ability. After scoring by hand or computer, the individual's profile can be compared with profiles from the normative sample (Butcher 2006). In the development of the MMPI-2, apart from the MacAndrew Alcoholism Scale Revised [MAC-R (MacAndrew 1965)] that was already part of the original MMPI, two novel substance abuse scales were added: the Addiction Potential Scale and the Addiction Admission Scale [APS; AAS (Weed et al. 1992)]. However, since our main focus is the correct assessment of psychopathology in AUD patients, the specific investigation of these alcoholism scales is beyond the scope of this article. For further reading, see Banken and Greene (2009).

Most of the MMPI and MMPI-2 studies investigate the clinical scales by their elevations and code types, as described by Graham (2006). Although it is clear that there is no unique alcohol personality in AUD patients (Banken and Greene 2009), code types are used to identify, in a quick way, AUD patients with similar treatment needs in improving treatment outcome (Allen 1996). Graham and Strenger (1988) found, in their review of the use of the MMPI in AUD patients, that the most consistent finding between alcoholic and non-alcoholic patients was a high score on clinical scale 4, which is quite stable over time, but not unique to AUD patients only. Egger and co-workers (2007) distinguished three types of alcohol dependence: (a) the antisocial, immature, risk-taking type; (b) the negativistic, alienated, schizoid type, and (c) the anxious, passive, introverted type. In this study it was pointed out, however, that such a distinction is not independent of other psychological and cognitive deficits during abstinence, for example inhibitory dysfunctions. On the other hand, a study with Korsakoff patients demonstrated low psychopathology and undisturbed personality patterns on their "flat" MMPI-2 profile, indicating the illusion of a problem free and well-adjusted patient group. The authors emphasized the need for further investigation into the lack of (illness) insight that accompanies several neuropsychiatric and neuropsychological phenomena (Egger et al. 2002).

Other studies identified the code type 2-4/ 4-2 (Schroeder and Piercy 1979, Graham and Strenger 1988, Johnson et al. 1992, Lesswing and Dougherty 1993, Donovan et al. 1998) indicating psychopathic deviation, acting out behaviour, and a negative treatment attitude. However, the MMPI was administered in the first two weeks after admission, where the influence of detoxification can affect its outcome. The latter is convincingly demonstrated in the study by Dush and Keen (1995) where the typologies of AUD patients directly after admission and after 30 days of treatment were investigated. The authors found a dramatic overall reduction in pathology on all clinical scales, with the exception of clinical scale 4. They concluded that the MMPI typology itself does not remain stable due to influence of treatment, detoxification over 30 days, the passage of time (from the crisis environment), and regression to the mean.

In short, during the acute phase of abstinence, the AUD patient is hampered by cognitive disturbances due to influence of withdrawal of alcohol, which in turn might be reflected on the MMPI-2 scales. It will take at least six weeks before there is a recovery of functioning to a somewhat stable level in AUD patients. Bates and co-workers (2002) found that the level of neuropsychological functioning will increase with the length of the abstinence period, because during such a

period, the brain will have time to regenerate (Geller 1991, Gazdzinski et al. 2008, Wobrock et al. 2009).

Method

An extensive literature search was performed in Pubmed, Medline, and Psychinfo for the period from 1975 through October 2011. On each of the combined search terms Alcohol AND Neurocorrection, Abstinence AND Neurocorrection, Alcohol AND Neurologically Relevant Items, Abstinence AND Neurologically Relevant Items, no articles were found. In the absence of such studies, the usefulness of existing MMPI-2 correction procedures, originally developed for neurological patient groups, is examined. Therefore, each of the combined search terms MMPI* AND Neurocorrection, MMPI* AND correction, MMPI* AND neurologically relevant items, MMPI* AND correction procedure, and MMPI* AND Neurologic were used to search the Psychinfo, Pubmed, and Medline database (see **table 1**).

Only studies on MMPI and MMPI-2 correction procedures, their clinical relevance, and studies that commented these procedures, were included. Studies on K-correction were excluded. Twenty-seven articles matched the criteria and eight studies were added by reference and citation analysis. A total of thirty-five articles were studied.

Table 1. *Search terms and hits in Pubmed, Psychinfo and Medline*

Search term	Pubmed	Psychinfo	Medline	
MMPI* AND neurocorrection	**2** (2)	**0** (2)	**2** (2)	
MMPI* AND correction	**13** (74)	**17** (67)	**11** (161)	
MMPI* AND Neurologically relevant items	**2** (3)	**2** (2)	**2** (3)	
MMPI* AND correction procedure	**7** (27)	**3** (15)	**3** (15)	
MMPI* AND neurologic	**9** (74)	**5** (71)	**7** (171)	
Remaining articles without overlap				27
Additional articles by reference and citation analysis				8
Total studied articles				35

Note. MMPI = Minnesota Multiphasic Personality Inventory. In parentheses the amount of articles, in bold the amount of articles who met the criteria of the current study.

Results

MMPI-2 and correction procedures

Baldwin (1952) was one of the first to apply a correction procedure in patients with Multiple Sclerosis (MS). MMPI items, which refer to neurological symptoms, were removed before scoring. In the development of correction procedures, different names were used for items, which refer to a neurological content. For convenience, the current study uses the term neurologically relevant items (NRI's). Besides the development of correction procedures in patients with MS (Meyerink et al. 1988, Nelson et al. 2003), procedures were developed in different patient groups, including epilepsy (Derry et al. 1997, Nelson et al. 2004), cerebrovascular disease (Gass 1992), stroke (Gass and Lawhorn 1991, Gass 1996), Spinal Cord Injury (SCI) (Kendall et al. 1978, Rodevich and Wanlass 1995, Barncord and Wanlass 2000), obstructive sleep apnea (Gale et al. 1999) and TBI (Alfano et al. 1990, Alfano et al. 1993, Cripe et al. 1995, Gass and Wald 1997, Van Balen et al. 1997). A correction procedure involves constructing a set of neurologically relevant items contained within existing personality or emotional scales that measures neurologic dysfunction. The effects of these NRI's are thus separated out and examined independently of emotional functioning. In this way, purer estimates of cognitive and emotional functioning can be obtained in groups of brain-damaged individuals (Nelson and Cicchetti 1995).

Correction procedures are available for both the MMPI, the MMPI-2, and the MMPI-2 short form. The procedures differ in the amount of a) NRI's that are endorsed; b) in the way these NRI's are selected, and c) how they are implemented in the scoring procedure.

Although several procedures have been developed for comparable patient groups, there are differences in the amount of NRI's that were identified (see **table 2**). For instance, in TBI patients, Alfano et al. (1990) identified 44 NRI's. In a follow up study, 13 NRI's were derived from these 44 NRI's (Alfano et al. 1993). Gass (1991) identified 14 and 15 NRI's for the MMPI-2 short form. Gass and Russell (1991) identified 42 NRI's, Artzy (in Brulot et al. 1997) identified 18 NRI's, and Van Balen et al. (1997) identified 24 NRI's. In using a correction procedure both the MMPI and the MMPI short form are used, explaining some of the differences in the amount of the NRI sets. However, the main difference is explained by the methodology used to identify items in both patients with TBI and patients with epilepsy, multiple sclerosis, stroke, and spinal cord injury.

Most of the correction procedures are based on the clinical experience of medical specialists, familiar with neurological patient groups. These specialists were asked to identify items in the MMPI booklet, which reflect neurologic symptoms that can be viewed as

Table 2. *Summary of MMPI-2 correction procedures and associated clinical scales*

Patient group	Authors	Number of NRI's	Method	Deleted/ prorated	Form	Affected clinical scales
Epilepsy	Derry et al. 1997	19	Empirical	Deleted	MMPI-2	1, 2, 3, 7, 8
Epilepsy	Nelson et al. 2004	25	Combined: statistical and empirical	Deleted	MMPI-2	1, 2, 3, 8
MS	Baldwin 1952	12	Empirical	Deleted	MMPI	1, 2, 3, 8
MS	Meyerink et al. 1988	30	Empirical	Deleted	MMPI	1, 2, 3, 8
MS	Nelson et al. 2003	19	Statistical	Deleted	MMPI-2	1, 2, 3, 8
SCI	Barncord and Wanlass 2000	49	Empirical	Deleted	MMPI-2	1, 2, 3, 7, 8
SCI	Kendall et al. 1978	10	Statistical	Deleted	MMPI	1, 2, 3, 4, 8
SCI	Rodevich and Wanlass 1995	28	Empirical	Deleted	MMPI-2	1, 2, 3, 7, 8
Stroke	Gass 1992	21	Statistical	Prorated	MMPI-2 short form	1, 2, 3, 7, 8
TBI	Alfano et al. 1990	44	Empirical	Deleted	MMPI	1, 2, 8
TBI	Alfano et al. 1993	13	Empirical	Deleted	MMPI	1, 2, 8
TBI	Artzy 1994	18	Statistical	Deleted	MMPI-2	
TBI	Gass and Russell 1991	42	Empirical	Prorated	MMPI	1, 2, 3, 7, 8
TBI	Gass 1991	14	Empirical	Prorated	MMPI-2 short form	1, 2, 3, 7, 8
TBI	Gass and Wald 1997	15	Statistical	Prorated	MMPI-2 short form	1, 2, 3, 7, 8
TBI	Van Balen et al. 1997	24	Empirical	Prorated	MMPI-2	1, 2, 3, 7, 8

Note. MMPI= Minnesota Multiphasic Personality Inventory, MS= Multiple Sclerosis, NRI= Neurologically Relevant Items, SCI= Spinal Cord Injury, TBI= Traumatic Brain Injury.

part of the illness. Based on the degree of agreement between the specialists, items were included in the correction procedure (Meyerink et al. 1988, Alfano et al. 1990, Gass and Russel 1991, Alfano et al. 1993, Rodevich and Wanlass 1995, Van Balen et al. 1997, Barncord and Wanlass 2000, Derry et al. 2002). There is a difference in the amount of specialists who were questioned, ranging from two (Meyerink et al. 1988, Derry et al. 1997, Barncord and Wanlass 2000, Derry et al. 2002) through 40 (Van Balen et al. 1997). Other authors used a statistical procedure to select NRI's by comparing the scores of neurological patients with the scores of a normative group. Items were only included in the procedure if they were statistically different. For instance, Kendall and colleagues (1978) used factor analysis to differentiate between SCI patients and a

matched non-hospitalised control group. Nelson and colleagues (2004) used a combined statistical and empirical procedure in order to enhance the validity of MMPI-2 in patients with epilepsy. In their study, a board-certified epileptologist analysed each MMPI-2 item and selected 15 items, which reflect the symptoms of epileptic seizures. The statistical procedure distinguished 13 items from epilepsy patients with normal controls. The combined statistical and empirical procedure identified 25 NRI's. In another study, in patients with MS, Nelson and colleagues (2003) used a procedure consistent with that used by Gass (1992) and Gass and Lawhorn (1991) in their MMPI-2 correction studies. This correction procedure involves the following steps: 1) identification of items endorsed by more than 25% of patients with MS; 2) statistical analysis to determine which items significantly differentiated patients with MS from controls, and 3) to determine item inter relatedness. The correction depends on the responses of the patient to the 14 items. As a result, the amount of items can vary, ranging from none to substantial. On the other hand, Artzy (in Brulot et al. 1997) compared item endorsement frequency of persons with closed head injuries with persons of the normative sample. Item responses frequencies were contrasted between normals and patients. Items that statistically discriminated between the normals and patients were included in the correction procedure. Sixty items were found, that differentiated between head injured patients and the normative group; Eighteen items differentiated between the head injured group and patients with chronic pain. In the development of this procedure, Artzy followed the "empirical keying" method of the MMPI to select the NRI's. However, in the application of such a procedure there is a chance that items are included in a correction procedure that statistically differentiate between groups, but have no relation to the theoretical construct being studied, as demonstrated by LaChapelle and Alfano (2005). This underscores the importance of a sound theoretical basis in obtaining the proper neurological items.

Another important finding is the way the correction procedures are implemented in the scoring procedure. In some studies on correction procedures, the NRI's must be deleted before scoring (Kendall et al. 1978, Alfano et al. 1990, Alfano et al. 1993, Artzy (in Brulot et al. 1997, Derry et al. 1997, Nelson et al. 2003, Nelson et al. 2004). Some authors recommend to score the MMPI twice, corrected and uncorrected, to specify the minimum and maximum limits for the patient on each of the affected scales (Kendall et al. 1978, Alfano et al. 1993). Van Balen et al. (1999) identified 24 NRI's, in TBI patients, by comparing the normative sample with the correction procedures rescored (NRI's scored in a pathological direction were rescored in the non pathological direction) and prorated (a statistical correction adopted from Gass and Russell (1991) to avoid overcorrection). In the NRI-prorated procedure, within each scale, the prorated raw score is estimated by (1) $NNe + (PNe \times NNe / NN)$
where NNe is the number of Non-NRI endorsements, PNe the patient's NRI endorsement, and NN the total number Non-NRI endorsements.
Although there is a broad variety of correction procedures in different patient groups, they correspond strongly to the way they act on the clinical scales. All correction procedures reduce the level of pathology on clinical scales 1, 2, and 8 to distinguish physical from psychological complaints, in order to make a more reliable diagnose regarding emotional disorders (see **table 2**). Most of the correction procedures reduce the level of pathology on clinical scales 1, 2, 3, 7, and 8, because these clinical scales contain the most neurological relevant items (Cripe 1989, Gass 1991).

Validity and clinical utility of the correction procedures

Since the development of MMPI correction procedures, several validity studies were published in order to evaluate its use in clinical practice. Several critiques pointed at the fact that these procedures assume the profiles of neurologic patients to be relative homogeneous, that correction procedures lack specificity for neurological impairment, and that they compromise the integrity of the MMPI as such (Cripe et al. 1995, Arbisi and Ben-Porath 1999, Edwards et al. 2003). Also, Greene et al. (1997) criticized the correction procedures for their poor empirical validity and advised clinicians to be cautious in using these sets of correction items until they have been validated empirically across several settings. Moreover, Cripe et al. (1995) suggest that any given item of the MMPI may be endorsed for a variety of reasons and that resulting scale elevations for two individuals can be the same for different reasons.

Replication studies, such as Dunn and Lees-Haley (1995) found that only 5 of the 14 NRI's, identified by Gass (1991), discriminated significantly between head-injured and non head- injured patients in a forensic setting. However, the correction effect is not clinical significant. Smith and Heilbronner (2000) used these NRI's in a sample of mild TBI patients in litigation and concluded that patients are more likely to endorse anxiety and cognitive disturbances early on after the injury. With time, they report fewer of these symptoms. This is in line with the findings that NRI's reflect acute neurologic symptoms that are likely to resolve following mild head injury (Rayls et al.1997, Rayls et al. 2000).

Glassmire et al. (2003) investigated three correction procedures (Alfano et al. 1993, Gass 1991, Gass and Wald 1997) on sensitivity and specificity. They found a strong sensitivity in discriminating Closed Head Injury (CHI) patients from normal individuals, but a poor specificity when discriminating CHI from psychiatric patients. These findings are not surprisingly, since in most psychiatric patients severe cognitive deficits are found. Brulot, Strauss, and Spellacy (1997) compared the correction procedures developed by Alfano (Alfano et al. 1993), Artzy (in Brulot et al. 1997), and Gass (Gass 1991) in patients with suspected head injury. The authors found that the NRI's lack discriminant validity. Edwards and colleagues (2003) compared three correction procedures (Meyerink et al. 1988, Alfano et al. 1990, Gass 1991) and concluded that these three correction procedures are not specific in distinguishing patients with closed head injury and psychiatric patients, it undermines the statistical integrity of the MMPI, and the meaning of scale elevations are less clear after correction. However, in 66% of their sample, no information is present regarding premorbid psychiatric functioning, or drug and alcohol abuse. Patients were administrated ranging from 1 month to 7 years following suspected head injury, while it is well known that the symptoms of acute neurologic consequences of mild head injury are likely to resolve after 3-6 months post injury (Rayls et al. 2000). In a replication study of the 44 NRI's identified by Alfano (Alfano et al. 1990), Hamilton et al. (1995) found evidence that these NRI's discriminate between neurological and non-

neurological groups. In addition, the authors suggest that in head-injured patients, emotional manifestations are more likely to be expressed in terms of cognitive, somatic, or behavioural dysfunction, caused by a lack of insight or other cognitive impairments resulting from brain damage, trouble expressing appropriate affect, decreased levels of arousal, or location of maximal damage. The latter implies that the danger of over scoring psychopathology in neurological patient groups remains when using the MMPI-2. This is in line with the recommendations of Hayes and Granello (2009), in their study with patients with MS, to score the MMPI-2 twice (with and without neurocorrections) to note differences that may be based on physical symptoms. Also, they recommend the use of a clinical interview that highlights MS symptoms to increase the effectiveness of MMPI-2 assessment in treatment planning.

Arbisi and Ben-Porath (1999) stated that, in order to obtain an accurate measure of psychopathology, the NRI's must be scored in a different direction (prorated). Also a cautious clinical application of the correction procedure is recommended, especially when using the MMPI-2 to assess the presence of affective disturbance following head injury. Therefore, the authors emphasize the importance of investigating the predictive validity of corrected and uncorrected profiles for the improvement of reliable and valid MMPI-2 assessment in neurological patient groups in the future.

Discussion

In clinical practice, the MMPI-2 can be a helpful instrument in the assessment of emotional functioning in patients with cognitive, emotional and motivational deficits and pre-existent personality factors (Arbisi and Ben-Porath 1999). However, during early abstinence, uncorrected MMPI-2 scales tend to reflect symptoms of withdrawal and cognitive recovery thus leading to overestimation of levels of psychopathology. Given the close similarity between TBI patients, in the early phase of recovery, and AUD patients, in the acute phase of abstinence, it is remarkable that, until now, no research has been conducted in which MMPI-2 typologies of AUD patients have been examined as to the validity of their interpretation when a neurobehavioural correction procedure would have been applied. This undocumented aspect of assessment in patients with AUD should be addressed in clinical research, particularly because both cognitive and emotional factors play an important role in the understanding of the patient's self-reported condition and of its course during abstinence.

The effects of abstinence and cognitive recovery on multiple scales of the MMPI-2, can easily lead to inadequate treatment planning, resulting in a more symptomatic approach. Such an approach (e.g. verbal group therapy for depression or anxiety, and long psychotherapeutic sessions) is inadequate because it ignores the underlying cognitive deficits during the acute phase of abstinence and increases the risk of drop-out (Crews 2005) even in apparently "clinically healthy" abstinent AUD patients (Davies et al. 2005). Allen (1996) concluded in his study, that repeating the MMPI during treatment, could assist in planning later treatment stages. He also recommends the delay of testing until the patients' condition has been stabilized after detoxification. This is in line with the findings of Dush and Keen (1995) where all clinical scales declined, except for clinical scale 4, over a period of 30 days of abstinence. Although one could argue that MMPI-2 assessment should be postponed until most symptoms are in remission, clinically, the early availability of information on psychological and socio-emotional functioning is of great importance to effective treatment design.

All this leads to the conclusion that detection of cognitive deficits is of major importance to the design of proper treatment strategies and to the maximisation of treatment outcome and not to rely on one measure only (Allen et al. 1997, Davies et al. 2005, Scheurich 2005). Currently, a forthcoming study on the effect of neurobehavioral correction on MMPI-2 profile configuration of patients with AUD, shows that uncorrected profiles in AUD patients tend to overestimate the levels of psychopathology; and underrate levels of disinhibitory behaviours and impulsive traits, leading to diagnostic drift and inadequate treatment planning (Walvoort et al. 2012). In this study, only the correction effects on the clinical scales were investigated. It is well known that the clinical scales have an item overlap and consist of demoralisation items. For instance, clinical scales 2 and 7 contain items to be related to anxiety, depression, and other emotional distress, assessing more demoralization than personality, psychopathology (Graham 2012). In order to avoid item overlap and to reduce demoralization, the MMPI-2 Restructured Clinical (RC) scales were developed (Tellegen et al. 2003). Recent studies of Van der Heijden and co-workers (Van der Heijden et al. 2008, Van der Heijden et al. 2010) indicate that the RC scales have a better internal consistency and a lower scale level intercorrelation than the clinical scales and as a result provide a higher density of information.

Another promising development in the assessment of AUD patients and neurological patients is the MMPI-2-RF. The MMPI-2-RF is shorter, is bases on the RC-scales and has several so-called Specific Problem scales, such as Malaise, Somatic complaints, and Neurological complaints. Recent research demonstrates meaningful relations between the MMPI-2-RF and the Temperament and Character Inventory (TCI) (Van der Heijden et al. in press), the Millon Clinical Multiaxial Inventory- III (Van der Heijden et al. 2012a), and in relation to DSM IV (Van der Heijden et al. 2012b). Until now, there are no studies on the impact of a correction procedure on the RC-scales or the other MMPI-2-RF scales. Validation studies are needed in order to justify this non-standard scoring procedure. This is of particular importance for forensic and litigation procedures, where clinicians are bound by standard assessment protocols. Future research on the interplay between personality and cognition and the aforementioned validation studies on the correction procedures are needed to thoroughly address this issue.

The current review stipulates that in the acute phase of abstinence, a correction procedure is necessary to avoid misinterpretation of complaints leading to inadequate treatment planning. Along with the withdrawal effects of alcohol, AUD patients also have problems in social cognition (self-awareness and illness insight) caused by the toxic effect of chronic alcohol use (Oscar-Berman and Marinkovic 2007). Recent evidence suggests that alcohol related impairments in emotional functions, may be observed when the cortico-limbic circuitry is unable to compensate for the hypo-activity of the amygdala, resulting in continued alcohol abuse and a wide array of behavioural problems including disinhibition, impulsivity, and interpersonal difficulties (Marinkovic et al. 2009).

In addition, other aspects of neuropsychological functioning will affect the clinical scales during

MMPI-2 administration, including understanding the MMPI-2 statements, the level of difficulty of the statements (e.g. double negatives), and reduced mental effort (e.g. sustained attention, working memory capacity, information processing speed, and decision making). Moreover, a study with a homogeneous group of Korsakoff patients, found deficits in a story comprehension task specifically caused by executive dysfunction (Oosterman et al. 2011). That cognitive dysfunction can influence self-report is also shown in a recent study with alcohol dependent patients by Lincoln and colleagues (Lincoln et al. 2011). They found impairments in the estimation and self-evaluation of past alcohol intake that could be attributed to verbal memory dysfunctions contingent upon chronic alcohol abuse. These studies suggest that AUD patients are both hampered by the somatic complaints and cognitive deficits during abstinence. Although it is clear that the somatic complaints "disappear" during abstinence (Becker 2008), the influence of the alcohol related cognitive deficits (e.g. executive functioning, social cognition and memory) on the MMPI-2 may be greater than expected.

Finally, this review adds to the hypothesis that, in order to acquire a sound diagnostic MMPI-2 profile in AUD patients, an MMPI-2 correction procedure is warranted. In developing such a correction procedure, the following steps will be required: First, a theoretical framework must be given, in which the correction items reflect the alcohol-induced cognitive deficits during abstinence. Second, the use of a pro-rated procedure is necessary in maintaining the statistical procedure of the test. Third, validation studies are needed to investigate the utility in clinical practice. Also, the development of the MMPI-2-RF Specific Problem scales (e.g. Neurological complaints and Cognitive complaints) is promising in the assessment of AUD patients. Studying the discriminatory potential of these scales in detecting underlying cognitive deficits in AUD patients and how elevated scale scores might affect the interpretation process of the other MMPI-2(-RF) scales would be the next step.

In conclusion, when AUD patients are assessed in the acute phase of abstinence the effects of alcohol withdrawal blur the clinical picture. Application of an MMPI-2 correction procedure may be of critical relevance for the correct interpretation of the psychopathology and personality profile. From there on, adequate and individualized treatment planning requires repeated evaluation of the patients' emotional and cognitive functioning. Further investigations should focus on the development and validation of the aforementioned correction procedure in conjunction with the MMPI-2-RF Specific Problem scales on its relation with cognitive recovery.

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