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Factor Analysis of the MMPI-A Content Scales: Item-Level and Scale-Level Analyses

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FACTOR ANALYSIS OF THE MMPI-A CONTENT SCALES:

ITEM-LEVEL AND SCALE-LEVEL ANALYSES

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ABSTRACT

FACTOR ANALYSIS OF THE MMPI-A CONTENT SCALES: ITEM-LEVEL AND SCALE-LEVEL ANALYSES ACROSS GENDER AND SETTING.

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This investigation identified and interpreted the overall factor structure of the MMPI-A content scales through the use of scale-level analyses, and examined the factor structure of each individual content scale through item-level analyses. The MMPI-A normative sample (805 males, 815 females) and a clinical sample (266 males, 92 females) were used in the analyses. Scale-level analyses yielded a two factor solution for the normative male and clinical groups and a one factor solution for the normative sample and normative female group. The factors were labeled General Maladjustment and Externalizing Tendencies. Item-level analyses provided one factor solutions for the majority of the MMPI-A content scales. These findings differed from the factor structures obtained in the creation of the MMPI-A Content Component scales recently developed by Sherwood, Ben-Porath, and Williams (1997). Implications of these findings are discussed.

To Michael, whose love and support
encouraged me to fulfill my dream.

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INTRODUCTION

This investigation identified and interpreted the overall factor structure of the MMPI-A content scales through the use of scale-level analyses, and examined the factor structure of each individual content scale through item-level analyses. These analyses were conducted with the MMPI-A normative sample and a sample of adolescents receiving psychiatric services. Additionally, factor analyses of the MMPI-A normative sample were performed separately for males and females as this sample is large enough to allow partitioning by gender. It was anticipated that factor analytic findings derived from this study would yield data useful to clinicians in applied settings.

Development of the MMPI

The Minnesota Multiphasic Personality Inventory (MMPI) was developed by Hathaway and McKinley in the late 1930's and early 1940's to meet the need for a wide range personality test that would assess abnormal behavior (Greene, 1991). Hathaway and McKinley devised this test to be a single inventory that encompassed a wide range of behaviors. A series of scales were constructed to detect abnormal behavior, and scale items were selected using the empirical approach to test development. With this method of test construction, items were retained for a scale if they

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Assessment was the journal model for this manuscript.

were answered differently by the criterion group (e.g..,depressed patients) than the normal group, without apriori judgments about what items should be on each scale. The criterion groups were selected by patient diagnosis at the University of Minnesota Hospital. Criterion group members for each scale were defined as having pure, uncomplicated diagnoses. The normative group consisted of 724 people who were visitors to the University of Minnesota Hospital during this period. The final product of the original MMPI consisted of a 556 item test with 10 standard clinical scales and 4 validity scales. Later developments included: (1) The addition of the Harris and Lingoes (1955) subscales which facilitate interpretation of identical scores on several of the clinical scales, (2) traditional supplementary scales including Welsh's (1956) Anxiety and Repression scales, (3) Barron's (1953) Ego Strength scale, and (4) the MacAndrew (1965) Alcoholism scale.

Development of the MMPI Content Scales. The MMPI content scales (Wiggins, 1966) were developed to provide the clinician with an additional source of interpretative information to the standard MMPI clinical scales (Wiggins, Goldberg, & Appelbaum, 1971). Factor analyses of the original 26 item-content categories designated by Hathaway and McKinley (1940) were used to identify reliable dimensions of self-report, representing the entire MMPI item pool. Rational and item-analytic procedures were then employed to construct a revised set of 13 homogenous content

scales that did not share items across scales (Wiggins, 1966). The content scales were devised in such a way that endorsement of scale items reflects the client's admission or self-report of pathology, thus providing the client with one way of communicating problems to the clinician. These final scales were named Social Maladjustment (*SOC*), Depression (*DEP*), Feminine Interests (*FEM*), Poor Morale (*MOR*), Religious Fundamentalism (*REL*), Authority Conflict (*AUT*), Psychoticism (*PSY*), Organic Symptoms (*ORG*), Family Problems (*FAM*), Manifest Hostility (*HOS*), Phobias (*PHO*), Hypomania (*HYP*), and Poor Health (*HEA*).

Use of the MMPI With Adolescents. The MMPI has been used with adolescents for both research and clinical functions since the test's development (Archer, 1997). While the MMPI was originally intended for individuals 16 years and older, Dahlstrom, Welsh and Dahlstrom (1972) noted that it could be used with children as young as 12 who were bright and able to accurately read test items. Archer (1987) also noted that a sixth-grade reading level is a prerequisite for understanding the items on the MMPI. Thus, the MMPI has been frequently used with adolescents and was one of the most widely used assessment instruments for measuring pathology in adolescents in 1990 (Archer, Imhof, Maruish, & Piotrowski, 1991). Hathaway and Monachesi (1963) collected the largest MMPI data set ever obtained on adolescents. Over a 10 year period (1947 to 1957), they gathered original and follow-up data on samples of

adolescents in the Minnesota school system, with the purpose of determining MMPI predictors related to the onset of delinquent behaviors. This data set also provided much needed information about differences in item endorsements between adults and adolescents, and male and female adolescents. In addition, it identified important longitudinal test-retest differences between middle and late adolescence. Finally, this data set was used later in the development of adolescent norms and also enabled Hathaway and Monachesi to establish personality correlates for high and low scores for each of the clinical scales (Archer, 1987).

Until the development of MMPI adolescent norms in the early 1970's, clinicians used adult norms to produce adolescent profiles. Marks and Briggs produced the first set of adolescent norms and published them in Dahlstrom et al. (1972, pp. 388-399). Separate norms were provided for males and females, and norms were further divided into age categories: 14 and below, 15, 16, and 17. These norms are the most frequently used norms with the MMPI and most research on the MMPI and adolescents has been based on their normative data (Archer, 1997).

Despite the popularity of the Marks and Briggs norms, other researchers also developed adolescent norms. Gottesman, Hanson, Kroeker, and Briggs developed a set of adolescent norms based on the responses of 15 and 18 year-olds from Hathaway and Monachesi's (1963) sample (published

in Archer, 1987). Normative raw scores for this sample fell between those reported for Marks and Briggs and the expected values for adults (Archer, 1987).

Colligan and Offord (1989) provided a more contemporary set of norms by gathering data from 1,315 adolescents residing in the Midwest. When comparing their norms to those of contemporary adults, the authors found significant differences between them. Thus, Colligan and Offord further emphasized the need for separate adolescent norms for the MMPI. In addition, they compared their norms with those of Marks and Briggs and found significant differences between them.

By 1990, there were several sets of adolescent norms for the MMPI, prompting Klinefelter, Pancoast, Archer, and Pruitt (1990) to compare how these data sets (i.e., Marks & Briggs, Gottesman et al., Colligan & Offord) affected MMPI interpretation. Their study of 300 adolescents demonstrated significant differences for all scales except for *Mf* and *Ma*. Results indicated that Colligan and Offord's norms most accurately represented normal subjects in terms of profile elevation issues, while profiles produced using either Marks and Briggs or Gottesman et al. seemed to best portray psychiatric inpatients and outpatients. Klinefelter et al. (1990) recommended using Marks and Briggs norms as the norms provide empirically based clinical correlates.

Overview of the MMPI-A

Test Development. Despite wide use of the MMPI with

adolescents, in a survey to clinicians conducted by Archer et al. (1991), many respondents expressed concerns with the MMPI's norms, specifically their datedness and lack of ethnic representation. In addition, clinicians felt the reading level requirement and length of the test were problematic (Archer et al., 1991). Other considerations included the need for a test with scales to assess adolescent problem areas and a need to standardize MMPI assessment practices for adolescents in general. The accumulation of the above considerations suggested a need to develop an improved MMPI for use with teenagers.

The MMPI Adolescent Project Committee (Robert P. Archer, James N. Butcher, Beverly Kaemmer, and Auke Tellegen) was developed in 1989. Goals of the committee included the following: to develop a test that was shorter in length than the MMPI without losing clinical information, to obtain a national normative sample for the test, and to maintain continuity between the MMPI and the adolescent form of the test. In order to determine the feasibility of producing an adolescent form of the MMPI, an experimental booklet called the MMPI Form Tx was created. The booklet contained 550 original MMPI items and 154 new items. The Form Tx did not contain the 16 replicated items from the original MMPI, and 13 percent of original items were reworded to increase understanding of item content. The form, along with a questionnaire on demographics was administered to the response group, and based on the

analyses of these data, the MMPI Adolescent Project Committee recommended development of the MMPI-A. The MMPI-A was released in August 1992 and was accompanied by a comprehensive manual that covered test administration, scoring and interpretation (Butcher et al., 1992).

Normative and Clinical Groups. The MMPI-A normative group consisted of junior and senior high school students in eight states (Minnesota, Ohio, California, Virginia, Pennsylvania, New York, North Carolina, and Washington) who were solicited by mail. Roughly 2500 adolescents were evaluated with the MMPI Form Tx in group sessions within school settings. Participants were paid for their voluntary participation (except in New York). The following exclusionary criteria were used: "(a) subjects with incomplete data; (b) Carelessness scale values > 35 (total number of items omitted by respondents or endorsed in the true and false direction); (c) original *F* scale value > 25; (d) subject age < 14 or > 18" (Archer, 1997, p. 48). These criteria resulted in the exclusion of roughly 900 participants and a sample of 805 males and 815 females.

Although test sites were chosen with the expectation that the sample would be representative of the United States census in terms of rural-urban residence, geographic location and ethnicity, the normative sample underrepresents adolescents who drop-out or are frequently absent from school (Butcher et al., 1992). In addition, parents with higher education levels are overrepresented. Age and grade

are well distributed, with the exception of underrepresentation of 18 year-olds. Importantly, ethnic representation is similar to that of the U.S. census figures with the exception that Hispanics are slightly underrepresented.

The MMPI-A clinical sample consisted of adolescents from a variety of treatment settings in the Minneapolis area including inpatient mental health facilities, day-treatment programs, and inpatient alcohol- and drug-programs. In addition to completing the MMPI-A, subjects answered the Child Behavior Checklist and the Devereux Adolescent Behavior Rating Scale, and information was obtained from parents, treatment team members, and hospital and school records. The same exclusionary criteria was applied to this group, resulting in a sample of 420 boys and 93 girls.

Demographics were different for the clinical group than the normative group. Minorities were underrepresented, specifically African Americans and Hispanics, and fewer of the adolescents came from intact homes. However, despite differences in demographics between groups and between the clinical group and Marks, Seeman, & Haller's (1974) clinical sample, there was a very similar pattern of responses between the two groups when scored on the original MMPI norms (Butcher et al., 1992). This implies that continuity between the MMPI and the MMPI-A was maintained.

Test Structure. The MMPI-A was released in August 1992. An extensive manual was provided which addressed test

administration, scoring and interpretation (Butcher et al., 1992). The final version of the MMPI-A consists of 478 items. The validity scales *L*, *F1*, and *K* and the standard clinical scales can be scored with administration of the first 350 items. Administration of the entire test is necessary to score the supplementary and content scales, as well as validity scales *VRIN*, *TRIN*, and *F2*. The MMPI-A is comprised of 13 basic scales, 4 new validity scales, 15 content scales, 6 supplementary scales, 28 Harris-Lingoes and 3 other subscales.

The basic scales of the MMPI-A were changed very little from the original MMPI. All but 58 items remain on these scales. The four new validity scales include *F1* and *F2* subscales of the *F* scale, and *VRIN* and *TRIN*, which address response consistency. New supplementary scales were added which examine adolescent concerns such as Immaturity (*IMM*), Alcohol/Drug Problem Potential (*PRO*), and Alcohol/Drug Problem Acknowledgement (*ACK*). The composition and structure of Harris-Lingoes and *Si* subscales changed very little (Archer, 1997).

Development of MMPI-2 and MMPI-A Content Scales. In order to delineate the development of the MMPI-A content scales, an explanation of the construction of the MMPI-2 content scales is necessary. The MMPI-2 content scales (Butcher, Graham, Williams & Ben-Porath, 1989) were developed by first sorting items from the experimental MMPI restandardization booklet into possible categories according

to their item content. A total of 22 content categories were selected for further study. Three independent raters then rationally grouped the 704 experimental test items into these 22 categories. Following category development, a group consensus meeting was conducted to determine which items would be kept. Twenty-one of the 22 item categories remained at the end of this first stage of development (Butcher et al.1989).

Stage two was the first statistical verification of the rationally derived provisional content scales using item-scale correlations and coefficient alphas as internal consistency measures (Cronbach, 1951). Several samples of clinical and normal group members, separated by gender, were used in the analyses. Items were deleted if their Pearson product-moment correlation coefficients were lower than the coefficients of the majority of the items on that scale, and if deleting the item would raise the scale's coefficient alpha by at least two points (e.g., .78 to .80). Additionally, items originally left out of provisional scales were added if their correlations with the scale reached or exceeded .50 (Williams, Butcher, Ben-Porath, & Graham, 1992).

The third stage in the development of the MMPI-2 content scales involved a rational review of scale item membership following the additions and eliminations of items that occurred during stage two. A few scale names were changed because their content domains had changed during the

stage modifications. Importantly, item overlap was inspected and largely eliminated during this stage (Williams et al., 1992).

Stage four was the final statistical refinement of the scales. In this stage, if an item correlated more highly with another scale than the one it had been assigned to, that item was eliminated from the scale. Uniform T scores consistent with the MMPI-2 standard scores (Butcher et al., 1989) were then derived for the MMPI-2 content scales. Fifteen homogeneous MMPI-2 content scales resulted from this final stage of development (Williams et al., 1992).

The 15 MMPI-2 content scales were comprised of many items from the original MMPI item pool and scale membership contained from 25% to 82% item overlap with corresponding Wiggins (1966) content scales. These MMPI-2 content scales were identified as: Anxiety (*ANX*), Fears (*FRS*), Obsessiveness (*OBS*), Depression (*DEP*), Health Concerns (*HEA*), Bizarre Mentation (*BIZ*), Anger (*ANG*), Cynicism (*CYN*), Antisocial Practices (*ASP*), Type A (*TPA*), Low Self-Esteem (*LSE*), Social Discomfort (*SOD*), Family Problems (*FAM*), Work Interference (*WRK*), Negative Treatment Indicators (*TRT*).

The MMPI-A content scales were constructed in essentially the same manner as the MMPI-2 content scales. The first stage in development was to examine the MMPI-2 content scales to determine if any of these constructs were developmentally inappropriate for adaption to the MMPI-A. The second stage consisted of refinement of the MMPI-A

content scales by the addition or deletion of specific items designed to improve psychometric characteristics. Stage three included a rational review and examination of scale content to determine item relevance related to the construct being measured. Further statistical refinement of the scales, including the elimination of items that displayed higher correlations with other content scales comprised stage four. The final stage involved selecting narrative descriptions for each scale using a combination of empirical findings and rational inferences based on item content of each scale (Williams et al., 1992).

The resulting 15 MMPI-A content scales are homogeneous, and provide important information about what adolescents are saying about themselves. While 11 of the 15 MMPI-A content scales heavily overlap with the MMPI-2 content scales, adolescent issues have been addressed in the development of four new content scales that include Low Aspirations (*A-las*), Conduct Problems (*A-con*), Alienation (*A-aln*), and School Problems (*A-sch*). A result of the development of the MMPI-A content scales was the elimination of some, but not all, of the item overlap that is prevalent among the basic and validity scales (Williams, et al. 1992, Graham, 1992). Item overlap among MMPI-A content scales is presented in Table 1.

Table 1

Number of Overlapping Items Between Scales

A-anx	X													
A-obs	1	X												
A-dep			X											
A-hea				X										
A-biz					X									
A-ang						X								
A-cyn			1				X							
A-aln			1				1	X						
A-con						1			X					
A-lse	1		2					1		X				
A-las								1			X			
A-sod								1				X		
A-fam								1					X	
A-sch				1							1			X
A-trt		2	3				1	3	1	2	2				X
A-	anx	obs	dep	hea	biz	ang	cyn	aln	con	lse	las	sod	fam	sch	trt

Note. Empty spaces signify no overlap between scales.

An Overview of Factor Analysis

Factor analysis is one of the most commonly used methods of developing and evaluating psychological measures (Floyd & Widaman, 1995). Factor analysis and principal component analysis are two types of procedures that share the goal of data reduction: to reduce a set of variables to a smaller set of new variables. The aim of this reduction is twofold. First, the pattern matrix derived from the factor analysis can be used to describe the relationship between the original and new variables. Second, scores for the new variables can be obtained to replace the original scores. These scores can then be used as the basis for subsequent analyses (Velicer & Jackson, 1990).

It is notable that in the fields of statistical analysis and psychological assessment, there appears to be controversy over the use of the terms factor analysis and principal component analysis. While some authors view the two as competing exploratory procedures (i.e., Velicer & Jackson, 1990; Snook & Gorsuch, 1989), others regard principal component analysis as a technique of factor analysis (Floyd & Widaman, 1995). For the purposes of this paper, factor analysis and principal component analysis will be used to describe competing explanatory procedures.

Exploratory and Confirmatory Factor Analysis. Factor analysis is useful for both exploratory and confirmatory purposes. The two general exploratory uses of factor analysis in the development and evaluation of psychological

measures include explanation of psychological constructs and data reduction. The goal of the first use is to identify the underlying dimensions of a domain of functioning, as assessed by a particular instrument. The second use of explanatory factor analysis is for data reduction, in which a larger set of related variables can be reduced to a smaller set of scores. Factor analysis as a confirmatory procedure is mainly a method for assessing the construct validity of measures. For example, construct validity is supported if the factor structure of the scale is consistent with the constructs the instrument is supposed to measure (Floyd & Widaman, 1995).

The primary theoretical difference between component analysis and common factor analysis is that common factor analysis includes error specificly in the model (Gorsuch, 1983). The common factor model closely follows the statistical paradigm (Snook & Gorsuch, 1989). Gorsuch (1988) asserted, "In common factor analysis it is explicitly noted that the variables may be fallible and that the sample correlation matrix need not be the population matrix; hence estimations from the correlation matrix most accurately represent the task at hand" (p.15). Additionally, in common factor analysis the factors are estimated to explain the covariances among the observed variables, while the factors are viewed as causes of the observed variables (Floyd & Widaman, 1995).

In contrast, component analysis has no error in the

model but rather assumes that the data matrix is completely reproducible from the factor scores (Snook & Gorsuch, 1989). Gorsuch (1988) stated that the component model perfectly reproduces each variable, thus following the mathematical paradigm. Therefore, it is assumed with component analysis that the sample correlation matrix accurately reflects the population matrix (Gorsuch, 1988). In essence, principal component analysis strives to explain the variance of the variables in as small a number of dimensions possible by creating components from the variables.

According to Floyd and Widaman (1995), "principal component analysis should be used primarily for data reduction, whereas common factor analysis should be used to understand the relations among a set of measured variables in terms of underlying latent variables" (p.290). However, the theoretical differences between component and common factor analysis are less important when they both provide similar data. Several authors have empirically investigated the differences between these procedures and have found essentially the same results using principal component and factor analysis (i.e., Velicer, 1977; Velicer, Peacock & Jackson, 1982, Velicer & Jackson, 1990). These authors suggested that the two methods produce the same conclusions (Velicer & Jackson, 1990). However, others have argued that results are similar only under certain conditions (Snook & Gorsuch, 1989; Widaman, 1993). Two conditions that affect when differences are found between principal component and

factor analysis are the number of variables and the value of the communalities (Floyd & Widaman, 1995; Snook & Gorsuch, 1989). The communality of a variable is the variance that variable shares with the latent variables underlying the set of observed values (Floyd & Widaman, 1995). The principle difference between the matrices from which components or factors are extracted is the number in the diagonal. Principal component analysis maintains a constant score of 1.0 in the main diagonal in an attempt to represent all of the variance of the observed variables. In contrast, factor analysis uses a calculated communality in the matrix that attempts to represent only the common variance of each variable (Snook & Gorsuch, 1989). This common variance is a variance shared with other observed variables. When fewer variables are used, the ratio of diagonal to off-diagonal elements decreases, providing the communality with an increased effect on the analysis. Gorsuch (1988) asserted that with an increasing number of variables, the method of exploratory analysis used becomes less important. He stated that specifically, when 30 variables are in the analyses and the communalities exceed .70, the analyses for a rotated solution with the same number of factors will be of insignificant difference to affect interpretation. In more recent work by Snook and Gorsuch (1989), that recommendation of 30 variables was increased to a minimum of 40 variables before the two procedures are able to provide comparable results.

Extracting Factors. Both factor analysis and principal component analysis extract components that account for the greatest possible variance in the observed variables. The first factor is extracted in a manner that produces the highest possible squared correlations between the variables and the factor, thus maximizing the amount of variance accounted for by a factor. Succeeding factors are extracted from the matrix after all variance accounted for by the previous factors is removed (Floyd & Widaman, 1995).

There are several methods used to decide the number of factors to retain. One method is the Kaiser-Guttman criterion, or eigenvalue > 1.00 rule. This method follows the assumption that each component has an eigenvalue that is the amount of variance accounted for by that component. A 1.0 eigenvalue component accounts for as much variance as a single variable. The total of all eigenvalues equals the total number of variables in a component analysis. Thus, an eigenvalue < 1.00 indicates that a component accounts for less variance than a single variable (Floyd & Widaman, 1995; Zwick & Velicer, 1986). Therefore, retaining eigenvalues < 1.00 does not serve a purpose, as they provide no summarizing power and the goal of the analysis is to reduce a set of variables. Several authors have criticized the Kaiser criterion for retaining too many components (Browne, 1968; Zwick & Velicer, 1986). Velicer and Jackson (1990) go further to suggest that the problems with overextraction using the Kaiser rule may be the cause of observed

differences between factor analysis and principal component analysis.

A second method for retaining factors is the scree test. Floyd and Widaman (1995) asserted that the scree test is one of the more accurate methods for retaining factors and usually provides satisfactory results. The scree test plots the eigenvalues of the unrotated factors and examines the slope of the line connecting them. The cutoff point for retaining factors lies where the slope approaches zero. The logic is that this is the point where eliminating the factors no longer results in losing important variance.

Another criterion for determining the number of factors to retain involves the number of variables loading on the factor. If a factor has only a single variable loading on it, then it is apparent that the factor will measure only what the variable measures, not providing additional information. This is not a desirable method of data reduction. Therefore, the general rule is three variables per factor are needed to identify common factors (Comrey, 1988). Additionally, because expanding the number of variables on a factor increases factorial stability, Gualdagnoli and Velicer (1988) suggested that it may be necessary to add variables to factors of interest that initially only have two or three variables with high loadings.

The meaning or psychological interpretation of factors is a separate method of factor extraction. This method

involves examining similar research and determining the likely number of factors to be retained. This method is a good supplement to the aforementioned mathematical and statistical procedures.

Factor Rotation. Following extraction, factors are rotated to a more simple structure to facilitate interpretation. Simple structure is accomplished when each variable loads on as few factors as possible, preferably just one. There are two methods of factor rotation. The first method is oblique rotation, in which the factors are allowed to remain correlated. Orthogonal rotation is the second and more popular method, in which the factors are uncorrelated. In exploratory analysis, orthogonal rotation employing the varimax procedure is the most commonly used method (Floyd & Widaman, 1995).

In exploratory analyses, factors are generally considered significant when their loadings exceed .30 or .40 (Floyd & Widaman, 1995). If a variable or variables do not have substantial loadings on any factor, the variables may be deleted from the analysis and the analysis may be rerun with the remaining items. A separate criterion for factor solutions is that the total factors should account for some percentage of the total variance of the variables. Streiner (1994) recommended that 50% of the total variance be explained by the factors, while Floyd and Widaman (1995) suggested that the factors should explain at least 80% of the estimated common variance. If less variance is

accounted for, then it may be possible to eliminate variables with weak factor loadings on all factors to improve the overall factor presentation.

Sample Size. The traditional rule for sample size has been a subject to variables ratio of 4:1 or 5:1 (Floyd & Widaman, 1995). Recent variants to this rule have been offered. For example, Gorsuch (1983) claimed that there should be at least five subjects per variable with the additional requirement of at least 200 participants. Floyd and Widaman suggested that 5 to 10 participants per variable is appropriate and is the common guideline used in exploratory and confirmatory analyses.

Cross Validation. Cross-validation of data is desirable for any type of exploratory analysis. When the sample size is large enough, participants can be randomly assigned to the original analysis group and a cross-validation group. One way that cross-validation is useful is to conduct exploratory analysis on half the sample and confirmatory factory analysis on the other half to confirm factor structure. However, confirmation will be unsuccessful when exploratory analysis fails to account for most of the variance in the data. When the sample size is not large enough to do cross-validation within the same study, comparisons across studies are beneficial (Floyd & Widaman, 1995).

Conceptual Issues

Scale-Level and Item-Level Analysis. Scale-level and item-level factor analyses of the MMPI and the MMPI-2 have long been conducted in an attempt to determine the tests' underlying dimensions. Scale-level analysis of the internal structure was the method of choice for early factor analyses of the MMPI (Dahlstrom, Welsh, & Dahlstrom, 1975). Advances in the computational abilities of computers have enabled researchers to examine the MMPI at the item-level of analysis in more recent investigations.

Item-level factor analysis locates the intercorrelations among individual test item endorsements (Tonsager, 1995). Item-level analyses of the MMPI have been conducted using two approaches. These approaches include factor analyzing the items within an individual scale and factor analyzing items across the item pool. The primary goals of item-level analysis have been to identify unique factors within a scale or entire item pool and to develop homogeneous subscales (Tonsager, 1995).

Numerous investigations of the MMPI item-level factor structure have been conducted. In 1957 and 1958, Comrey performed the most systematic investigation of the item-level structure of the MMPI basic scales (Comrey 1957a, 1957b, 1957c, 1958a, 1958b, 1958c, 1958d, 1958e, 1958f; Comrey & Margraff, 1958). Several authors also studied the item-level factor structure of the basic scales using the shortened forms of the MMPI (i.e., Barker, Fowler, &

Peterson, 1971; Beck et al., 1989; Overall, Hunter, & Butcher, 1973). Recent work has subjected the entire MMPI item pool to factor analyses and factor scales have been developed (Costa, Zonderman, Williams, & McCrae, 1985; Johnson, Butcher, Null, & Johnson, 1984).

Methodological Problems in Factor Analyzing the MMPI, MMPI-A. The MMPI, MMPI-2, and MMPI-A basic scales have been factor analyzed by numerous investigators. In contrast, the MMPI-2 and MMPI-A content scales have received less attention. Methodological concerns with factor analyzing the MMPI as addressed by Tonsager (1995), will be discussed prior to reviewing the studies in this body of literature.

It has long been recognized by many authors that the high number of overlapping items on the MMPI scales is problematic for statistical analysis (i.e., Budescu & Rogers, 1981; Comrey, 1988; Gynther & Green, 1982; Hsu, 1992; Shure & Rogers, 1965; Tonsager, 1995). Horn, Wanberg, and Appel (1972) noted that the clinical and validity scales of the original MMPI have 69% item overlap. The clinical and validity scales of the MMPI-A also contain a number of common items, due to the MMPI-A restandardization committee's goal to maintain continuity between this scale and the MMPI and MMPI-2.

Item overlap or shared items between scales contributes to several problems for factor analytic studies. These problems include: (1) shared error between items which makes it difficult to determine the true amount of error accounted

for (Gorsuch, 1983), and (2) spurious factors that may emerge as a result of the built-in correlation of overlap items (Guilford, 1952; Shure & Rogers, 1965). Additionally, Comrey (1988) stated that the more item overlap in the measure, the higher the spurious degree of correlation that is induced.

In contrast to the high number of overlapping items among the MMPI (and MMPI-A) basic scales, the MMPI-A content scales have relatively few common items. When the content scales have overlapping items the numbers range from 1 to 3 (See Table 1). Thus, the problem with common items that has plagued factor analytic studies of the MMPI, MMPI-2, and MMPI-A basic scales is of less concern with the MMPI-A content scales.

Varied Methodologies Employed. A separate concern regarding MMPI factor analytic studies is the lack of consistent methodology employed (Tonsager, 1995). Most of the research on the MMPI and it's revised versions (MMPI-2 and MMPI-A) has been conducted using principal component analysis (i.e., Butcher & Pancheri, 1976; Costa et al., 1985; Horn et al., 1972; Johnson et al., 1984; Reddon, Marceau, & Jackson, 1982; Tonsager & Finn, 1992). Several investigators have also conducted cluster analysis on the scale scores (Stein, 1968; Tryon, 1968). In several more recent studies, Bernstein and his colleagues have examined the internal structure of the MMPI through confirmatory factor analyses (Bernstein & Garbin, 1985; Bernstein, Teng,

Grannemann, & Garbin, 1987). Due to the large range of procedures used across studies, it is difficult to accurately compare findings.

Selection of Factors. Another issue relevant to comparing factor analysis research outcomes pertains to the number of factors retained (Tonsager, 1995). As discussed earlier, there are several methods available for retaining factors. The Kaiser Criterion method is a popular means of retaining factors, yet has been criticized for retaining too many components. Because the Kaiser rule is the default in most computer programs, over extraction has potentially been a problem in many investigations. Velicer and Jackson (1990) suggested that over extraction may result in differential findings between studies. In addition, Comrey (1988) asserted that over extraction followed by a varimax rotation will result in the final retained factors being inappropriately inflated at the expense of the first few major factors, thereby distorting interpretations. Like Velicer, Comrey further suggested that the over extraction of factors may be the cause of observed differences between research findings.

Raw Scores Versus T-Scores. A third pertinent concern with factor analysis of the MMPI basic scales and content scales is the question of whether the raw scores or the T-scores should be used in the analysis (Tonsager, 1995). Although this issue has not been the focus of attention in the research literature, Butcher and Tellegen (1966) argued

that T-scores should not be used in research computations, as they add another element of error to the analysis. It is probable that the uniform T-scores developed for the MMPI-2 and MMPI-A clinical and content scales may be more problematic in research computations. While the uniform T-scores function to smooth the data, they make the task of comparing the factor structures of the MMPI and the MMPI-A more difficult. A review of the factor analytic studies of the MMPI reveals a lack of consensus about which scores to use in analysis. The past four decades have evidenced investigators using both means, with a trend toward use of the T-scores in more recent work (e.g., Archer & Klinefelter, 1991; Bernstein & Garbin, 1985; Bernstein et al., 1987; Carmin, Wallbrown, Ownby, & Barnett, 1989).

Sample size. Factor analytic investigations of the MMPI have employed varied numbers and types of subject for the past four decades (Tonsager, 1995). As noted earlier in the text, the traditional rule for sample size has been a subject to variables ratio of 4:1 or 5:1, with even five to 10 subjects per variable in common use. Many of the MMPI factor analytic studies do not adhere to these standards, while the number of subjects used in previous investigations varies widely, from 107 to 13,433. With this range in the number as well as type of subjects used, comparison across studies is difficult.

Naming factors. In addition to the statistical considerations affecting the comparison of factor analytic

studies of the MMPI, Tonsager (1995) noted that the problem of naming factors remains a separate concern. Naming factors has been primarily a subjective decision, with several ways of accomplishing this task. The most basic means of naming a factor is to determine what items or constructs load most heavily on that factor and define the name of the factor by these loadings. A separate method of naming factors is to insert purposely scale items whose meanings are well established. When the items load on their perspective factors, the factors will have well established definitions available for naming them. The final method of naming factors is to have raters who are experts in the area under investigation name the factors independently and compare findings for consistent names. This method controls for individual subjectivity and is the most objective means of naming factors.

Factor analysis of the MMPI has produced many different interpretations of similar factors. For example, scale-level analyses of the MMPI basic scales have consistently produced a first factor with similar scale loadings. However, this factor has been designated several different names over the past few decades. For example, this factor has been defined as Psychoticism (Butcher & Pancheri, 1976; Wheeler, Little, & Lehner, 1951), Ego-Weakness vs. Ego-Strength (Kassebaum, Couch, & Slater, 1959), and General Maladjustment (Archer & Klinefelter, 1991).

MMPI-A Content Scales. The composition of the MMPI-A

content scales may present a concern specific to factor analysis of these scales. In particular, most of the items on the MMPI-A content scales (Williams et al., 1992) require a true response for endorsement. The issue of how the acquiescent response set affects factor analysis of the MMPI has been a matter of debate for several decades and remains an area of contention today (e.g., Block, 1965; Edwards, 1970; Edwards & Edwards, 1991, 1992; Jackson & Messick, 1961, 1962; Messick & Jackson, 1972). Most recently, Jackson, Fraboni, and Helmes (1997) have reported a set of analyses they interpret as demonstrating that the MMPI-2 content scales are heavily affected by social desirability. They argue that "the emergence of large general factors derived from correlations among arbitrarily-keyed desirability scales, each with heterogeneous content, provides strong evidence that stylistic response determinants linked to item desirability are substantially present in the MMPI-2 item pool" (p.116). These authors conclude that "the findings that MMPI-2 content scales substantially load on factors defined by desirability scales and that extremely high congruence coefficients exist between such factor loading and those derived from content scale intercorrelations support the interpretation that MMPI-2 content scales share considerable mutual redundancy that is linked to response styles" (p.116).

As noted previously, 11 of the 15 MMPI-A content scales heavily overlap with the MMPI-2 content scales. Therefore,

examination of the MMPI-2 content scale factor analytic studies (e.g., Archer, 1992; Tonsager, 1995; Tonsager & Finn, 1992) should provide an indication of the likely number of factors to emerge.

MMPI Factor Analytic Studies

Validity and Clinical Scale Analysis. Factor analysis of the MMPI commenced shortly after the creation of the test (e.g., Kassebaum et al., 1959; Tyler, 1951; Welsh, 1956; Wheeler et al., 1951). Early factor analytic studies of the MMPI validity and clinical scales produced between two and four factors. Close agreement between studies on the factor patterns of the first two factors was found. These factors were interpreted differently by separate researchers. They were often named Psychotic and Neurotic (e.g., Shure & Rogers, 1965; Wheeler et al., 1951) and appeared to measure the same dimensions which are represented by Welsh's Anxiety scale (factor I) and Welsh's Repression scale (factor II). In the following literature review, the total amount of variance accounted for by the factor structure is provided if this information was furnished by the authors.

Wheeler and colleagues (1951) factor analyzed the MMPI basic and validity scales using a sample of 222 college males and psychiatric patients and concluded that there was substantial similarity between the two populations on the first two factors. Factor I was labeled Psychotic and was marked by 7(*Pt*), 8(*Sc*) and a negative loading on *K*. Factor II was named Neurotic and had the highest loading on 3(*Hy*).

However, different loadings were found for factors III and IV.

Welsh (1956) used a sample of 150 male medical VA patients and factor analyzed the basic scales, and Welsh's Anxiety (*A*) and Repression (*R*) scales. He concluded that *A* and *R* accounted for the majority of common variance among the scales, but that there was still a good amount of unique variance. The *A* scale loaded .99 on factor I, with inconsequential loadings on factors II and III. In contrast, scale *R* showed a loading of .88 on factor II and -.22 on factor I. Factor I was marked by 7(*Pt*), 8(*Sc*), *A* and negative loadings on *K*. Factor II was marked by 3(*Hy*), *R*, and negative loading on 9(*Ma*).

In 1959, Kassebaum et al. factor analyzed the MMPI basic and supplementary scales using a sample of 160 male college students. Their analyses provided three factors, with the third factor accounting for only 5% of the total variance. The first factor was named Ego-Weakness vs. Ego-Strength and was marked by Welsh's *A*, 7(*Pt*) and 8(*Sc*). This factor accounted for 39% of the total variance. Welsh's *A* loaded most heavily on this factor which appears to be a measure of general maladjustment. Factor II was interpreted as Introversion-Extraversion and contained high loadings on Welsh's *R* and 0(*Si*), and a negative loading on 9(*Ma*). The second factor accounted for 10% of the total variance and appears to be the standard Repression factor often defined as factor II. The third factor was marked by 3(*Hy*), which

had low saturations on the first two factors.

The first factor analytic studies of the MMPI contained several notable problems. First, all the studies contained a small number of participants. Second, all samples were predominantly male. Finally, none of this research addressed the impact of item overlap on their findings.

The second decade of factor analytic research on the MMPI brought about examination of the MMPI in regards to potential concerns with the earlier work. In 1961, Eichman factor analyzed the MMPI validity, clinical, *A* and *R* scales in a population of 147 female inpatients. Four factors were produced, with the first two factors again representing general maladjustment and repression. Factor I accounted for 63% of the common factor variance, and the second factor accounted for 16% of the common factor variance. Eichman also found that his factors III and IV were similar to Kassebaum et al.'s (1959) results with male psychiatric patients. The third factor accounted for 10% of the common factor variance and was labeled Physical Symptomatology. Factor IV was named Acting-Out Tendencies and accounted for 11% of the common factor variance in the study.

In an important study of the 1960's, Shure and Rogers (1965) questioned the findings that the MMPI factor structure was comprised of Psychotic and Neurotic dimensions. Instead, these authors argued that these data were a methodological artifact related to item overlap within the MMPI. Shure and Rogers ran a series of factor

analytic studies that demonstrated the effects of shared items on the MMPI factor structure. While the Neurotic and Psychotic factors remained consistent for the full MMPI scales and the common item correlation matrix, these factors did not emerge for the truncated scales. Shure and Rogers research raised concerns about the effects of shared items on the MMPI factor structure, resulting in many researchers in the late 1960's and early 1970's using non-overlapping truncated subscales in factor analytic studies of the MMPI (e.g., Anderson, Davis, Jr., & Wolking, 1966; Cattell & Bolton, 1969; Tryon, 1968). These studies were conducted to determine if the MMPI factor structure would remain consistent after the elimination of item overlap.

In a review of most of the early MMPI factor analytic studies, Horn et al. (1972) concluded that scale level analyses defined two or possibly three factors that accounted for the majority of the variance in the basic clinical scales (for representative studies see: Anderson et al., 1966; Block, 1965; Messick & Jackson, 1961; Shure & Rogers, 1965; Welsh, 1956). The first factor, represented by Welsh's *A* scale, was marked most consistently by 7(*Pt*), 8(*Sc*), and 6(*Pa*) and less consistently by 2(*D*), 4(*Pd*), 3(*Hy*), *F*, and *K* (negatively loaded). The second factor was defined by loadings on scales 9 (*Ma*) and 8 (*Sc*), with 0 (*Si*), *F*, and 5 (*Mf*) less consistently loading on this factor. The items on this second factor comprised Welsh's *R*, with outgoingness at one pole and repression at the other

pole. The third factor found in some studies was defined as a preoccupation with somatic processes and identified by the presence of 1 (*Hs*) and 3 (*Hy*). Horn and his colleagues concluded that the interpretability of factor analytic studies was not valid if: (a) they did not control for item overlap, and (b) they did not use objective simple structure rotational procedures. They also disputed the belief that two identifiable factors consistently emerge in the factor analysis of the MMPI basic scales.

In a more extensive investigation, Butcher and Pancheri (1976) factor analyzed the MMPI validity and clinical scales with two large samples of males and females, one psychiatric and one of normals. They discovered four consistent factors including Psychoticism, Overcontrol, Social Introversion and Masculinity-Femininity. The first factor (Psychoticism) accounted for a range of 39% to 52% of overall variance across samples. Factor II, labeled Overcontrol, explained 15% to 32% of additional variance. Twelve percent to 24% of variance was explained by the Social Introversion factor, and factor IV accounted for an additional 9% to 13% of overall variance. There were many similarities between the analyses of the two studies, and there were no gender or cultural differences reported.

More recent research into the factor structure of the MMPI clinical and validity scales has examined the gender and racial differences obtained through factor analysis (ie., Bernstein & Garbin, 1985; Bernstein et al., 1987;

Carmin et al., 1989). Bernstein and colleagues (1987) factor analyzed a very large sample of male and female job applicants and inmates (N=13,433) and determined that a three factor solution was invariant across race, sex, and context of testing. The overall variance accounted for by the three factor structure ranged from 67% to 71%. These authors hypothesized that while no differences were found across several demographic variables including race and gender, examinees' level of education may have influenced test results.

A review of the factor analytic studies of the MMPI validity and clinical scales indicates a wide range of procedures used, a range of factors generated, and differential interpretations. At present, there does not appear to be consensus as to how the MMPI factor structure should be assessed. Generally, factor analytic studies of the MMPI clinical and validity scales have identified four factors, with the third and fourth factor being more difficult to interpret. One major factor which appears to be related to general maladjustment, usually has very high loadings on 7(*Pt*) and 8 (*Sc*) with negative loadings on *K*. The second major factor likely represents repression and demonstrates high loadings on 3 (*Hy*), and frequently has low loadings on 9 (*Ma*).

Item Level Analysis. More recent factor analytic studies of the MMPI have benefitted from larger sample sizes and advanced computer technology. These advances have made

it possible to examine the factor structure of the entire MMPI item pool. Early item-level analyses often did not use the entire MMPI item pool. For example, Barker et al. (1971) factor analyzed a 373 item short form of the MMPI using a sample of 1,575 Veterans Administration patients. They identified nine factors that were interpreted as MMPI psychotic and neurotic profiles and individual scales except K, which was divided among several factors. Although the total variance accounted for by the factor solution was not reported, the authors noted that the first principal component accounted for 12% of the variance. They concluded that this indicated that no single factor or dimension permeates the set of MMPI items.

In an analysis of 168 MMPI items, Overall and colleagues (1973) found six factors that were labeled: Somatization, Depression, Psychotic Distortion, Low Morale, Acting Out, and Masculinity-Femininity. However, it was found that only the first five factors clearly accounted for variance in excess of the flat right hand tail of the factor-variance curve. The resulting five factors were similar in content to the first five factors found by Barker et al. (1971).

In 1982, Reddon et al. conducted one of the first item-level analyses of the entire MMPI item pool with a principal component analysis. In an analysis of 682 prison inmates, these authors found six factors accounting for more than 80% of the variance. These factors were named: General

Maladjustment, Somatic Complaints, Impulse Expression, Cynical Outlook, Religiosity, and Severe Maladjustment. The authors concluded that social desirability influenced the factor structure, specifically the first and fourth factors. A major limitation of this study was that the sample size was too small given the number of variables in the analysis.

Johnson et al. (1984) also conducted a principal component analysis on the 566 MMPI items with a sample of 11,138 psychiatric patients (68% male, 32% female). Analyses were computed on an initial sample of 5,506 subjects and a cross-validation sample of 5,632. Twenty-one replicated factors were obtained using an orthogonal varimax solution. There was high agreement to factor labels by experts and the factor groups were similar to Wiggins Content scales. The resulting factor labels were as follows: Neuroticism, Psychoticism, Cynicism, Denial of Somatic Problems, Social Extroversion, Stereotypic Femininity, Aggressive Hostility, Psychiatric Paranoia, Depression, Delinquency, Inner Directedness, Assertiveness, Stereotypic Masculinity, Neurasthenic Somatization, Phobias, Family Attachment, Well-Being in Health, Intellectual Interests, Religious Fundamentalism, Sexual Adjustment, and Dreaming. Although overall variance was not reported, it is notable that the first 10 factors accounted for less than 20% of overall variance, and 123 unrotated factors were needed to explain 50% of the variance in the data. In addition, many factors were included that accounted for less

than 1% of the variance, and a number of factors were represented by item loadings of less than .30.

In an attempt to replicate Johnson et al.'s (1984) study, Costa et al. (1985) performed a principal component analysis of the 550 MMPI items on a sample of 1,576 male and female hospital patients. The authors were able to interpret only nine factors, and thus, were unable to replicate Johnson et al. (1984). Five of the nine components identified-Neuroticism, Cynicism, Religious Orthodoxy, and Intellectual Interests-paralleled closely to five factors from previous studies (i.e, Johnson et al., 1984; Reddon et al., 1982). Limitations of this study included a very limited participant to variable ratio and potential limitations in the subject sample. Specifically, the participants were cardiac patients, not necessarily representative of a normal population and not screened for the presence of psychiatric disturbances.

In the largest factor analytic study of the MMPI, Beck et al. (1989) employed principal component analysis on the first 399 MMPI items (clinical and validity scales) using a sample of 20,000 (11,571 male, 9289 female). Six to 25 factors were found, with the preferred solution containing the following seven factors: Neurotic Symptoms, Somatization, Psychopathy, Psychotic Symptoms, Extraverted Femininity, Suspicious Cynicism, Optimism and Family Rapport. There was reasonable correspondence between men, women, Blacks, and Whites for some factors, while other

factors appeared to replicate poorly. The authors concluded that such findings argue in favor of sex- and race-specific factor-scoring methods. The conclusions of this study regarding racial differences may have been weakened by a small sample of black women (717) relative to the number of variables (399).

Like factor analytic studies of the MMPI basic and validity scales, item-level analyses of the MMPI have employed different statistical procedures, varied number of subjects, and different types of sample populations. As a result, item-level analyses have generated from six to 25 factors for the entire MMPI item pool. In general, there is consensus about the item content of the first five factors, although the interpretation may vary. Generally, the content of these factors include: general maladjustment, somatic complaints, impulse expression, psychopathy, and cynicism.

MMPI Factor Analysis With Adolescents. Little research has been generated on factor analytic findings of the MMPI for adolescents. Archer and his colleagues have produced the only published work in this area (Archer, 1984; Archer & Klinefelter, 1991; Archer, White, & Orvin, 1979). In his first examination of the MMPI factors generated for adolescents, Archer et al. (1979) employed principal component analysis of the MMPI validity and clinical scales on a sample of 64 adolescents (34 males and 30 females). The analysis generated three factors that accounted for a

cumulative sum of 67% of total MMPI scale score variance. The first factor was characterized with high positive loadings on scales *Hs*, *D*, *Sc*, *Pa*, *Hy*, *Pt*, *F*, and *Pd*, and was labeled a General Psychopathology factor. Factor two carried high positive loadings on *K* and *L* and a high negative loading on *Si* and was defined as Defensiveness. Factor three was described as Sociopathy and had high positive loadings on *Ma* and *Pd*. While this study carried important implications to the field as it was the first to produce MMPI factors for adolescents, results were limited by the small number of participants used in the analyses.

In an attempt to replicate his earlier findings, Archer (1984) factor analyzed the MMPI clinical and validity scales on a sample of 156 (76 male and 80 female) adolescents from two residential inpatient settings. Four factors emerged that accounted for 69% of MMPI scale variance. The first factor, labeled Psychoticism, was depicted by high positive loadings on scales *F*, *Pa*, *Sc*, and *Ma*, more neurotic loadings on *Hs* and *Pt*, and a negative loading on scale *K*. The second factor was marked by high loadings on scales *Hs*, *D*, *Hy*, and *Pd*, and labeled Neurotic/Characterological symptomatology. The third factor, labeled Overcontrol or Defensiveness, contained positive loadings on *L* and *K* and a negative loading on *Pd*. The fourth factor was identified with positive loadings on the two "nonclinical scales" *Mf* and *Si*, and has been called Masculinity-Femininity or Introversion-Extroversion. These findings are similar to findings for

adult populations as discussed previously and lend further support to the four factor interpretation for the MMPI clinical and validity scales.

The most recent investigation of the MMPI factor structure for adolescents was conducted by Archer and Klinefelter (1991). Item-level and-scale level analyses of the MMPI were conducted by employing principal component analysis to a sample of 1,762 adolescents (1033 males, 729 females). Scale-level analyses were conducted separately for males and females on MMPI T-score data for protocols scored appropriately on Marks and Briggs' (1972) adolescent norms. Scale-level analyses produced five factors for each gender. The cumulative proportion of variance accounted for by the five factors was .72 for males and .74 for females. These results were fairly consistent with Archer's (1984) prior findings and more generally with the adult literature for scale-level analyses. The first factor, labeled General Maladjustment, was consistent for males and females and has been noted by Graham (1990) to be the most consistent dimension to emerge in the factor analysis of the MMPI basic scales. The remaining factors contained some overlap in loading patterns, but also contained some scale loadings that differed by gender. For example, factor II for males combined social introversion with somatic preoccupation, while factor II for females combined social introversion with depressive features.

To determine item-level analyses, Archer and

Klinefelter (1991) employed the eigenvalue of 1 criterion and Cattell's scree test to determine the number of factors to rotate. The authors found 17 factors with item loadings greater than .30. The factors accounted for 26% of the total MMPI item variance and were labeled: Neuroticism/General Maladjustment, Psychoticism, Somatization, Cynicism, Phobias and Fearfulness, Extroversion/Sociability, Masculinity, Femininity, Delinquency, Hostility, Familial Discord, Denial of Somatic Concerns, Self-Esteem, Denial, Mania, Self-Consciousness, and Religiosity. These factors contained a substantial degree of overlap with the 21 factors identified by Johnson et al. (1984). In particular, 11 factors were identified as common to both studies, and the item loading patterns of these factors indicated substantial overlap on the item level as well as on the factor labeling level. When the item-level analyses were conducted separately by gender, 16 of the 17 factors replicated for males while only 10 of the 17 factors replicated for female protocols. A limitation of these results however, is that the sample size was too small to warrant conclusions regarding gender differences.

Factor Analysis of the MMPI Content Scales. There have been a limited number of factor analytic investigations of the MMPI content scales developed by Wiggins for the original form of the MMPI. In his original monograph, Wiggins (1966) examined the internal structure of the scales. He performed a factor analysis of the 13 scales

which yielded three factors in each of three varied populations (Air Force normals, male psychiatric inpatients, and male college students). The retained factors accounted for 69%, 71%, and 62% of the total scale variance in the Air Force, psychiatric, and college samples, respectively. The factors were very similar for the different groups, whereas the specific structure varied slightly between the samples. Factor I emphasized a cynical attitude toward life, hostility toward other people, restlessness, low morale, and family disorganization. Factor II was marked by self-reported maladjustments, both physical and social. Factor III was defined by *REL* and *FEM*.

Wiggins (1969) factor analyzed the 26 content categories designated by Hathaway and McKinley (1940) on a sample of 250 male and 250 female college students. Principal component analysis yielded seven factors for men and six for women that accounted for 60.9% and 55.1% of the total variance. Factor I appeared to be the general maladjustment dimension found in the clinical scales. Wiggins suggested that the content categories that loaded most heavily on this factor reflected subjectively experienced distress on the part of the respondent. The remaining factors loaded somewhat differently for males and females. However, the first three factors for both genders appeared to represent general complaints (physical complaints, anxiety) while the last three seemed to center around more specific categories (sexual attitudes, deviant

religious attitudes).

In an attempt to replicate Wiggins's (1966) analyses, Jarnecke and Chambers (1977) employed principal component analysis on the MMPI content scales based on the responses of 242 male psychiatric inpatients. In addition to the content scale scores, age, IQ, and education were also factor analyzed. Five factors emerged which accounted for 71% of the common variance. Three factors were very similar to Wiggins'(1966) factors. The final two factors were marked by education and IQ as one factor, and age as the final factor. This overall similarity to Wiggins results provided support for the generalizability of the dimensions of self-report being tapped by the MMPI content scales across different psychiatric samples. It also further strengthened the argument that the derived factor dimensions are stable across psychiatric samples.

As part of an investigation of the external correlates of the Wiggins Content scales, Lachar and Alexander (1978) intercorrelated T values for the MMPI clinical scales, *A*, *R* and the 13 content scales, and submitted the correlation matrix to a principal component factor analysis. The investigators obtained five factors that accounted for 96% of the common variance among the scales. The factors were labeled: Somatic Complaints and Psychological Discomfort (I), Response Style (II), Depression and Anxiety (III), Traditional Sex Role Interest (IV), and Interpersonal Conflict (V). Lachar and Alexander suggested that results

of the factor analysis supported the interpretive intent of the content scales, as well as suggested their relative vulnerability to a defensive response set.

Factor Analysis of the MMPI-2 Content Scales. In the eight years since the creation of the MMPI-2 content scales, only a few factor analytic investigations of their item content have been undertaken. Archer (1992) conducted principal factor analyses of the MMPI-2 content scales from a sample of 153 female and 161 male adult psychiatric inpatients partitioned by gender. Results provided evidence that the 15 content scales were accounted for by two principal factors for both men and women. The first factor accounted for the majority of the common scale variance (.77 for females, .84 for males), and corresponded closely to the first factor identified for the basic scales that has been often labeled General Maladjustment or Neuroticism. Items loading on the first factor included *ANX*, *OBS*, *DEP*, *LSE*, *SOD*, *WRK* and *TRT*. The second factor was labeled Externalizing Tendencies and contained loadings on scales *ANG*, *ASP*, and *TPA*. The second factor provided an additional .10 variance for males and .16 for the female sample. Although conclusions are limited by the small number of subjects, Archer reported that the factor structure was somewhat clearer for females than for males.

Tonsager and Finn (1992) factor analyzed the MMPI-2 content scales on a larger sample of 1,138 male and 1,462 female normals. Their analyses also produced a two factor

solution for both males and females. The first factor was labeled Negative Emotionality and accounted for 50% of the variance. Scales loading on this factor included: *WRK*, *LSE*, *TRT*, *DEP*, *ANX*, *OBS*, and *SOD*. Factor II accounted for approximately 10% of the variance and was named Constraint. This factor was comprised of these scales: *CYN*, *ASP*, *BIZ*, *TPA*, *ANG*, and *FAM*. With the exception of *HEA* and *FRS* scales, the factor loading patterns appeared to be congruent between males and females. These results closely paralleled Archer's (1992) findings.

More recently, Tonsager (1995) investigated the factor structure of the MMPI-2 content scales and tested whether the structure was invariant in males and females and in normal and clinical populations. Principal component factor analyses were conducted on the MMPI-2 protocols of 1445 females and 1124 males from the MMPI-2 normative sample and a psychiatric sample (647 females, 705 males). The MMPI-2 content scales' factor structure was demonstrated to be invariant across gender and psychiatric status. A two factor solution compatible with earlier research, consistently emerged across samples. Factor I was labeled General Maladjustment/Emotional Distress and accounted for the largest source of test variance (49% to 53%). This factor was marked by loadings on *ANX*, *LSE*, *DEP*, *OBS*, *TRT*, *WRK*, *HEA*, and *FRS*. Factor II was characterized by loadings on scales *ANG*, *TPA*, *CYN*, and *ASP* and was labeled Constraint vs. Disinhibition. The second factor added 9% to 10%

additional variance.

The MMPI-2 content scales appear to have two underlying dimensions. The largest factor is similar to the general maladjustment factor that is the first factor found in analyses of the MMPI clinical scales. The second factor appears to be related to externalizing tendencies. The reviewed factor analytic studies do not demonstrate gender differences within the factor structure of the content scales, and suggest that the content scales have factorial stability across samples.

MMPI-A Factor Analysis. Since it's development in 1992, the MMPI-A has been the subject of just four factor analytic studies. This is likely due to the number of participants required to conduct factor analyses, demanding time to collect a sufficient amount of data on this new instrument. The MMPI-A test manual (Butcher et al., 1992) provides the factor structure obtained from a principal component analysis of the 13 basic scales using the MMPI-A normative sample. Butcher et al. found a four factor solution for each gender, with factors corresponding to the dimensions of general maladjustment, Overcontrol, and MMPI scales 0(*Si*) and 5(*Mf*). The factor solution accounted for 78.6% of the total variance for the male group, and 78% of the total variance for the female group. These findings were similar to Archer's (1984) findings of four factors noted previously in his analysis of MMPI basic scale data from 156 adolescent inpatients. This factor structure is also similar to the

five factor solution identified by Archer and Klinefelter (1991) in their factor analysis of 1,762 adolescent inpatients' MMPI basic scale data.

In a separate analysis of MMPI-A item level and scale-level factor structures, Archer, Belevich, and Elkins (1994) conducted factor analyses on the full 478 item MMPI-A, and scale-level analyses on the 69 scales and subscales of the measure. The MMPI-A normative sample of 1,620 adolescents (805 males and 815 females) was analyzed in combined gender groups. Item-level analysis resulted in the retention of 14 factors that accounted for 81% of the common variance. The factors were labeled the following: General Maladjustment, Developmental Symptomatology, Adolescent Vigor, Sociability, Stereotypic Femininity, Cynicism, Somatization, Delinquency, Psychotic Dyscontrol, Depression, Familial Discord, Academic Interests, Paresthesia, and Hostility. Eight factors emerged for the scale-level analysis, accounting for 93% of scale variance and labeled: General Maladjustment, Immaturity, Disinhibition/Excitatory Potential, Social Comfort, Health Concerns, Naivete, Familial Alienation, and Psychoticism. Archer and his colleagues contended that the item-level analysis produced factors that were similar to previous factors identified in adolescent and/or adult factor studies of the original MMPI. In addition, several of the item-level factors produced in the study were unique to the MMPI-A and were related to adolescent development.

Archer (1992) conducted factor analyses of the combined

MMPI-A content and supplementary scales on the MMPI-A normative sample of 815 girls and 805 boys. Three factors emerged for each gender. Factor I accounted for 73% of the overall variance for females and 70% of the overall variance for males. The first factor was labeled General Maladjustment and closely corresponded to the first factor produced in similar analyses of the MMPI-2 content scales (Archer, 1992). Scales loading on Factor I included: *A-anx*, *A-obs*, *A-dep*, *A-biz*, *A-lse*, *A-trt*, *A-aln* and Welsh's Anxiety scale. Factor II was very similar for males and females, and was comparable to the MMPI-2 content scales factor II. This factor accounted for 12% of overall variance for the female sample, and 15% of the overall variance for the male group. The second factor appeared to be related to an externalizing dimension and was characterized by loadings on the content scales *A-con*, *A-fam*, *A-sch*, the supplementary scales related to substance abuse *MAC-R*, *ACK*, *PRO*, and *IMM*. Unlike the two factor solutions produced by factor analyses of the MMPI-2 content scales, the MMPI-A content and supplementary scales produced a third factor accounting for 10% of the overall variance in the female sample and 12% of the overall variance in the male sample. This factor was related to repression and social discomfort for girls and general neuroticism or maladjustment and disinhibition for boys. Factor III was described by loadings on *A-sod* and Welsh's Repression for girls, and *A-obs*, *A-ang*, *A-cyn*, Welsh's Anxiety, and a negative loading on Welsh's Repression for

boys. A similar factor loading pattern was produced when factor analyses were repeated on a small inpatient sample of 54 females and 68 males.

Most recently, Sherwood et al. (1997) developed the MMPI-A Content Component scales which break down 13 of the 15 content scales into two to four dimensions. Sherwood et al. used a multi-stage, multi-method approach combining rational and statistical procedures. This method began with separate item-level principal component analyses for each of the 15 content scales using a clinical sample of 613 participants. The clinical sample was divided by gender and subsequently each gender was split in half for cross-validation, and a separate principal components analysis was run. The component structures for each scale were then examined across the four subsamples, and items with consistent factor structure were assigned to provisional Component scales. The next stage of development consisted of scale refinement in which internal and external item analyses and rational inspection of the scales were employed. The final stage of development included labeling the Component scales through a process of rational review of scale items. Only *A-anx* and *A-obs* were unable to be broken down into further dimensions. Nine of the 13 MMPI-A content scales were divided into two Content Component scales (*A-biz*, *A-ang*, *A-cyn*, *A-lse*, *A-las*, *A-sod*, *A-fam*, *A-sch*, *A-trt*). *A-hea*, *A-aln*, and *A-con* were partitioned into three Component scales, and *A-dep* was broken down into four subscales.

Factor analytic studies of the MMPI-A have demonstrated the similarity of the factor structure to the original MMPI (Archer, 1984; Archer et al., 1994; Archer & Klinefelter, 1991). An exception to this is the emergence of unique factors (e.g., factor III) that relate specifically to adolescent development (Archer, 1992). Like the MMPI-2 content scale analyses, the factor structure of the MMPI-A content and supplementary scales has been demonstrated to be stable across gender within the normative sample (Archer, 1992). No factor analytic investigations of the MMPI-A content scales without the addition of the supplementary scales have been performed at this time. Therefore, there is not yet enough research with a large psychiatric sample to determine whether the MMPI-A content scales have factorial stability across samples, or whether the gender similarities hold up within a psychiatric population. Further research is needed to determine the factorial stability of the MMPI-A content scales across these settings and gender. Additional research is also needed to replicate Sherwood, et al.'s (1997) item-level analysis of individual MMPI-A content scales.

Purpose of This Study

Several factor analytic studies have recently been conducted on the MMPI-2 content scales (e.g., Archer, 1992; Tonsager, 1995; Tonsager & Finn, 1992). These analyses have consistently demonstrated that MMPI-2 content scales yield two stable factors. The degree to which the MMPI-A content

scales will yield a similar factor structure has not been empirically evaluated. Therefore, one purpose of this study was to identify and interpret the overall factor structure of the MMPI-A content scales through the use of scale-level analyses. A second objective of this study was to examine the factor structure of each individual content scale through item-level analyses, and compare these structures to the MMPI-A content component scales developed by Sherwood, et al. (1997). These analyses were conducted within and across two diverse samples: the MMPI-A normative sample and a sample of adolescents receiving psychiatric services. Additionally, factor analyses of the MMPI-A normative sample were performed separately for males and females because this sample is large enough to allow partitioning by gender.

Practical Implications

Identifying the factor structure of the MMPI-A content scales has several functions. First, it may modify the clinical interpretation of the content scale data derived from the MMPI-A. If it is found that there are only a few dimensions underlying the 15 content scales, clinicians may wish to emphasize these underlying dimensions as part of individual scale interpretation. For example, if the Negative Treatment Indicators (*A-trt*) scale loads on a General Maladjustment factor, it may be prudent to interpret the *A-trt* scale results as part of the General Maladjustment factor in addition to interpretations that emphasize potential problems the individual may have with treatment.

At the very minimum, knowledge of factor analytic results will enable the clinician to briefly examine factor scores to obtain an overview evaluation of the respondent's psychological functioning. The content scales will then depict how these major dimensions will be expressed for that individual. This would allow for hierarchical interpretation (i.e., beginning with factorial dimensions and working toward individual scale level scores) which has been effectively used with the NEO-PI (Costa & McCrae, 1985) and the Wechsler scales (Wechsler, 1989, 1991, 1997).

The second potential effect of these analyses is that a revised profile form could be developed that would reorganize content scales from their seemingly arbitrary array of scales to one organized by factor structure. Archer and Klinefelter (1991) recently used factor dimensions to organize interpretation of the MMPI with adolescents. The MMPI-A Structural Summary has also been recently developed by Archer and Krishnamurthy (1994). The Structural Summary organizes the 69 scales and subscales of the MMPI-A into eight factors, facilitating test interpretation. Tonsager (1995) recently recommended reorganizing the MMPI-2 content scales by factor structure, similar to the proposal for the MMPI-A.

Identifying the underlying dimensions within each content scale will allow for examination of the content subareas contained within specific content scales. This was done for the MMPI basic scales by Harris and Lingoes in the

1950s (Harris & Lingoes, 1955). Similar to basic scale interpretation, a content scale T-score of 65 may represent elevation of different subcontent areas. For example, a rational review of the item content of the MMPI-A Anger (*A-ang*) scale indicates that this collection of items may assess a variety of anger-related symptoms including irritability, impatience, and physical assaultiveness. A factor analysis of the (*A-ang*) item pool will indicate the extent to which these dimensions are empirically reflected in the factor structure of this content scale. Factor analysis may also allow for the development of useful scales like the Harris-Lingoes. Sherwood et al. (1997) have recently developed such scales for the MMPI-A content scales. Data from this study could potentially support this latter effort by Sherwood and her colleagues.

Factorial Stability. Factor analysis of the MMPI-A content scales within and across populations (normative versus psychiatric samples) and gender will allow for the examination of factor structure in a manner relevant to the issue of factorial stability. Factorial stability refers to the extent to which the underlying structure of what is being measured is composed of the same variables or dimensions across individuals, conditions, or samples (Tonsager, 1995). If the MMPI-A content scales have a factor structure that is similar across samples in this investigation, the factors that emerge have greater generalizability across settings. According to Watson,

Clark, and Harkness (1994), the stability of the factor structure of a measure will influence the generalizability of scoring, interpretation, and prediction within and across individuals, conditions, or variables.

Generalizability of scoring refers to the ability to utilize similar scoring methods for the same test with different populations (Tonsager, 1995). Generalizability of scoring of the MMPI-A content scales is important to determine because if the scales' factor structure varied across sample (i.e., gender, setting), different scoring criteria would be necessary for each population to assess the underlying dimensions. In addition, if the MMPI-A factor structure were found to be unstable, the test would have various meanings for different individuals or groups. Finally, if factorial stability was not denoted across groups, it would likely be more difficult to predict factor outcome.

Several questions guided this research endeavor:

1. What are the factor structures of the MMPI-A content scales collectively and individually?
    a. What are the major underlying dimensions of the collective MMPI-A content scales?
    b. Are there meaningful groups of items within each MMPI-A content scale that can facilitate test interpretation?
2. Is the factor structure of the MMPI-A content scales similar across gender in the normative sample and setting?

a. Are there significant psychiatric-status related differences in the factor structure of the collective MMPI-A content scales?

b. Are there significant psychiatric-status related differences in the factor structure of individual MMPI-A content scales?

c. Are there significant gender related differences in the factor structure of the individual and collective MMPI-A content scales within the normative sample?

Hypotheses

It was predicted that:

1. Scale-level analysis of the MMPI-A content scales would result in a two factor structure comparable to the factor structure of the MMPI-2 content scales. The first factor was expected to relate to general maladjustment and the second factor was expected to be marked by scales relating to an externalizing dimension.

2. Item-level analyses would produce discrete and salient factors or subscales for each of the MMPI-A content scales that would aid in obtaining a more refined assessment of the construct of interest.

3. The factor structure of the scale-level analyses was expected to be found to be similar across gender within the normative sample and across setting.

METHOD

Participants

Normative Sample. Participants from the MMPI-A normative group comprised the majority of the participants for this study. This sample includes 805 males and 815 females ages 14 to 18, and in grades 7 to 12. Participants in the normative group came from Minnesota, California, Virginia, Ohio, Pennsylvania, New York, North Carolina, and Washington. Ethnic composition of the sample includes 76% Caucasian, 12% African-American, and 12% participants from other ethnic groups. The adolescents' parents used in the MMPI-A normative sample are well-educated, and overrepresent higher education levels as compared to the 1980 U.S. Census data. This overrepresentation of higher educated individuals is similar to the composition of the MMPI-2 normative sample (Archer, 1997). Approximately two thirds of the sample reported living with both biological parents. All participants met the following exclusionary criteria: "(a) subjects with incomplete data; (b) Carelessness scale values > 35; (c) original *F* scale value > 25; (d) subject age < 14 or > 18" (Archer, 1997, p. 48). A more detailed description of the selection of subjects and subject characteristics can be found in the *MMPI-A Manual for Administration and Scoring* (Butcher et al., 1992).

Psychiatric Sample. The clinical group was comprised of 358 adolescents (266 boys and 92 girls) between the ages of 13 and 18, who were receiving psychiatric services at the

time of the psychological assessment. This sample had a mean age of 15.06 years with a standard deviation of 1.46 years. Fifty-eight percent of the sample (206 participants) were receiving inpatient treatment in Virginia when the assessment was conducted. The remaining portion of the sample (152 participants) were evaluated in various treatment centers in Minnesota and North Carolina. The majority of this sample (81%) was obtained from inpatient treatment centers, 15% from outpatient settings, 3% from residential treatment facilities, and 1% from day treatment centers. The clinical sample was comprised of individuals with the following diagnoses: Depressive Disorders - 36%, Conduct Disorder - 34%, Adjustment Disorders - 3%, Bipolar Disorder - 3%, Anxiety Disorders - 3%, Attention-Deficit/ Hyperactivity Disorder - 2%, and other disorders made up the final 19% of the sample. All participants had met the requisite 7th grade reading level for the MMPI-A (Archer, 1997), had received a DSM-III-R diagnosis, and had produced valid and accurate MMPI-A profiles defined by (*?*) raw score $\leq$ 30, *F* scale T score $\leq$ 100, and *L* and *K* scores $\leq$ 65. The sample's ethnic distribution was comprised of 81.6% Caucasians, 10.5% African-Americans, 2% Hispanics, 1.3% Native Americans, and 4.6% other or unknown ethnic groupings. Reading ability was evaluated using standard scores and grade equivalent scores derived from the reading component of one of four standardized achievement tests. These tests included the Wide Range Achievement Test -

Revised (WRAT-R; Jastak & Wilkinson, 1984), the Peabody Individual Achievement Test - Revised (PIAT-R; Markwardt, 1989), the Woodcock-Johnson Psycho-Educational Battery Revised (Woodcock & Johnson, 1989), or the Kaufman Assessment Battery for Children (K-ABC; Kaufman & Kaufman, 1983).

Procedure/Data Analyses

The underlying factor structure of the collective MMPI-A content scales and the individual content scales was investigated in two phases. The first phase investigated the factor structure of the collective content scales through scale-level analyses. The second phase examined the factor structure of each individual content scale through item-level analyses. In both phases, identical statistical procedures were used to identify the factor structures.

Analyses were conducted on archival data that was collected from various sources and presented earlier in the manuscript. In order to perform factor analyses, the participants' MMPI-A content scale raw scores were first intercorrelated. The use of raw scale scores rather than T-scores in the analyses is based on several considerations. First, the MMPI-A content scales are scaled on uniform, non-linear T-scores, which make factor analyses difficult. Second, Butcher and Tellegen (1966) recommended that raw scores be used in most research computations with the original MMPI, and this advice appears appropriate for the MMPI-A. Third, many of the factor analytic studies of the

original MMPI used raw scores. Therefore, the use of raw scores will allow greater comparability between the MMPI and the MMPI-A.

Factor Extraction. To perform factor analyses, the correlational matrix from the 15 MMPI-A content scales was subjected to principal factor analysis using the FACTOR method program of SAS. The number of components to be retained was determined by the following criteria: (1) Kaiser's criteria or eigenvalue greater than 1, (2) Scree test (Cattell, 1966), and (3) the psychological interpretability of the factor. One of the goals of this investigation was to examine the factorial stability of the MMPI-A content scales. Thus, factor extractions were conducted across varying samples for both the scale level and item level analyses. The factor solutions were determined separately from the intercorrelational matrices of the combined normative group, normative males, normative females, and the combined clinical group.

Factor Rotation. The factor structures that emerged across the various samples were examined using both unrotated and rotated solutions to aid in the interpretation of those solutions. The promax or oblique rotation procedure was used as it allows for the possibility that the factors are correlated with one another. Oblique rotation has also been the method of choice for previous MMPI-A factor analytic investigations (e.g., Archer, et al., 1994) and therefore maintains consistency with earlier work.

Finally, use of the oblique rotation is supported by the presumption that the extracted factors were not orthogonal to each other, given the item and construct overlap among many MMPI-A content scales.

Factor Interpretation. The final phase of each study involved the interpretation of the underlying dimensions of the collective and individual MMPI-A content scales. As discussed earlier in the text, there are several ways to interpret or name factors. For the purposes of this investigation, factors were independently labeled by four experts in assessment who based their decisions on examination of the item loading patterns of each factor and assigned labels based on item content. In addition to using expert raters, the writer independently engaged in the labeling task. Items with the highest correlation with a factor were used to name the factor.

RESULTS

Preliminary Analyses

T-tests and chi square statistics were performed to compare the clinical sample to the normative sample across several dimensions including age, gender, and race. Age was found to be significantly different between the groups, $t(467) = 6.08$, $p < .05$, with the normative group ($M = 15.57$) being an average one half year older than the clinical sample ($M = 15.07$). Chi square analyses demonstrated that the two groups differed by gender, $X^2(4, N = 1980) = 21.08$, $p < .05$. The normative group was comprised of an equal distribution of males and females, while the clinical group consisted of 63% males and 37% females. There was no significant difference between groups according to race, $X^2(4, N = 1983) = 1.68$, $p > .05$.

Scale-Level Analyses

The 15 MMPI-A content scales were subjected to principal factor analyses across the four samples (entire normative sample, normative males, normative females, clinical group). Factors were extracted according to apriori criteria for determining the optimal number of factors. Table 2 presents the number of factors retained for each sample as well as the variance accounted for by the factors. Independent raters named the factors based on their review of the item loadings on each of these factors. These ratings are presented in Table 3.

A review of the eigenvalues and the scree plots

Table 2

Collective MMPI-A Content Scales Factor Solutions and Variance Accounted for by the Factors

	Normative			Clinical
	Combined	Males	Females	Combined
Scale				
Collective	1 (.47)	1 (.47)	1 (.49)	1 (.47)
		2 (.07)		2 (.09)

Table 3

Rater's Interpretation of Factors

	Raters					
Scale	1	2	3	4	5	Consensus
A-anx I	Worry	Worry	Anxiety	Anxiety	Anxious Worrying	Anxiety/ Worry
A-obs I	Rumination	Indecision	Rumination/ Indecisive	Obsessive	Indecisive/ Obsessive	Rumination Indecision
A-dep I	Dysphoria	Unhappiness	Dysphoria/ Depression	Depressed Unhappiness	Depression	Depression
A-hea I	Body Pains	Somatization	Somatic Discomfort	GI/Nausea	Somatization	Somatization
II	Good Health	Neurological Symptoms	Denial of Health Complaints	Neurological Symptoms	Health Satisfaction	Denial of Health Complaints
A-biz I	Psychoticism	Psychotic Experiences	Psychoticism	Psychotic Symptoms	Reality Distortion	Psychoticism

Table 3 Continued

	Raters					
Scale	1	2	3	4	5	Consensus
A-ang I	Explosive Anger	Volatility/ Explosive	Anger/ Hostility	Angry Discontrol	Irritability/ Anger	Anger
A-cyn I	Interpersonal Suspicious	Misanthropic Attitudes	Cynicism	Cynicism	Cynicism/ Distrust	Cynicism
A-aln I	Skepticism	Estrangement	Alienation	Alienation	Alienation	Alienation
A-con I	Acting Out Behavior	Antisocial Behavior	Externalizing Behavior	Delinquent/ Oppositional	Defiant Behavior	Oppositional
A-lse I	Low Self-Worth	Self-Depreciation	Low Self-Esteem	Self-Doubt	Personal Unworthiness	Low Self-Worth
A-las I	Learning Oriented	Intellectual Orientation	Low Academic Achievement	Intellectual Interests	Studious/ Inquisitive	Intellectual Orientation
II	Low Initiative	Passivity	Poor Initiative	Defeatism	Uninitiating Follower	Poor Self-Initiation

Table 3 Continued

	Raters					
Scale	1	2	3	4	5	Consensus
A-sod I	Extroversion	Extroversion	Extroversion	Sociability	Social Enjoyment	Extroversion
II	Introversion	Shyness	Shyness	Shyness	Social Avoidant	Shyness
A-fam I	Persecution by Family	Family Problems	Familial Discord	Resentment of Family	Family Alienation	Familial Discord
(N) II	Parental Cohesion	Family Cohesion	Parental Affection	Affectional Attachment	Family Cohesion	Family Cohesion
(C) II	Family Alienation	Family Estranged	Family Alienation	Family Harmony	Family Cohesion	Family Cohesion
III	Family Love	Family Cohesion	Parental Affection	Love for Parents	Family Cohesion	Family Love
A-sch I	Negative School Attitude	Negative School Attitude	Poor School Attitude	Resentment of School	School Unhappiness	Negative School Attitude

Table 3 Continued

		Raters					
Scale		1	2	3	4	5	Consensus
	II	School Conduct	Misbehavior in School	Poor School Conduct	Resentment of School	School Dissatisfied	Negative School Attitude
A-trt	I	Helplessness	Helpless	Helplessness	Defeatism	Ineffectual Helplessness	Helpless
(NM)	II	Unwillingness to Disclose	Unwilling to Disclose	Low Self-Disclosure	Low Self-Disclosure	Verbal Restraint	Unwilling to Disclose
(C)	II	Inability to Change	Inability to Change	Inability to Change	Alienated Hopeless	Hopeless	Inability to Change

Note. (N) represents the normative group, (C) represents the clinical group, and (NM) represents the normative male group.

indicated a two factor structure was the best fit for the normative male and clinical groups. However, both the combined normative sample and the normative female group produced one factor solutions. The two factor solutions accounted for a total of 55% to 59% of the overall variance in MMPI-A content scales scores, while the one factor solutions comprised 54% to 56% of the overall variance. Factor I was identified by very strong loadings on *A-trt*, *A-dep*, *A-aln*, *A-anx*, *A-lse*, *A-hea*. The first factor accounted for 47% to 49% of the overall variance. Factor II was marked by strong positive loadings on the *A-cyn*, *A-con*, and *A-ang* scales and positive loadings on the rest of the scales. This factor contributed an additional 7% to 9% of the variance. Factor I was named General Maladjustment and the second factor was labeled Externalizing Tendencies. The factor structure is presented in Table 4.

Individual Scale Item-Level Analyses

Each of the 15 MMPI-A content scales was subjected to principal factor analyses. Factors were extracted for each scale for each of the four samples (entire normative sample, normative male, normative female, clinical group) according to apriori criteria for determining the optimal number of factors. Factor structure ranged from one to three factor solutions. Table 5 presents the number of factors retained for each scale as well as the variance accounted for by these factors.

One factor solutions. Nine of the 15 content scales

Table 4

Factor Structure of the Collective MMPI-A Content Scales

	Normative				Clinical	
	Combined	Males		Females	Combined	
	Factors					
Scale	I	I	II	I	I	II
A-trt	**.84**	**.77**	**.70**	**.85**	**.78**	**.73**
A-dep	**.82**	**.80**	**.65**	**.84**	**.88**	**.52**
A-aln	**.79**	**.80**	**.61**	**.81**	**.80**	**.60**
A-anx	**.79**	**.74**	**.69**	**.79**	**.80**	**.57**
A-lse	**.78**	**.78**	**.59**	**.79**	**.86**	**.53**
A-fam	**.71**	**.68**	**.63**	**.69**	**.46**	**.62**
A-obs	**.71**	**.53**	**.75**	**.73**	**.70**	**.66**
A-biz	**.69**	**.67**	**.58**	**.68**	**.63**	**.53**
A-sch	**.68**	**.67**	**.60**	**.67**	**.45**	**.66**
A-cyn	**.61**	.34	**.71**	**.67**	.38	**.69**
A-con	**.60**	**.42**	**.69**	**.67**	.31	**.81**
A-hea	**.60**	**.66**	.33	**.62**	**.67**	.32
A-ang	**.59**	**.40**	**.69**	**.61**	**.42**	**.78**
A-las	**.51**	**.57**	.31	**.51**	**.50**	**.43**
A-sod	**.47**	**.60**	.24	**.46**	**.57**	.13

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 5

Factor Solutions and Variance Accounted for on Individual MMPI-A Content Scales

	Normative			Clinical
	Combined	Males	Females	Combined
Scale				
A-anx	1 (.15)	1 (.14)	1 (.16)	1 (.20)
A-obs	1 (.15)	1 (.15)	1 (.15)	1 (.20)
A-dep	1 (.16)	1 (.14)	1 (.18)	1 (.22)
A-hea	1 (.12)	1 (.12)	1 (.12)	1 (.14)
	2 (.03)	2 (.03)	2 (.03)	2 (.03)
A-aln	1 (.12)	1 (.11)	1 (.13)	1 (.14)
A-biz	1 (.21)	1 (.13)	1 (.13)	1 (.14)
A-ang	1 (.11)	1 (.12)	1 (.11)	1 (.16)
A-cyn	1 (.15)	1 (.15)	1 (.16)	1 (.15)
A-con	1 (.11)	1 (.11)	1 (.11)	1 (.17)
A-lse	1 (.13)	1 (.13)	1 (.14)	1 (.20)
A-las	1 (.08)	1 (.08)	1 (.09)	1 (.09)
A-sod	1 (.13)	1 (.13)	1 (.14)	1 (.18)
	2 (.05)	2 (.05)	2 (.04)	2 (.06)
A-fam	1 (.12)	1 (.12)	1 (.13)	1 (.14)
	2 (.05)	2 (.05)	2 (.04)	2 (.05)
				3 (.03)
A-sch	1 (.12)	1 (.12)	1 (.12)	1 (.12)
				2 (.06)
A-trt	1 (.10)	1 (.10)	1 (.11)	1 (.16)
		2 (.04)		2 (.04)

produced one factor solutions that were consistent across the four samples for each scale. These scales include: *A-anx*, *A-obs*, *A-dep*, *A-aln*, *A-biz*, *A-ang*, *A-cyn*, *A-con*, and *A-lse*.

A-anx. The one factor solution for this scale accounted for a range of 15% to 23% of the overall scale variance for the four samples, with the first factor accounting for 14% to 20% of the overall variance. The factor was named Anxiety/Worry. The factor structure for *A-anx* scale is presented in Table 6.

A-obs. A one factor solution accounting for a range of 14% to 20% of the overall scale variance was determined for this scale across samples. Factor I defined 15% to 20% of the overall variance and was named Rumination/Indecision. Table 7 presents the factor structure for this scale.

A-dep. The one factor solution for this scale accounted for a range of 20% to 27% of the overall scale variance for the four samples, with the first factor accounting for 14% to 22% of the overall variance. The factor was labeled Depression. The factor structure for *A-dep* is presented in Table 8.

A-aln. A one factor solution accounting for a range of 12% to 19% of overall scale variance was determined for this scale across samples. Factor I explained 11% to 14% of overall variance, and was named Alienation. Table 9 presents the factor structure for this scale.

Table 6

Factor Structure for the A-anx Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
185	**.51**	**.51**	**.50**	**.53**
404	**.49**	**.48**	**.47**	**.53**
281	**.47**	**.49**	**.47**	**.45**
383	**.47**	**.45**	**.50**	**.50**
255	**.53**	**.51**	**.56**	**.59**
279	**.46**	**.47**	**.46**	**.51**
285	**.43**	.38	**.49**	.34
318	**.43**	**.43**	**.42**	**.56**
468	**.43**	.36	**.47**	**.48**
377	**.41**	.37	**.44**	**.42**
402	**.40**	.36	**.44**	**.54**
28	**.40**	.37	**.43**	**.47**
163	.32	.31	.32	**.43**
14	.30	.33	.28	**.41**
36	.30	.24	.33	**.41**
353	.20	.21	.17	.34
196	-.24	-.23	-.24	-.22
424	-.26	-.28	-.22	-.37
375	-.27	-.21	-.32	-.32
209	-.30	-.29	-.24	-.33
134	-.31	-.26	-.34	-.34

Table 6 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
Eigenvalue	3.19	2.91	3.42	4.12
% Variance	.15	.14	.16	.20

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 7

Factor Structure for the A-obs Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
308	**.51**	**.48**	**.50**	**.54**
185	**.46**	**.47**	**.42**	**.50**
129	**.45**	**.45**	**.47**	**.50**
421	**.45**	**.44**	**.46**	**.49**
78	**.43**	**.43**	**.45**	**.48**
370	**.43**	**.43**	**.43**	**.54**
307	**.42**	.35	**.50**	**.43**
394	.38	.35	.38	**.49**
83	.38	.39	.33	**.42**
412	.37	.36	.35	**.47**
368	.35	.30	.39	.36
310	.34	.29	.38	.34
293	.29	.37	.22	**.41**
52	.25	.28	.23	.34
444	.24	.33	.17	.33
Eigenvalue	2.29	2.25	2.30	3.02
% Variance	.15	.15	.15	.20

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 8

Factor Structure for the A-dep Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
62	.58	.55	.62	.66
259	.49	.46	.52	.58
347	.49	.44	.52	.50
53	.48	.44	.50	.52
379	.48	.46	.46	.67
177	.47	.42	.49	.52
124	.47	.45	.45	.57
283	.46	.36	.53	.59
49	.45	.37	.53	.33
372	.41	.41	.41	.41
88	.40	.35	.46	.50
242	.39	.37	.44	.45
311	.38	.37	.36	.41
399	.35	.34	.37	.53
35	.28	.25	.30	.39
68	.26	.25	.26	.17
219	.25	.35	.19	.30
139	.24	.17	.23	.45
203	.22	.24	.21	.34
371	.21	.20	.22	.24

Table 8 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
230	.20	.21	.20	.30
3	-.18	-.16	-.18	-.32
9	**-.41**	-.38	**-.44**	-.36
360	**-.43**	**-.40**	**-.43**	**-.48**
71	**-.45**	**-.42**	**-.49**	**-.48**
91	**-.57**	**-.53**	**-.61**	**-.60**
Eigenvalue	4.16	3.63	4.63	5.67
% Variance	.16	.14	.18	.22

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 9

Factor Structure for the A-aln Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
446	**.48**	**.49**	**.48**	**.51**
20	**.47**	**.47**	**.50**	**.52**
473	**.45**	**.45**	**.45**	**.49**
242	**.42**	.36	**.47**	**.42**
211	**.40**	.35	**.44**	.28
317	**.40**	.33	**.45**	**.40**
438	.39	**.43**	.37	.28
227	.36	.34	.38	.35
369	.35	.30	**.40**	.31
471	.35	.34	.37	**.46**
39	.34	.35	.34	.32
16	.34	.27	.39	**.44**
463	.30	.32	.29	.39
362	.24	.22	.25	.31
413	.17	.18	.16	.25
104	-.09	-.09	-.11	-.20
448	-.20	-.16	-.24	-.23
74	-.24	-.25	-.23	-.36
450	-.25	-.24	-.26	-.27
260	-.35	-.32	-.38	-.32
Eigenvalue	2.36	2.16	2.64	2.77

Table 9 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
% Variance	.12	.11	.13	.14

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

A-biz. The one factor solution determined for this scale accounted for a range of 14% to 25% of the overall scale variance for the four samples with the first factor explaining 13% to 20% of the overall variance. The factor was labeled Psychoticism. The factor structure for this scale is presented in Table 10.

A-ang. A one factor solution accounting for a range of 12% to 19% of the overall scale variance was determined for this scale across samples. Factor I explained 11% to 16% of the overall variance and was named Anger. Table 11 presents the factor structure for *A-ang.*

A-cyn. The one factor solution for this scale accounted for a range of 15% to 19% of the overall scale variance, with the first factor accounting for 15% to 16% of the overall variance. The factor was labeled Cynicism. The factor structure for this scale is presented in Table 12.

A-*con.* A one factor solution accounting for a range of 13% to 23% of the overall scale variance was determined for this scale across samples. Factor I explained 11% to 17% of the overall variance and was named Oppositional Behavior. Table 13 presents the factor structure for *A-con.*

A-lse. The one factor solution for this scale accounted for a range of 14% to 24% of the overall scale variance for this scale across samples. The first factor explained 12% to 20% of overall variance and was labeled Low Self-Worth. This factor structure is presented in Table 14.

Table 10

Factor Structure for the A-biz Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
439	**.54**	**.50**	**.58**	**.66**
291	**.47**	**.44**	**.51**	**.47**
296	**.46**	.39	**.52**	**.44**
299	**.44**	**.44**	**.44**	**.62**
278	**.43**	**.44**	**.42**	**.40**
29	**.40**	.37	**.43**	**.41**
173	**.40**	**.43**	.36	**.52**
132	.37	**.44**	.29	**.49**
428	.37	.38	.35	.35
250	.35	**.40**	.32	**.43**
417	.34	.35	.34	**.43**
314	.34	.31	.36	.36
22	.33	.35	.32	**.50**
92	.33	.32	.33	**.47**
332	.32	.34	.31	**.50**
433	.28	.29	.29	**.47**
315	.28	.28	.28	**.51**
155	.16	.20	.11	.36
387	-.31	-.33	-.29	-.31
Eigenvalue	4.13	2.67	2.67	2.63

Table 10 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
% Variance	.21	.13	.13	.14

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 11

Factor Structure for the A-ang Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
282	**.46**	**.44**	**.48**	**.50**
367	**.44**	**.44**	**.43**	**.49**
201	**.43**	**.46**	.39	.35
461	.39	**.42**	.35	**.46**
128	.37	**.41**	.37	**.45**
388	.34	.37	.29	.30
416	.34	.34	.32	.33
34	.32	.30	.35	**.51**
111	.32	.34	.28	.29
453	.29	.26	.32	**.51**
382	.28	.32	.27	.32
445	.26	.29	.25	.39
378	.25	.28	.24	**.41**
401	.22	.18	.25	.26
458	.21	.21	.21	.19
26	.18	.18	.16	.27
355	-.39	-.33	**-.45**	**-.45**
Eigenvalue	1.88	1.95	1.84	2.64
% Variance	.11	.12	.11	.16

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 12

Factor Structure for the A-cyn Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
107	**.51**	**.48**	**.54**	**.49**
77	**.50**	**.46**	**.55**	**.54**
118	**.49**	**.50**	**.48**	**.42**
373	**.46**	**.48**	**.43**	.36
72	**.45**	**.40**	**.49**	.38
211	**.43**	**.46**	**.40**	**.41**
325	**.42**	**.46**	.39	.32
265	**.40**	**.43**	.37	**.41**
238	.39	.35	**.44**	**.40**
395	.38	.36	**.41**	.35
295	.38	**.41**	.36	.35
100	.38	.32	**.43**	.37
267	.38	.36	.39	.36
55	.36	**.40**	.33	.36
406	.35	.30	**.41**	.19
334	.35	.33	.37	.33
330	.34	.33	.35	**.43**
263	.32	.28	.37	**.44**
47	.31	.35	.28	.30
371	.31	.26	.35	**.41**
225	.30	.28	.32	.36

Table 12 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
213	.29	.28	.29	.32
Eigenvalue	3.37	3.23	3.59	3.26
% Variance	.15	.15	.16	.15

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 13

Factor Structure for the A-con Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
462	**.45**	**.45**	**.48**	**.54**
345	**.45**	**.48**	**.38**	.37
477	**.40**	**.41**	**.40**	**.43**
354	**.40**	.35	**.42**	**.57**
478	.39	.36	**.40**	**.47**
469	.38	**.42**	.34	**.51**
455	.37	.37	.38	**.41**
445	.36	.38	.34	**.43**
117	.36	.36	.36	**.54**
234	.34	.33	.30	**.51**
224	.33	.32	.32	**.48**
456	.32	.34	.29	.38
32	.31	.31	.30	**.41**
252	.31	.31	.32	**.40**
232	.30	.34	.26	.24
99	.29	.26	.29	.36
361	.28	.34	.23	.36
356	.27	.25	.29	**.44**
442	.26	.24	.28	.26
391	.16	.21	.14	.33
96	-.20	-.17	-.17	-.29

Table 13 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
465	-.27	-.17	-.34	-.34
249	-.32	-.26	-.33	-.34
Eigenvalue	2.57	2.53	2.48	4.01
% Variance	.11	.11	.11	.17

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 14

Factor Structure for the A-lse Scale

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
70	**.51**	**.45**	**.53**	**.52**
124	**.49**	**.46**	**.49**	**.57**
379	**.47**	**.44**	**.46**	**.63**
468	**.45**	**.48**	**.41**	**.48**
306	**.44**	**.45**	**.41**	**.50**
400	**.40**	.38	**.42**	.36
385	.39	.33	**.43**	**.52**
430	.37	.41	.34	**.40**
441	.37	.37	.39	**.41**
280	.34	.32	.38	**.45**
67	.34	.32	.34	.36
432	.32	.39	.27	**.40**
384	.30	.30	.32	.32
358	.29	.25	.33	**.41**
415	.27	.24	.32	**.41**
74	-.15	-.15	-.18	-.32
105	-.22	-.15	-.31	-.38
58	-.27	-.24	-.33	**-.44**
Eigenvalue	2.41	2.26	2.57	3.58

Table 14 Continued

	Normative			Clinical
	Combined	Males	Females	Combined
	Factors			
Item #	I	I	I	I
% Variance	.13	.13	.14	.20

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

Two factor solutions. MMPI-A content scales *A-hea* and *A-sod* contained two factor solutions that were similar across samples for each scale. The two factor solution for *A-hea* explained 16% to 27% of the overall scale variance with the first factor accounting for 12% to 14% of the overall scale variance. Factor II contributed an additional 3% of the scale variance. Table 15 presents the factor structure. Factor I was named Somatization, and factor II was labeled Denial of Health Complaints.

A-sod. The two factor solution obtained for this scale had a first factor that accounted for a range of 13% to 18% of the total scale variance across samples. Factor II explained an additional 4% to 6% of the scale variance. The two factor solution accounted for 17% to 26% of the overall scale variance. The factor structure is presented in Table 16. The first factor was labeled Sociability/Extroversion and factor II was defined as Shyness.

One, two and three factor solutions. Four of the MMPI-A content scales produced factor structures that were inconsistent across samples. These scales included *A-las*, *A-fam*, *A-sch*, and *A-trt*.

A-las. This scale obtained one factor solutions for the combined normative group, normative males, and normative females, but found a two factor solution for the clinical group. The one factor solution accounted for a range of 11% to 12% of the overall scale variance, and the

Table 15

Factor Structure for the A-hea Scale

	Normative						Clinical	
	Combined		Males		Females		Combined	
	Factors							
Item #	I	II	I	II	I	II	I	II
25	**.60**	-.11	**.56**	-.14	**.61**	-.13	**.60**	-.15
56	**.59**	-.10	**.53**	-.11	**.61**	-.15	**.65**	-.20
106	**.52**	-.17	**.48**	-.24	**.54**	-.11	**.65**	-.21
37	**.48**	-.21	**.42**	-.28	**.48**	-.19	**.53**	-.23
97	**.45**	-.27	.39	-.31	**.49**	-.23	**.40**	-.29
17	.34	-.19	.25	-.16	.37	-.23	.29	-.20
167	.38	-.30	.37	-.37	.39	-.26	**.48**	**-.40**
50	.34	-.21	.32	-.18	.32	-.28	**.51**	-.39
41	.35	-.24	.31	-.17	.37	-.34	.38	-.27
93	.32	-.17	.35	-.16	.33	-.19	.32	-.17
11	.27	-.13	.34	-.16	.24	-.13	.31	-.30
143	.28	-.25	.28	-.25	.27	-.25	.36	-.31
470	.24	-.17	.31	-.18	.20	-.19	.19	-.24
233	-.13	.11	-.15	.16	-.11	.05	-.15	.24
44	-.35	.35	-.32	.40	-.36	.32	-.37	**.47**
54	-.38	.30	-.36	.35	**-.41**	.25	-.34	**.48**
168	**-.40**	.25	-.29	**.41**	**-.41**	.10	-.38	.37
210	**-.49**	**.42**	**-.41**	**.52**	**-.52**	.32	-.35	**.55**
275	-.18	**.41**	-.24	.39	-.14	**.44**	-.10	.33
374	-.15	.39	-.14	.39	-.17	.38	-.25	.32
172	-.23	.39	-.15	**.48**	-.26	.30	-.25	**.48**

Table 15 Continued

	Normative						Clinical	
	Combined		Males		Females		Combined	
	Factors							
Item #	I	II	I	II	I	II	I	II
193	-.14	.34	-.20	**.42**	-.07	.26	-.13	**.44**
87	-.29	**.40**	-.29	**.40**	-.29	.39	-.32	.39
138	-.20	.35	-.14	.38	-.22	.35	-.20	.30
135	-.36	**.42**	-.22	**.52**	**-.41**	.34	-.38	**.45**
157	-.38	**.41**	-.24	**.44**	**-.40**	**.42**	-.35	**.46**
152	-.24	.35	-.19	**.40**	-.22	.31	-.18	.38
174	-.09	.25	-.11	.31	-.06	.17	-.08	.25
239	-.25	.32	-.24	.36	-.25	.27	-.18	.34
18	-.16	.27	-.14	.29	-.15	.25	-.12	.16
113	-.23	.29	-.17	.32	-.25	.26	-.25	.23
42	-.23	.29	-.15	.24	-.28	.23	-.30	.31
112	-.17	.19	-.13	.20	-.17	.17	-.05	.15
231	.18	-.17	.19	-.28	.20	-.35	.37	-.27
443	.15	-.31	.09	-.26	.19	-.32	.31	**-.40**
422	.14	-.31	.15	-.29	.15	-.31	.17	-.19
187	.04	-.30	.09	-.29	.01	-.30	.29	-.17
Eigenvalue	4.42	1.06	4.38	1.14	4.50	1.03	5.31	1.29
% Variance	.12	.03	.12	.03	.12	.03	.14	.03

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 16

Factor Structure for the A-sod Scale

	Normative						Clinical	
	Combined		Males		Females		Combined	
	Factors							
Item #	I	II	I	II	I	II	I	II
292	**.54**	-.18	**.52**	-.14	**.54**	-.19	**.63**	-.21
335	**.54**	-.22	**.58**	-.22	**.52**	-.19	**.63**	-.30
331	**.49**	-.16	**.43**	-.16	**.52**	-.14	**.64**	-.27
339	**.40**	-.10	.37	-.15	**.44**	-.02	**.51**	-.14
450	.38	-.06	.37	-.11	.39	-.01	.26	-.12
82	.37	-.06	.33	-.21	**.40**	-.21	**.52**	-.18
336	.38	-.28	.35	-.33	**.41**	-.21	.37	-.37
319	.33	-.22	.29	-.24	.31	-.18	.38	-.01
328	-.29	.20	-.29	.22	-.30	.16	-.25	**.43**
264	-.33	.10	-.29	.14	-.34	.04	**-.41**	.36
304	**-.46**	.33	**-.54**	.33	**-.40**	.30	**-.41**	**.50**
178	-.05	**.50**	-.13	**.54**	.01	**.48**	-.12	**.43**
160	-.14	**.53**	-.20	**.52**	-.08	**.54**	-.19	**.54**
475	-.30	**.53**	-.39	**.55**	-.22	**.51**	**-.43**	**.59**
248	-.18	**.46**	-.18	**.47**	-.15	**.46**	-.20	.37
316	-.34	**.44**	**-.40**	**.48**	-.29	.39	**-.48**	**.52**
43	-.17	.37	-.16	**.42**	-.15	.33	-.15	**.44**
408	-.14	.29	-.13	.32	-.17	.29	-.12	**.40**
410	-.22	.32	-.22	.33	-.21	.30	-.34	**.43**
151	-.07	.26	-.09	.27	-.09	.28	-.07	.27
290	-.06	.21	-.11	.25	-.02	.19	-.01	.33

Table 16 Continued

	Normative						Clinical	
	Combined		Males		Females		Combined	
	Factors							
Item #	I	II	I	II	I	II	I	II
245	.22	-.25	.16	-.31	.27	-.19	.25	-.28
262	.37	**-.40**	.35	**-.43**	.37	-.35	**.41**	-.28
46	.31	**-.49**	.28	**-.48**	.33	**-.48**	**.46**	**-.40**
Eigenvalue	3.21	1.11	3.02	1.25	3.36	1.04	4.23	1.32
% Variance	.13	.05	.13	.05	.14	.04	.18	.06

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

two factor solution explained 16% of the overall scale variance. The first factor accounted for 8% to 9% of overall scale variance, while the second factor contributed an additional 7% of the scale variance for the clinical group. The factor structure is presented in Table 17. Factor I was labeled Intellectual Orientation and factor II was named Poor Self-Initiation.

A-fam. A review of the eigenvalues and scree plots for this scale indicated two factor solutions for the normative, normative male, and normative female groups. The clinical group, however, obtained a three factor solution, with the third factor contributing only 3% of the scale variance. Factor I accounted for a range of 12% to 14% of overall scale variance, while the second factor explained an additional 4% to 5% of scale variance. The two factor solution explained 19% to 21% of the overall scale variance, and the three factor solution accounted for 29% of the overall scale variance. The factor structure is presented in Table 18. The first factor was labeled Familial Discord, factor II was named Family Cohesion for the normative male group and Family Alienation for the clinical sample. The third factor was interpreted as Family Love/Cohesion.

A-sch. This scale obtained one factor solutions for the normative, normative male, and normative female groups, while a two factor solution was determined to be the best fit for the clinical group. The one factor solution accounted for a range of 13% to 15% of overall scale

Table 17

Factor Structure for the A-las Scale

	Normative			Clinical	
	Combined	Males	Females	Combined	
	Factors				
Item #	I	I	I	I	II
188	**.44**	**.48**	**.40**	**.65**	.07
403	**.41**	**.48**	.34	**.65**	.12
170	.36	.39	.38	**.45**	-.12
411	.26	.25	.27	**.43**	.01
447	.26	.27	.27	.14	-.35
436	.26	.33	.22	.29	-.10
324	.24	.37	.14	.23	-.10
409	.23	.23	.23	.35	-.04
397	.11	.17	.09	.11	.08
39	-.10	-.07	-.13	.02	.37
218	-.21	-.06	-.32	-.05	.41
464	-.21	-.07	-.31	-.07	.26
27	-.26	-.17	-.30	.04	.35
430	-.30	-.25	-.33	.04	**.43**
351	-.31	-.26	-.35	-.21	.24
340	-.38	-.25	**-.45**	-.01	**.51**
Eigenvalue	1.32	1.31	1.44	1.61	1.16
% Variance	.08	.08	.09	.09	.07

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 18

Factor Structure for the A-fam Scale

	Normative						Clinical		
	Combined		Males		Females		Combined		
	Factors								
Item #	I	II	I	II	I	II	I	II	III
269	**.56**	-.30	**.53**	-.22	**.61**	.36	**.43**	.29	-.22
438	**.54**	-.30	**.57**	-.31	**.53**	.26	**.53**	.30	-.12
19	**.53**	-.27	**.50**	-.29	**.53**	.26	.35	**.41**	-.15
240	**.41**	.02	.36	.01	**.41**	-.03	.28	.34	-.03
194	.36	.06	.35	.05	.33	-.09	.27	.34	-.05
137	**.45**	-.23	**.42**	-.17	**.48**	.27	.31	.28	-.17
363	**.40**	-.23	.39	-.14	**.41**	.19	.20	.30	-.15
359	.37	-.09	.38	-.09	.36	.09	**.40**	.25	-.03
396	.28	.11	.27	.11	.25	-.12	.05	.37	-.00
277	.27	.10	.26	.15	.28	-.07	.22	.16	-.02
454	.37	-.21	.34	-.17	**.41**	.23	.28	**.42**	-.24
191	**.41**	-.33	.39	-.32	**.43**	.33	**.60**	.12	-.17
181	.36	-.24	.34	-.26	.37	.21	**.41**	.22	-.21
302	.33	-.17	.34	-.21	.30	.11	.17	.29	-.31
344	.37	-.35	.34	-.32	**.41**	.35	.36	**.45**	-.00
352	.26	-.12	.19	-.09	.30	.14	.13	.30	-.12
381	.20	-.17	.24	-.19	.19	.14	.13	.19	-.12
451	-.31	.30	-.21	.34	-.40	-.24	-.19	-.05	.17
79	**-.43**	.24	**-.40**	.25	**-.43**	-.24	-.17	**-.43**	.05
258	.00	**.45**	-.00	**.49**	-.05	**-.40**	-.14	.08	**.54**
182	-.01	.39	.04	**.43**	-.11	-.33	-.13	-.02	**.52**

Table 18 Continued

	Normative						Clinical		
	Combined		Males		Females		Combined		
	Factors								
Item #	I	II	I	II	I	II	I	II	III
365	-.29	**.49**	-.24	**.54**	-.37	**-.42**	-.29	**-.40**	.29
460	-.08	.37	-.09	**.41**	-.10	-.31	-.26	-.18	.15
86	-.08	.36	-.06	.39	-.10	-.36	.26	**-.40**	**.50**
457	-.14	.35	-.13	.37	-.18	-.33	-.17	-.30	.12
398	-.20	.35	-.12	**.43**	-.26	-.26	-.07	-.16	.28
119	-.38	.38	-.30	**.41**	**-.45**	-.33	-.21	**-.42**	.31
6	-.14	.30	-.13	.30	-.13	-.33	.32	**-.49**	**.48**
303	.19	-.27	.24	-.29	.16	.24	.24	.09	-.32
366	.20	-.34	.26	-.38	.18	.30	.05	.22	-.33
440	.21	-.34	.30	-.34	.18	.34	.29	.15	-.11
57	.28	**-.42**	.32	-.39	.30	**.43**	**.54**	.20	-.16
184	.34	**-.44**	.27	**-.46**	**.43**	**.40**	.25	**.42**	-.38
215	.11	**-.40**	.15	-.39	.11	**.43**	.14	.27	**-.59**
405	.10	**-.44**	.13	**-.41**	.12	**.47**	.05	.12	**-.48**
Eigenvalue	4.28	1.61	4.26	1.70	4.42	1.44	4.87	1.74	1.11
% Variance	.12	.05	.12	.05	.13	.04	.14	.05	.03

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

variance, and the two factor solution explained 21% of the overall scale variance. Factor I accounted for 12% of overall scale variance across samples, and the second factor contributed an additional 6% of scale variance for the clinical group. Table 19 presents the factor structure. Factor I was identified as Negative School Attitude, and factor II was labeled Poor School Conduct.

A-trt. A review of the criteria for retaining factors established one factor solutions for the combined normative and normative female groups, and two factor solutions for the normative male and clinical groups. The one factor solution accounted for a range of 13% to 15% of the overall scale variance, while the two factor solution explained 14% to 23% of the overall scale variance. Factor I accounted for a range of 10% to 16% of scale variance across samples. The second factor contributed an additional 4% of scale variance for the normative male and clinical groups. The factor structure is presented in Table 20. The first factor was labeled Helplessness, and factor II was identified as Unwillingness to Disclose for the normative male group and Inability to Change for the clinical group.

Factor Correlation Tables

A set of intercorrelations were run for each of the MMPI-A content scales as well as for the combined content scales. The magnitude of the correlations between groups (i.e., normative group, normative males, normative females, clinical group) for each factor provided strong support for

the aforementioned results.

Table 19

Factor Structure for the A-sch Scale

	Normative			Clinical	
	Combined	Males	Females	Combined	
	Factors				
Item #	I	I	I	I	II
452	**.51**	**.56**	**.46**	**.56**	-.09
69	**.49**	**.48**	**.51**	**.60**	-.05
389	**.46**	**.42**	**.48**	**.46**	.12
425	**.43**	**.48**	.39	**.57**	.09
33	**.42**	**.45**	.38	.20	-.17
12	**.42**	**.42**	**.41**	**.43**	.14
443	.36	**.41**	.34	.22	-.22
101	.33	.30	.33	.17	**.59**
380	.33	.33	.33	.19	.19
220	.31	.35	.27	.27	-.22
464	.31	.28	.35	.29	-.14
80	.30	.32	.24	.15	**.59**
435	.27	.25	.31	.29	.01
466	.26	.32	.21	**.45**	-.09
364	.18	.22	.17	.20	-.20
257	.12	.11	.16	.09	-.30
338	.07	.10	.06	.17	.01
166	-.18	-.10	-.27	-.10	.25
153	-.33	-.26	**-.41**	**-.50**	.11
459	-.35	-.35	-.34	-.33	.06
Eigenvalue	2.35	2.43	2.30	2.48	1.12

Table 19 continued

	Normative			Clinical	
	Combined	Males	Females	Combined	
	Factors				
Item #	I	I	I	I	II
% Variance	.12	.12	.12	.12	.06

Note. Factor loadings ≥ .40 are in bold-face type. Combined refers to samples combined across gender.

Table 20

Factor Structure for the A-trt Scale

	Normative				Clinical	
	Combined	Males		Females	Combined	
	Factors					
Item #	I	I	II	I	I	II
421	**.46**	**.45**	.28	**.44**	**.47**	.28
340	**.43**	.39	.31	**.43**	**.50**	.29
256	**.42**	.26	**.45**	**.45**	**.48**	.07
426	.39	**.40**	.07	**.43**	.35	**.54**
444	.38	**.45**	.20	.32	.39	.31
27	.38	.35	.24	.38	.32	.24
432	.37	.39	.21	.35	**.43**	**.40**
20	.37	.24	.33	**.41**	.39	**.48**
414	.37	.32	.29	.37	**.49**	**.42**
357	.37	.25	.38	.38	**.50**	.08
242	.33	.27	.16	.39	.30	**.52**
369	.33	.14	**.42**	.37	**.50**	.28
371	.32	.30	.14	.35	**.42**	.24
423	.32	.39	.11	.30	.35	.27
472	.28	.08	**.45**	.32	**.59**	.22
358	.28	.28	.11	.29	.27	.31
434	.26	.26	.18	.25	.37	.20
88	.25	.26	.01	.32	.22	**.50**
427	.25	.30	.12	.23	.33	.15
418	.25	.25	.17	.22	.15	.17
420	.23	.23	.04	.25	.25	.07

Table 20 Continued

	Normative				Clinical	
	Combined	Males		Females	Combined	
	Factors					
Item #	I	I	II	I	I	II
356	.18	-.00	.26	.26	**.40**	.26
449	.17	.03	**.41**	.14	.38	.27
431	-.17	-.31	.18	-.18	-.09	**-.40**
437	-.19	-.28	.15	-.23	-.07	**-.42**
419	-.25	-.31	.00	-.25	-.17	**-.42**
Eigenvalue	2.64	2.55	1.03	2.83	4.12	1.04
% Variance	.10	.10	.04	.11	.16	.04

Note. Factor loadings $\geq$ .40 are in bold-face type. Combined refers to samples combined across gender.

DISCUSSION

The first objective of this study was to determine the factor structure of the collective MMPI-A content scales for each sample and to compare these results to the factor structure of MMPI-2 content scales from previous research (e.g., Archer, 1992; Tonsager, 1995; Tonsager & Finn, 1992). It was hypothesized that scale-level analyses of the MMPI-A content scales would result in a two factor structure comparable to the factor structure of the MMPI-2 content scales, with the first factor describing general maladjustment and the second factor relating to an externalizing dimension (e.g., Archer, 1992; Tonsager, 1995; Tonsager & Finn, 1992). The second objective of this study was to examine the factor structure of individual MMPI-A content scales to determine whether discrete and salient factors would be obtained. It was expected that these factors would be potentially relevant to a more refined assessment of the construct of interest, i.e., creation of factor based subscales. This study's final objective was to determine the stability of factor structures across gender and setting for both the collective MMPI-A content scales and the individual MMPI-A content scales.

Scale-Level Analyses

The principal factor analyses conducted on the 15 MMPI-A content scales yielded a two factor structure for two groups (normative males, clinical group) and a one factor solution for the other two samples (combined normative

group, normative females). The one factor solution was inconsistent with previous factor analytic investigations (e.g., Archer, 1992; Tonsager, 1995; Tonsager & Finn, 1992) in which two factors were found. It is likely that the explanation for this lies in the weak second factor, i.e., the relatively limited amount of variance accounted for by this factor. While the General Maladjustment first factor has consistently accounted for at least 50% of the total score variance in factor analytic research of the MMPI-2 and the MMPI-A content scales, factor II (when obtained) has accounted for only 9% to 16% of the total variance. In the present investigation, this second factor appeared too limited to account for enough variance to reach the eigenvalue > 1 criteria set for retaining factors. Upon examining Table 4, it is notable that the eigenvalues for the second factor range from 1.03 to 1.33, while the eigenvalues for the two groups that did not find a second factor are .71 and .80. While the absolute difference between these eigenvalues is modest, their values were critical in meeting the 1.0 eigenvalue criterion, and thus directly affect whether a second factor was produced.

A separate but related reason for the production of one factor solutions is the use of principal factor analysis in this study. As noted earlier in the text, there has been an ongoing debate concerning the difference between principal factor analysis and principal component analysis. Several authors (e.g., Floyd & Widaman, 1995; Snook & Gorsuch, 1989;

Widaman, 1993) have claimed that principal component analysis and principal factor analysis produce similar results only when there are at least 40 variables in the analysis and communalities exceed .70. When fewer variables are used, the ratio of diagonal to off-diagonal elements decreases, providing the communality with an increased effect in the analysis. Gorsuch (1983) recommended that with relatively few variables in the analysis, it is more prudent to use principal factor analysis to avoid spuriously high factor loadings. Floyd and Widaman (1995) also argued that if only a small number of items load on each dimension and if the items have relatively low communalities, the results of principal component analysis and principal factor analysis diverge markedly. They continued by stating that in these cases, common factor analysis leads to accurate estimates of factor loadings and factor correlations; in contrast, component analysis tends to lead to positive bias in estimates of loadings. While Archer (1992) used principal factor analysis in his MMPI-2 and MMPI-A content scale analyses, Tonsager (1995) employed principal component analysis. Because of the small number of variables and low communalities in the diagonals of the current principal factor analytic study, the differences between present results and Tonsager's (1995) results are less surprising.

Stability of Factor Structure. Current results are equivocal regarding the stability of the MMPI-A content scales factor structure across setting and gender. However,

the structure of the first factor is similar across samples. What is most notable about the first factor structure is the strong positive loadings across the MMPI-A content scales for all four samples. What appears to differentiate one factor from two factor solutions is the loadings of *A-cyn*, *A-con*, and *A-ang*, which are the only scales that load higher on the second factor than the first in the two factor solutions. While a two factor solution was not found across settings in this study, the General Maladjustment first factor is robust and stable in all samples.

Clinical Implications. The factor analyses of the MMPI-A content scales have important implications for the interpretation of these scales. The first is that while the individual scales measure a variety of areas, they appear to be meaningfully related to each other. Tonsager (1995) proposed that the MMPI-2 Content Scale Profile Sheet be reorganized according to this two factor dimension, in contrast to the seemingly arbitrary order of scale appearance used presently in the Content Scale Profile Sheet. Using this guideline, the scales would be divided according to whether they are part of the General Maladjustment factor or the Externalizing Tendencies factor. This reorganization could be appropriate for the MMPI-A Content Scale Profile Sheet as well, but as previously noted the second factor appears more tentative for the MMPI-A.

If one adapted a two factor solution, then the second implication of the two factor solution is that it provides a

hierarchical structure that allows the clinician to derive a quick overview of the respondent's psychological functioning. The clinical scale scores would then illustrate how the General Maladjustment and Externalizing Tendencies dimensions will be expressed for that individual. The revised profile sheet would facilitate use of the hierarchical interpretation by organizing scales according to factors. An example of this revised printout is presented in Figure 1.

Individual Scale Item-Level Analyses

The principal factor analyses conducted on the 15 individual content scales yielded nine scales (*A-anx*, *A-obs*, *A-dep*, *A-aln*, *A-biz*, *A-ang*, *A-cyn*, *A-con*, *A-lse*) with one factor solutions and two scales with two factor solutions (*A-hea*, *A-sod*) consistent across samples. The other four scales (*A-las*, *A-fam*, *A-sch*, *A-trt*) produced factor structures that were inconsistent across samples.

One Factor Solutions. As previously noted, nine of the 15 content scales produced one factor solutions across samples. These results are inconsistent with recent work by Sherwood et al. (1997) in which 13 of the MMPI-A content scales were divided into two to four content component scales. For example, Sherwood et al. produced four Content Component scales for the *A-dep* scale with Component scales containing four to seven items. Similarly, three Component scales were developed for the *A-con* scale. Factor analysis in the present study determined both of these scales to have

General Maladjustment

Externalizing Tendencies

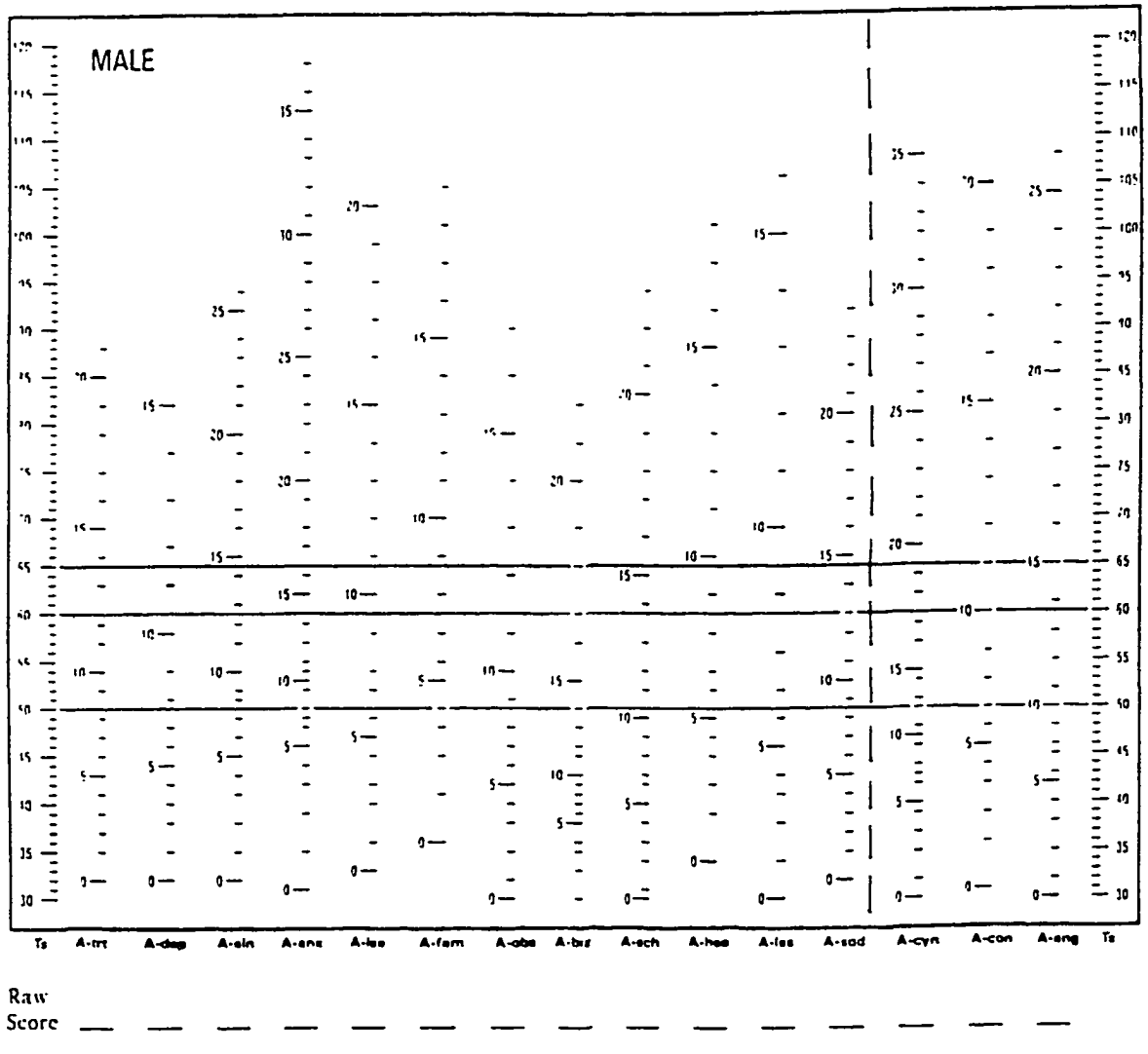

Figure 1. Revised MMPI-A Content Scale Profile Sheet

robust one factor solutions across samples.

Two Factor Solutions. The *A-hea* scale produced a two factor solution in the present study, with factors named Somatization and Denial of Health Complaints. Sherwood et al. (1997) developed three Content Component scales for *A-hea*, which were labeled: Gastrointestinal Complaints, Neurological Symptoms, and General Health Concerns. It is notable that while each investigation produced multiple factors or Component scales, there is no similarity in the content of these scales. Two factor solutions were obtained for the *A-sod* scale in each study, with Shyness being the label for the second factor or scale in each study. The first Component scale, however, was labeled Introversion by Sherwood et al. and the first factor was named Extroversion in the present investigation. The results of the present factor analysis would not support the development of Component scales for the MMPI-A content scales based solely on factor analysis dimensions.

One, Two, and Three Factor Solutions. Several of the scales that produced inconsistent factor structures across settings in this study appeared to have consistent factor structure across gender within the normative group. *A-las* and *A-sch* each had similar one factor solutions for the combined normative group, normative males, and normative female groups, but produced a small second factor for the clinical group. In addition, *A-fam* yielded a two factor solution for all samples except the clinical group whose

analyses produced a third factor. A likely explanation for the extra factor produced by the clinical group may be that the clinical group's content scales have more variability in scores than the normative group, given the range of symptomatology present in the clinical group. The extra variability within this sample may have produced enough additional variance in scores to elevate the eigenvalues in the clinical group just above the eigenvalue > 1 criterion (eigenvalue = 1.15 for *A-las*; eigenvalue = 1.12 for *A-sch*).

In contrast to the consistent factor structures of the other content scales, the *A-trt* scale did not have a second factor that was consistent across samples. Rather, the weak second factor produced different loading patterns for the clinical group and the normative male group. The robust first factor, however, was congruent across samples.

Stability of the Factor Structure. Factorial stability refers to the extent to which the underlying structure of what is being measured is composed of the same variables or dimensions across individuals, conditions, or samples (Tonsager, 1995). Examination of the individual MMPI-A content scales factor structures reveals that 11 of the 15 content scales have factor structures that are similar across setting and gender. These 11 scales include: *A-anx*, *A-obs*, *A-dep*, *A-aln*, *A-biz*, *A-ang*, *A-cyn*, *A-con*, *A-lse*, *A-hea*, and *A-sod*. These scales can be deemed stable and thus have greater generalizability across settings. The other four MMPI-A content scales (*A-las*, *A-fam*, *A-sch*, and *A-trt*)

do not have factor structures that are consistent across setting, but generally maintain a stable first factor.

Clinical Implications

An important implication of this research is that a clinician should be cognizant of the underlying dimensions of individual MMPI-A content scales when utilizing the newly developed MMPI-A Content Component scales. Data from the present investigation found that nine of the 15 MMPI-A content scales do not break down into more than one underlying dimension. In addition, three other content scales divided into one and two factor structures that were inconsistent across samples. Therefore, viewed from a factor analytic perspective, the MMPI-A Content Component scales may overemphasize the number of discrete or independent dimensions found for individual content scales.

The MMPI-A Content Component scales were developed with the purpose of supplementing the information available from the content scales in a manner similar to that which is provided by the Harris Lingoes subscales of the MMPI clinical scales (Harris & Lingoes, 1955). The idea of developing subscales that enhance interpretation of the content scales is a good one. However, the present investigation did not support the factor analytic dimension of this work. It is notable that the MMPI-A Content Component scales were developed using an approach that combined rational and statistical procedures, while the current study solely and exclusively employed exploratory

principal factor analyses without apriori judgments concerning the expected number of underlying dimensions. The difference between these results, therefore, may pertain to the method employed in determining underlying scales or factors. While Sherwood et al. noted the use of principal component analysis to perform the statistical portion of their scale development, they failed to delineate in their monograph whether they used exploratory or confirmatory factor analyses. It is possible that they used a confirmatory method of factor analysis with an apriori number of factors to be retained for each scale. Additionally, while the goal of the present study was to provide support for the MMPI-A content component scales, all procedures remained exploratory in nature. Future studies may wish to examine the factor structure of these scales across other variables such as ethnicity and gender within a clinical sample.

A separate implication of the present investigation is that most of the MMPI-A content scales produce factor structures that are similar across samples. The significance of this conclusion is that these scales do not appear to vary in content dimensions as a function of either gender or clinical status of the respondent. Therefore, most of the MMPI-A content scales appear to have a similar internal structure across different individuals or groups.

Limitations of the Study

A limitation of the present investigation was the

occurrence of demographic differences between the clinical and normative groups on gender and age variables. While age has not been addressed in previous factor analysis studies of the MMPI in adolescents, gender differences in the factor structure of the MMPI-A basic scales were addressed by Butcher et al. (1992) in the test manual. These authors concluded that gender had a minimal effect on scale loadings and no discernible effect on the obtained factor solution. Additionally, Archer's (1992) factor analysis of the combined MMPI-A content and supplementary scales found similar three factor solutions for the normative sample partitioned by gender. Future researchers may want to conduct MMPI-A content scale factor analyses on samples matched on salient demographic variables to rule out potential variations due to demographic effects.

A separate limitation of the current study was the relatively small clinical sample (N = 358). While the sample size did not allow for comparison of factor structures across gender, it was large enough to meet the traditional subject to variables ratio of 5:1 recommended for the main factor analyses (Floyd & Widaman, 1995).

Other limitations of this study are related to methodological problems inherent in the content scales. It is well documented that the MMPI-A content scales contain face valid items, and that with the exception of *A-hea* and *A-las*, a true response is typically the deviant endorsement direction (Archer, 1997; Williams, et al., 1992). The *A-obs*

and *A-cyn* content scales, for example, consist entirely of items scored in the true direction, and the *A-biz* and *A-ang* scales each contain only one item scored in the false direction. Thus, the client's test taking approach could potentially influence the factor structure results. For example, Tellegen (1985) advised, "obvious items (e.g., MMPI-A content scales) can be expected to work only when the respondents are candid (p.638)." It is possible that the factor structure of the MMPI-A content scales may be influenced by response style issues including social desirability and the acquiescence response style. However, the MMPI-A validity scales should be of value in detecting these types of response styles. Specifically, the *TRIN* scale elevates when an acquiescent response style has been used, and *L* and *K* elevate when an examinee has responded in a socially desirable or defensive manner. In the current study, the use of cutoff scores for *L* and *K* in the clinical sample probably limited the effects of socially desirable response styles for this group. Future researchers may benefit from examining MMPI-A content scale factor analytic findings of high versus low *TRIN* scale scores, and high versus low *K* and *L* scale scores.

A further limitation of this study pertains to the use of factor analysis with dichotomous variables such as those inherent in the true-false format of the MMPI-A content scales. Problems with factor analyzing dichotomous variables were recognized in the 1940s, with the observation

that factor analysis results with dichotomous data could be due only to variation in endorsement rates across items, and not reflective of underlying constructs or dimensions. Recently, several authors (Floyd & Widaman, 1995; Panter, Swygert, Dahlstrom, & Tanaka, 1997) have further discussed the specific problems inherent in factor analyzing dichotomous data. The crux of this issue is that the factor structure is directly determined from the intercorrelational matrix in factor analysis. While the Pearson correlations used in a matrix may assume values that theoretically range from -1.0 to 1.0, when analyzing dichotomous variables the value of the obtained correlations are much reduced. The size of the correlational statistic is constrained by the marginal totals of responses to two items, producing a restricted range of values. This issue of the effects of dichotomous data on factor analysis results was manifested in the present analyses by the modest amount of variance accounted for by the factors in the individual scale analyses. This issue, however, would not affect the factor structure, but would be limited to the amount of variance accounted for by the obtained factors. It is notable that the other large scale investigation of the MMPI through item-level analysis (Johnson et al., 1984) also obtained limited variance for the factor solution. For example, the first 10 factors in the Johnson et al. study accounted for less than 20% of the overall variance, and 123 unrotated factors were needed to explain just 50% of the variance in

the data. The authors also noted that many factors were included that accounted for less than 1% of the variance, and a number of factors were represented by item loadings of less than .30.

One solution to the problem of factor analyzing dichotomous variables is to use special programs such as TESTFACT (Wilson, Woods, & Gibbons, 1991) and NOVAX (Waller, 1994), to arrive at unbiased estimates of factors from dichotomous data. A second means of dealing with dichotomous items is to compute sums of two or more similar items. These items have scores that fall on greater than dichotomous scales and are thus more immune from the problem of isolating difficulty factors (Floyd & Widaman, 1995). While these solutions may produce more accurate factor analytic findings, a review of the factor analytic literature on the MMPI, MMPI-2, and MMPI-A indicate that these methods have not been employed in this research (i.e., Archer, 1992; Archer & Klinefelter, 1991; Costa et al., 1985; Johnson et al., 1984; Reddon et al., 1982; Tonsager, 1995; Tonsager & Finn, 1992). Thus, utilizing these corrections would have produced results that are not comparable to prior findings. Nevertheless, future researchers may want to apply one or more of these methods to factor analysis of the MMPI-2 and the MMPI-A to evaluate these effects on factor analytic results.

A final limitation of the present investigation was the use of the default Multiple Square Correlations (MSC)

command in the SAS package to determine the communalities in the diagonals of the intercorrelation matrix from which the factors were extracted. If the default command had been overruled and an iterative procedure had been employed, an iterative procedure would not have changed the factor structure. However, it may have enabled the factor structure of the item-level analyses to account for a greater proportion of variance. Because of the dichotomous nature of the data, the variance accounted for would not have increased substantially, but some effect would have been observed. Future researchers may want to use this procedure when performing item-level analysis of individual scales.

Future researchers may also want to develop a linear regression formula for each of the two dimensions determined from factor analysis. This would enable clinicians to derive overall factor scores for the General Maladjustment and Externalizing Tendencies dimensions similar to the internalizing and externalizing dimension scores found on the Child Behavior Checklist (Achenbach & Edelbrock, 1983).

Summary and Conclusions

The first objective of this study was to determine the factor structure of the collective MMPI-A content scales. Principal factor analyses yielded a two factor structure for the normative male and clinical groups and a one factor solution for the combined normative sample and the normative female group. The factors were named General Maladjustment

and Externalizing Tendencies. The one factor structure was inconsistent with previous factor analytic investigations (Archer, 1992; Tonsager, 1995; Tonsager & Finn, 1992) in which two factors were found across samples.

The second objective of this study was to examine the factor structure of individual MMPI-A content scales to determine whether discrete and salient factors would be obtained from these item pools. One factor solutions were obtained for the majority of the MMPI-A content scales. These findings appear to differ from the results used in the creation of the MMPI-A Content Component scales recently developed by Sherwood et al. (1997). Further, current findings raise cautions regarding the subdivision of the content scales in clinical interpretation of these measures.

The final objective of this investigation was to determine factorial stability of both the collective and the individual MMPI-A content scale analyses. Collective scale analyses determined that the first factor was similar across samples, but that the small second factor was influenced by sample or method characteristics. Individual scale analyses found 11 of the 15 scales to be similar across setting, while the other four scales had similar first factors but inconsistent second factors. Future research may help to further clarify the complicated issues related to the factor structure stability of the MMPI-A content scales.

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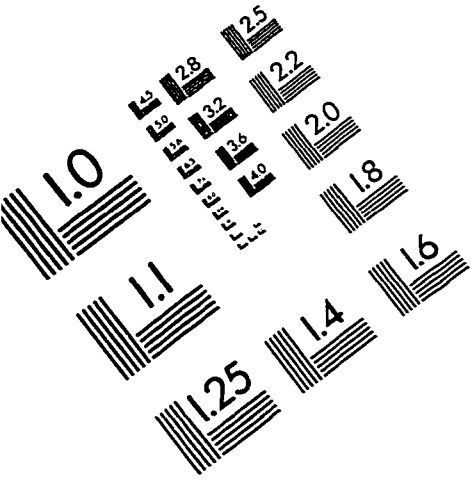
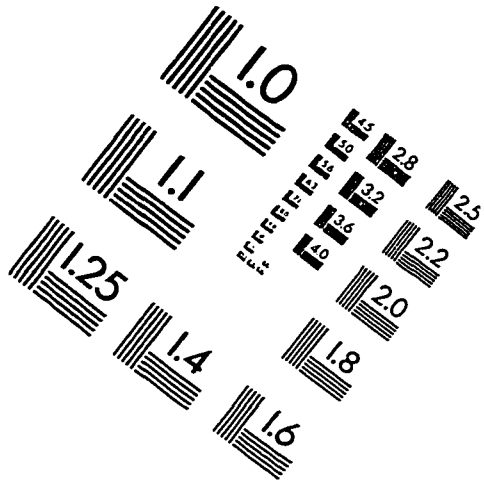
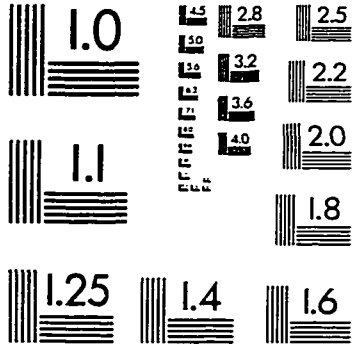
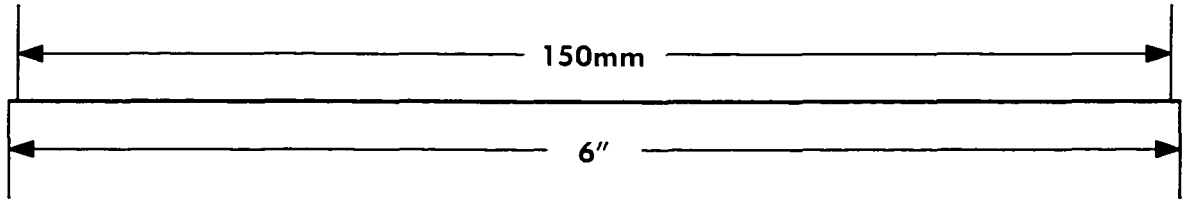
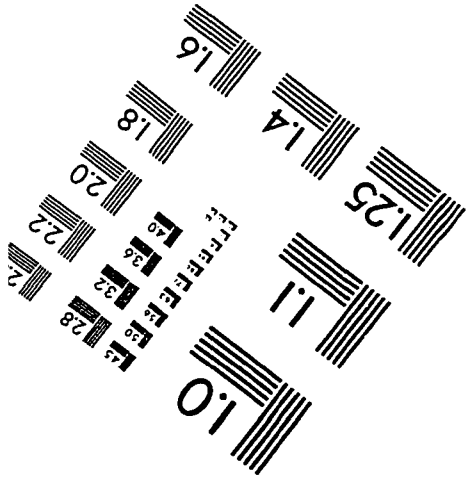
IMAGE EVALUATION
TEST TARGET (QA-3)











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