

The Utility of the MMPI-2 at Assessing Substance Abuse

Jeeyoung Lim[†]

The Institute of Psychological Science, Seoul National University

This study examined the effectiveness of the MMPI-2 substance abuse scales, *MAC-R*, *APS*, and *AAS*, in differentiating between substance abusers and non-substance-abusing psychiatric patients. Results support the use of all three scales at assessing substance abuse problems. The incremental validity of *APS* and *AAS* in comparison to *MAC-R* was examined using a series of hierarchical regression analyses. Results indicate that *AAS* added substantially to *MAC-R* and *APS* in predicting substance abuse and that *APS* added only moderately to *MAC-R* and *AAS*. Although *AAS* demonstrated the superiority over *APS* in detecting substance abuse problems, the addition of *AAS* did not provide discriminative information beyond that provided by *MAC-R* alone. Optimal cutoff scores and classification accuracy were also evaluated. Suggestions were offered for further research to establish the clinical utility of the new scales in various settings.

Keywords : MMPI-2, substance abuse, MAC-R, APS, AAS

[†] Corresponding Author : Jeeyoung Lim / The Institute of Psychological Science, Seoul National University /
San 56-1, Shillim-dong, Kwanak-gu, Seoul, Korea, 151-742 / Tel: 02-880-6431 / E-mail: mmpi2@unitel.co.kr

Alcohol and other addictive substances are prominent in contemporary society and abuse of them is one of the most pervasive mental health problems. Many individuals with psychological distress try to find temporary relief from the pressures of living through the use of these substances and some of them eventually develop alcohol or drug abuse disorders. Consequently, clinicians find that an assessment of the way in which patients learn or fail to learn to deal with alcohol and other drugs is an important assessment question in any pretreatment diagnostic situation. The MMPI and the MMPI-2 (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989) have been widely used for assessing these and other mental health problems.

The MacAndrew Alcoholism Scale (*MAC*) was originally developed to assess alcohol abuse problems by selecting items that differentiated individuals who were known to be alcoholics from individuals experiencing non-alcohol-related psychiatric problems (MacAndrew, 1965). Although MacAndrew identified 51 items that differentiated these two groups, two items with obvious alcohol abuse content were eliminated and a 49-item version of this scale has been used most widely. Empirical research with the *MAC* scale has generally been supportive of its use to assess general addiction proneness rather than alcoholic tendencies alone (Graham & Strenger, 1988). In the revision of the MMPI, 4 items dealing with religious content were replaced with those items from the new MMPI-2 item-pool that significantly separated alcoholics from non-alcohol-abusing psychiatric patients (McKenna & Butcher, 1987). The *MAC-R* scale has been shown to be useful for detecting possible substance abuse problems. Graham (1989) reported that high *MAC-R* scorers were rated by their spouses as drinking alcohol excessively, taking too many risks, not seeming to care about other people's feelings, and having been arrested or in trouble with the law. In another study, Levenson et al. (1990) found that heavy drinkers and problem drinkers had higher *MAC-R* scores than lighter drinkers or non-problem drinkers. The general rule of thumb for interpreting the

MAC-R scale is that individuals with *MAC-R* scores of 65 or greater are likely to present life-style characteristics associated with developing a substance abuse problem (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989).

The Addiction Potential Scale (*APS*) is composed of 39 MMPI-2 items to measure the personality factors underlying the development of addictive disorders (Weed, Butcher, McKenna, & Ben-Porath, 1992). The scale was empirically constructed by selecting items that differentiated substance abuse sample from normative and psychiatric inpatient samples. The Addiction Acknowledgement Scale (*AAS*) is composed of 13 MMPI-2 items to measure willingness to acknowledge problems with alcohol or drugs (Weed et al. 1992). The *AAS* scale is designed to assess whether substance abuse problems are actually acknowledged by the patient, whereas the *MAC-R* and *APS* scales attempt to assess the potential for developing such problems. The construction of the *AAS* scale began with a rational search of the MMPI-2 item pool for those items that clearly addressed substance abuse problems. 14 items were selected through this rational search and then purified by examining alpha coefficients, which resulted in dropping three items that did not contribute to internal consistency. Two items in the MMPI-2 item pool were included in *AAS* on the basis of their contribution to internal consistency and consistency in content with items already identified. A high *AAS* score (T 60) is considered to indicate that the client has acknowledged a large number of alcohol or drug use problems. A low *AAS* score does not mean, of course, that the client does not have a substance abuse problem, rather that the client has not admitted to having or has denied having problems.

Weed et al. (1992) reported that *APS* and *AAS* differentiated substance abusers from psychiatric patients and normals more effectively than *MAC-R*. They also found that *APS* distinguished between substance abusers and psychiatric patients better than *AAS*. As Weed et al. (1992) pointed out, however, their findings were limited because the

samples used in the development and cross-validation of *APS* and *AAS* came from the same settings. Greene, Weed, Butcher, Arredondo, and Davis (1992) replicated major findings of Weed et al. (1992) using samples from different settings. However, the magnitude of discrimination by *APS* in the study conducted by Greene et al. (1992) was much less than in the study conducted by Weed et al. (1992). In addition, whereas Weed et al. (1992) found that *MAC-R* was not effective at discriminating between substance abuse and psychiatric samples, the results presented by Greene et al. (1992) suggested its effectiveness.

Although the results of the validation study conducted by Greene et al. (1992) provided some independent evidence of utility of the newly devised MMPI-2 substance abuse scales, *APS* and *AAS*, at discriminating between substance abusers and psychiatric patients, a couple of methodological considerations remain to limit the practical utility of these new scales until further research is conducted. The first consideration is concerned with the control group of psychiatric patients used by Greene et al. (1992). No attempt was made to refine the psychiatric sample by screening for substance dependencies. In fact, approximately 20% of the psychiatric patients in the control group of the study by Greene et al. (1992) were substance-dependent. Thus, a considerable decrease in discrimination by *APS* may be due to the absence of a homogeneous contrast group, which attenuated scale effectiveness by inflating the false positive rate, or due to the weakness of the scale itself. The reason for this is not clear. Research is needed to validate the new scales with a homogeneous contrast group, that is, the psychiatric sample within which patients with secondary substance abuse problems are eliminated. The second consideration is associated with the base rate. Since the test-performance parameters will be affected by the base rate of phenomenon under study (Butcher, Graham, & Ben-Porath, 1995), the issue of base rate within the sample needs to be addressed. Both sensitivity and specificity are values that depend on the properties of the test, and they

are the probabilities of accurate positive or negative test results given that the person is or is not substance dependent. Clinicians, however, frequently face the question, "what is the probability of substance abuse given a positive or negative test result?" These probabilities, called positive predictive power (PPP) and negative predictive power (NPP), are a function of test validity and the base rate of substance abuse in the sample. In practice, PPP and NPP are of great concern since these indices tell how useful the assessment instrument is for making actual decisions. Thus, before clinical use, sensitivity and specificity should be converted into positive predictive power and negative predictive power.

This study was conducted (a) to explore the effectiveness of the MMPI-2 substance abuse scales, *MAC-R*, *APS*, and *AAS*, in differentiating substance abusers from psychiatric patients with no secondary substance abuse problems, (b) to examine the incremental validity of the new scales, *APS* and *AAS*, in comparison to *MAC-R*, and (c) to evaluate optimal cutoff scores and classification accuracy of *MAC-R*, *APS*, and *AAS*.

METHOD

Subjects

Two samples were used in this study: a sample from an inpatient substance abuse treatment program and a sample of psychiatric patients. Substance abuse sample consisted of 95 patients (55 men and 40 women) admitted to a 3-to-4-week residential treatment program for alcoholism and other substance dependencies in Southern Indiana. All patients had received a diagnosis of alcohol or drug dependence, according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., [DSM-IV]; American Psychiatric Association, 1994). The mean age of these substance abusers was 31 years ($SD = 8.01$). The mean education of substance abusers was 11.15 years ($SD = 2.19$). These

patients were administered the MMPI-2 approximately 1 week after admission once they were detoxified completely. Psychiatric patient sample consisted of 93 patients (52 men and 41 women) in an inpatient unit of a state psychiatric hospital in Southern Indiana, who did not have a substance abuse or substance dependence diagnosis as a primary or secondary Axis I diagnosis. These patients had received a wide variety of *Diagnostic and Statistical Manual of Mental Disorder* (4th ed., [DSM-IV]; American Psychiatric Association, 1994) diagnoses including major depressive disorder (31%), schizophrenia (23%), anxiety (16%), bipolar (15%), personality disorder (8%), and posttraumatic stress disorder (7%). The mean age of psychiatric patients was 29 years ($SD = 7.12$). The mean education level for these patients was 12.09 years ($SD = 2.13$). The MMPI-2 was administered to these patients by psychologists or psychology interns as part of standard intake procedures. At the time of testing, patients had been stabilized on psychiatric medication. The two groups did not differ significantly for age, gender, education level, or race.

Scoring and Exclusion Criteria

The MMPI-2 results were scored for the 3 standard validity scales, the 10 clinical scales, the 3 substance abuse scales including *MAC-R*, *APS*, and *AAS*, and for the Back *F* (*Fb*). MMPI-2 protocols from both samples were excluded if they met any of the following criteria: (a) more than 30 item omissions, (b) *F* raw score greater than 25, and (c) *Fb* raw score greater than 25. 11 subjects (4 in the substance abuse sample and 7 in the psychiatric sample) were excluded on the basis of these criteria. Therefore, a total of 177 subjects were included in the final analyses (91 in the substance abuse sample and 86 in the psychiatric sample).

Analyses

Multivariate Analysis of Variance (MANOVA) was

conducted to explore the possible differences in means of the validity, clinical, and substance abuse scales between substance abusers and psychiatric patients. A MANOVA yielding a significant F were followed by univariate ANOVAs in order to determine which scales differentiated between the substance abuse and psychiatric samples. Since these ANOVAs included multiple comparisons, a Bonferroni correction for error in significance testing was applied. Then, a series of hierarchical regression analyses were performed to examine the incremental validity of *APS* and *AAS*. Finally, optimal cutoff scores and classification rates of *MAC-R*, *APS*, and *AAS* were evaluated.

RESULTS

Table 1 contains the means and standard deviations for standard validity, clinical, and substance abuse scales (*MAC-R*, *APS*, and *AAS*) from the profiles of the substance abuse and psychiatric groups. As pointed out in a number of studies (Craig, 1988; Graham, 1978; Kammeier, Hoffmann, & Loper, 1973; Loper, Kammeier, & Hoffmann, 1973; MacAndrew, 1978), substance abuse group showed highly elevated scores on the *Pd* scale. A MANOVA revealed significant differences in the validity, clinical, and substance abuse scales in relation to substance abuse (Wilks' $\Lambda = .481$, $F(16, 160) = 10.794$, $p < .001$). Univariate F s revealed significant differences on the *Pd* and *Ma* scales between the substance abuse and psychiatric groups. All three substance abuse scales, *MAC-R*, *APS*, and *AAS* showed significant differences between the two groups.

Next analyses compared the scores on *MAC-R*, *APS*, and *AAS* for the two groups by examining the relation between group membership and scale scores. Group membership was coded 1 in the psychiatric patient group and 2 in the substance abuse group. Thus, a positive correlation indicates a higher score in the substance abuse group than in the psychiatric patient group. If the new substance abuse scales,

Table 1. Means and Standard Deviations of the MMPI-2 Standard Validity, Clinical, and Substance Abuse Scales

Scales	Groups	
	Substance Abusers	Psychiatric Patients
<i>L</i>	54.22 ± 8.72	56.48 ± 12.80
<i>F</i>	78.88 ± 23.71	77.00 ± 25.66
<i>K</i>	41.25 ± 9.95	45.23 ± 10.54 *
<i>Hs</i>	58.59 ± 12.44	56.10 ± 16.72
<i>D</i>	59.15 ± 12.38	63.84 ± 14.26 *
<i>Hy</i>	60.04 ± 11.79	56.10 ± 15.40
<i>Pd</i>	70.99 ± 11.49	65.08 ± 13.22 **
<i>Mf</i>	56.25 ± 13.62	52.41 ± 9.89 *
<i>Pa</i>	74.41 ± 21.47	69.43 ± 17.21
<i>Pt</i>	62.87 ± 13.48	65.38 ± 15.88
<i>Sc</i>	72.14 ± 17.10	70.67 ± 18.96
<i>Ma</i>	67.01 ± 13.06	57.42 ± 11.64 **
<i>Si</i>	55.92 ± 11.81	58.80 ± 12.51
<i>MAC-R</i>	72.77 ± 10.61	57.67 ± 11.41 **
<i>APS</i>	57.36 ± 9.13	47.50 ± 10.09 **
<i>AAS</i>	72.76 ± 13.54	56.05 ± 11.70 **

Note. Means for the Validity (*L*, *F*, and *K*) and Substance Abuse scales (*MAC-R*, *APS*, and *AAS*) are presented in linear *T* scores.

Means for the Clinical Scales are presented in uniform *T* scores, except for Scales *Mf* and *Si* which are reported in linear *T* scores.

* $p < .05$ based on univariate *F* tests with 1, 175 degrees of freedom.

** $p < .003$ based on univariate *F* tests with 1, 175 degrees of freedom corrected for multiple comparisons using the Bonferroni correction.

APS and *AAS*, do a better job than *MAC-R* at discriminating between individuals with substance problems and non-substance-abusing psychiatric patients, one would expect the correlation between the new scales and group membership to be higher than the one found for *MAC-R*. *APS* correlated .46 with group membership and *AAS* correlated .55, whereas *MAC-R* correlated .57. A *t* test indicates that these correlations are significantly different ($p < .001$). Thus, *AAS* seemed to be as strong as *MAC-R* in

the discrimination between members of the substance abuse and psychiatric samples, whereas *APS* appeared to have less discriminative power than *MAC-R* and *AAS*.

To test the incremental validity of the new *APS* and *AAS* scales in discriminating between substance abusers and non-substance-abusing psychiatric patients, regression analyses were performed with group membership, the dependent variable, regressed on *MAC-R*, *APS*, and *AAS* linear *T*-scores, which served as independent variables. A series of

hierarchical regression analyses were performed. In comparison between *MAC-R* and *APS*, *MAC-R* entered into the regression equation first, and the ability of *APS* to add incrementally to the prediction of group membership was tested by examining the *F* (change) statistic and beta weights. Next, *APS* was entered into the regression equation first and the ability of *MAC-R* to add incrementally was tested with the *F* (change) statistic and beta weights. Examination of Table 2 indicates that each of the *MAC-R* and *APS* scales added significantly to the other in discriminating between substance abusers and psychiatric patients. However, the discriminative power of *MAC-R* was

greater than that of *APS*. In comparison between *MAC-R* and *AAS*, examination of the *F* (change) statistic and beta weights indicates that *AAS* added significantly to *MAC-R* in the prediction of group membership when *MAC-R* was entered into regression equation first. When the order of entering variables into regression equation was reversed, *MAC-R* also added significantly to *AAS* in the discrimination between substance abuse and psychiatric patient groups. Although the discriminative efficiency of *AAS* was comparable to that of *MAC-R*, *AAS* failed to contribute in predicting substance abuse beyond *MAC-R*. A final set of analyses compared *APS* with *AAS*. Each of the *APS* and

Table 2. Hierarchical Regression Analyses for discriminating between Substance Abusers and Psychiatric Patients

	R^2	F_{change}	P_{change}	β
Comparison between <i>MAC-R</i> and <i>APS</i>				
<i>MAC-R</i> entered first				
<i>MAC-R</i>	.32			.45
<i>APS</i>	.36	9.65	<.01	.22
<i>APS</i> entered first				
<i>APS</i>	.21			.22
<i>MAC-R</i>	.36	40.01	<.001	.45
Comparison between <i>MAC-R</i> and <i>AAS</i>				
<i>MAC-R</i> entered first				
<i>MAC-R</i>	.32			.37
<i>AAS</i>	.40	22.15	<.001	.34
<i>AAS</i> entered first				
<i>AAS</i>	.31			.34
<i>MAC-R</i>	.40	27.09	<.001	.37
Comparison between <i>APS</i> and <i>AAS</i>				
<i>APS</i> entered first				
<i>APS</i>	.21			.20
<i>AAS</i>	.33	31.49	<.001	.43
<i>AAS</i> entered first				
<i>AAS</i>	.31			.43
<i>APS</i>	.33	6.78	<.05	.20

Table 3. Positive Predictive Power (PPP), Negative Predictive Power (NPP), Sensitivity, Specificity, and Overall Accuracy (OA) for *MAC-R*, *APS*, and *AAS*

Scales & cutoff scores	PPP	NPP	Sensitivity	Specificity	OA
<i>MAC-R</i> ≥ 65	.78	.81	.82	.74	.79
≥ 60	.73	.89	.92	.64	.79
<i>APS</i> ≥ 65	.87	.57	.34	.94	.63
≥ 60	.84	.61	.45	.91	.67
<i>AAS</i> ≥ 65	.87	.88	.89	.86	.88
≥ 60	.82	.89	.91	.72	.85

Note. Base Rate for Substance Abuse in this study was .51. *MAC-R* 65 is based on Butcher and Williams (1992).

APS and *AAS* 65 is based on Butcher et al. (1989). *APS* and *AAS* 60 is based on Butcher and Williams (1992).

AAS scales added significantly to the other in predicting group membership. However, *AAS* provided greater predictive power than *APS*.

Classification rates of *MAC-R*, *APS*, and *AAS* are reported in Table 3. The base rate for substance abuse in the current sample was .51. *T* score 65 on *AAS* yielded the best overall accuracy (88%) with a sensitivity of 89%, a specificity of 86%, and positive and negative predictive powers of 87% and 88%, respectively. Overall classification accuracy was equal at *T* score cutoffs of 60 and 65 on *MAC-R*. However, positive predictive power and specificity were lower at a cutoff of 60. For the *APS* scale, overall accurate classification rates were rather poor at both cutoffs, ranging from 63% to 67%.

DISCUSSION

The present study examined the utility of the MMPI-2 substance abuse scales, *MAC-R*, *APS* and *AAS*, in discriminating between substance abusers and non-substance-abusing psychiatric patients. Results support the use of all three scales as effective screening tools for substance abuse.

Hierarchical regression analyses indicate that *AAS* added substantially to *MAC-R* and *APS* in predicting substance abuse and that *APS* added only modestly to *MAC-R*. Although *AAS* demonstrated the superiority over *APS* in identifying substance abusers, the addition of *AAS* did not provide discriminative information beyond that provided by *MAC-R* alone. Classification accuracy analyses indicate that a *T* score cutoff of 65 on *AAS* produced the best overall accuracy of 88%. The overall accuracy rates were equal at *T* score cutoffs of 60 and 65 on *MAC-R*. *APS* produced rather poor overall accurate classification rates at both cutoffs.

Unlike the previous findings that *APS* and *AAS* were stronger discriminators between substance abuse and psychiatric patient samples than *MAC-R* (Greene et al, 1992; Weed et al., 1992), the results obtained in this study indicate that neither *APS* nor *AAS* showed incremental contribution in predicting substance abuse beyond *MAC-R*. These results may suggest that the new *APS* and *AAS* scales themselves are not robust enough to contribute significantly to the prediction of substance abuse beyond the existing *MAC-R* scale. However, since the current results were obtained from the modest number of subjects, one should be cautious to conclude that *APS* and *AAS* are less

effective discriminators for substance abuse problems than *MAC-R* and further research should be conducted to explore the utility of the new substance abuse scales in a larger sample.

Although the scale that provided the least discriminative power for the current sample was *APS*, a measure of personality traits associated with substance abuse, rather than a direct measure of open acknowledgement of substance abuse, there may have been some possible confounds such as attitude toward treatment that influenced the ability of *APS*. For example, the items such as "Although I am not happy with my life, there is nothing I can do about it now" and "I recognize several faults in myself that I will not be able to change" may discriminate between the two samples not because they detect substance dependence but because they identify a group of substance abusers who are willing to accept help or to change behavior. Further research is needed to examine these and other possible factors that may influence on the effectiveness of the *APS* scale, thereby identifying meaningful subgroups of items that will result in useful subscales.

Because content-based scales are considered to be more susceptible to response distortion than empirically keyed ones and *AAS* items have the obvious nature, intentional response distortion, particularly a defensive test-taking attitude may result in artificially low *AAS* scores. In settings such as forensic and occupational settings in which respondents are more likely to suppress pathological symptoms, it is important to examine profile validity and rule out distorted patterns of responding before interpreting the *AAS* scores. In contrast, in settings in which the individual is motivated to provide accurate information, the *AAS* scale developed using content-based approaches may provide useful information. Further studies are needed to examine relative resistance of substance abuse scales to response distortion such as defensiveness.

As regards with the clinical utility of *MAC-R*, *APS*, and *AAS*, continued demonstrations that substance abusers in

substance abuse treatment program have higher scores on these scales than individuals not in treatment or in psychiatric hospitals may do little to empirically justify the usefulness of these scales in typical screening or naturalistic settings. One would expect loss in predictive accuracy of these scales when they are used in naturalistic settings because the minority of substance dependent persons in formal treatment may be different from the majority who do not get formal treatment and who need to be identified. Therefore, research is needed to validate these scales in various settings such as personnel screening, routine assessment in medical hospitals, or outpatient mental health clinics.

A final consideration is associated with the methodological aspect. Since most *MMPI-2* interpretive guides do not provide sufficient analytic detail and contain limited if any discussion of the sensitivity or specificity of the *MMPI-2* scales, indices, or scale patterns, the parameters of interpretive use are uncertain. Since ROC (Relative Operating Characteristics; Swets, 1973) analysis provides a detailed understanding of scale accuracy and errors across entire range of scores, future research employing ROC analytic techniques will lead to a growing sense of predictive efficiency and to a more detailed understanding of decision making.

Although this study supports the use of the new substance abuse scales, *APS* and *AAS*, in the discrimination between substance abuse and non-substance-abusing psychiatric samples, additional studies with varying sample characteristics should be undertaken to examine the effectiveness of the new scales, thereby maximizing their clinical utility in various settings.

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물질관련장애평가에 있어서 MMPI-2의 유용성

임 지 영

서울대학교 심리과학 연구소

본 연구는 물질관련장애환자와 비중독 정신과 환자들을 구별하는 데 있어서 미네소타 다면적 인성검사 2판(MMPI-2)에 포함된 물질관련장애 평가척도들(MAC-R, APS, 그리고 AAS)의 유용성을 알아보기 위해 수행되었다. MAC-R, APS, 그리고 AAS 세 척도들 모두 물질관련장애를 탐지하는 데 유용하다는 결과가 얻어졌다. 미네소타 다면적 인성검사 1판(MMPI)에 포함되기도 했던 MAC-R 척도에 비해 MMPI-2에 새롭게 포함된 APS와 AAS 척도들이 물질관련장애 탐지에 얼마나 더 효과적인지를 알아보기 위해 일련의 위계적 회귀 분석을 실시한 결과, 물질관련장애를 예언하는 데 있어서 APS 척도는 MAC-R 및 AAS 척도들보다 훨씬 예언력이 낮은 것으로 나타난 반면, AAS 척도는 MAC-R 척도에 상당하는 예언력을 보였다. 또한 세 척도들에 대한 적정 변별점(cutoff)과 분류률이 조사되었다. MMPI-2에 새롭게 포함된 APS와 AAS척도들이 기존의 MAC-R 척도를 능가하는 변별력을 보이지는 못했으나, 다양한 특성의 표본들을 이용하여 세 척도들의 임상적 유용성을 평가하는 더 많은 연구가 이루어져야 할 것으로 보인다.

주요어 : 미네소타 다면적 인성검사, 물질관련장애