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Validation of the Memory Attention Concentration Evaluation

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Validation of the Memory Attention Concentration Evaluation

A Thesis

Presented To

Eastern Washington University

Cheney, Washington

In Partial Fulfillment of the Requirements

for the Degree

Master of Science

By

Andrea Griechen

Spring 2013

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MASTER'S THESIS

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Abstract

Psychological professionals recommend following a number of steps to examine a client's claim of malingering, including the use of standardized measures (Binder, 2002). Psychometric testing is available to assist with the evaluation for malingering. The Portland Digit Recognition Test (PDRT; Binder & Willis, 1991) has been found to be a valid measure of a client's motivation to perform inadequately on memory evaluations and thus, detects clients attempting to memory malinger. The PDRT takes approximately 45 minutes to administer. A shortened computer version of the PDRT is the Memory Attention Concentration Evaluation (MACE) which was created to cut down on administration time (Smiley, 2000). Another memory malingering test is the Test of Memory Malingering (TOMM; Tombaugh, 1996). This measure is designed specifically to catch those who are attempting to memory malinger. The Minnesota Mulitphasic Personality Inventory-2 is a widely used test with validity scales designed to monitor the motivation and truthfulness of a test taker (Butcher, Dahlstrom, Graham, Tellegen & Kaemmer, 1989). The present study focuses on further validating the MACE, by both correlating and comparing the hit rates of the MACE to the specific validity measures of the Minnesota Multiphasic Personality Inventory-2 and the TOMM. The results revealed a strong correlation between the MACE and the TOMM, and a moderate negative correlation between the MACE and the MMPI-2 validity scales. A multiple regression with all variables entered, the F-K and K scales were the only strong predictors of the F scale; however, when just the two TOMM Trials and the MACE were entered only the MACE best predicted the F scale. Chi square analysis revealed varying degrees of sensitivity, specificity, positive predictive value, negative predictive value, and hit rates. The various results are discussed.

Keywords: malingering, MMPI-2, TOMM, MACE, PDRT

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Malingering is a word first used to describe soldiers avoiding being sent back into the field during times of war to avoid battle (Nies & Sweet, 1994). Today the *Diagnostic and Statistical Manual, 4th edition, Text Revised* (*APA, 2000*), defines malingering as "the intentional production of false or grossly exaggerated physical or psychological symptoms, motivated by external incentives" (p. 739).

Malingering is often found in countries that have "highly developed labor and tort law," where damages or benefits can be obtained (Bury & Bagby, 2002, p. 3). This may translate into people applying for disability benefits when they are not disabled. A study by Rogers, Salefin, Sewell, Goldstein, and Leonard (1998), estimated that approximately one in six people might malinger in this context. Studies by Lees-Haley (1992; 1997) found that approximately 30% of their personal injury claimants malingered. A 2002 survey of board certified neuropsychologists felt that 39% of their clients claiming head injuries, 15% claiming a depressive disorders and 14% claiming anxiety issues were malingering (Mittenberg, Patton, Canyock & Condit, 2002). The enormous cost to tax payers and rising insurance premiums that malingering places on society exemplifies why it is important to research malingering.

To evaluate a client for malingering, it is recommended that one conduct a clinical interview, observe the client's behavior, use standardized measures, and obtain any other evidence available (Hall and Poirier, 2001; Sattler & Joseph, 2009). The Portland Digit Recognition Test (PDRT) has been found to be a valid measure of a client's motivation to perform inadequately on memory evaluations (Binder, 2002), and thus, meets recommendations for using standardized measures. However, this test takes approximately 40-50 minutes to administer, inconveniencing both the examinee and the examiner. A shortened version of the

PDRT, known as the Memory Attention Concentration Evaluation or MACE (MACE), was created to help with this problem (Smiley, 2000). Prior unpublished studies comparing MACE scores to the malingering detecting subscale scores of the MMPI-2 found the MACE to be a valid test of memory malingering (Jamieson-Turner, 1997; Smiley, 2000). The present study is a replication plus extension of the Jamieson-Turner and Smiley studies using an extra validity scale score of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989), the Infrequency Psychopathology (F[p]) scale and an extra measure, the Test of Memory Malingering (TOMM; Tombaugh,1996). The present study is also being conducted to provide data and information to the State of Washington's Department of Social and Heath Services, so that they may be willing to endorse and possibly provide remuneration when evaluators use the MACE during a forensic evaluation of malingering.

Literature Review On The Detection Of Malingering

According to *DSM-IV-TR*, malingering is a condition that can be the center of clinical attention, but is not considered a mental disorder. It is not given a formal diagnosis code like other disorders, but rather indicated with the V code of V65.2. According to the DSM-IV TR, this code is placed on Axis I (APA, 2000). Malingering can involve false or altered physical issues, cognitive symptoms and/or emotional conditions. Real physical issues can be separated from physical malingering by looking for associated symptoms that occur with injury and disability such as muscle atrophy, fasciculation and contraction of skeletal muscles, visual disturbances, papillary light reflex, abnormal retinal appearance, ocular divergence, and nystagmus (Hall & Poirier, 2001). Physical malingering may be indicated if the client endorses continued vigorous exercise despite a complaint of low back pain, extreme sensitivity to touch,

faked hemi paresis, right or left side headaches without problems on the opposite side of the body, drug response or motor movement inconsistencies, and incongruence between a client's behavior during evaluation and behavior while in private (Hall & Poirier, 2001).

Cognitive disability or impairment consists of changes in attention, memory, language, and thinking. These could manifest legitimately as problems with stupor, unconsciousness, recall issues, amnesia, aphasia, word salad, schizophrenia and dementia (Hall & Poirier, 2001). Those with cognitive disability may also develop emotional issues including changes with affect, activity level, hesitation, poor cooperation, frustration, and aggravation (Hall & Poirier, 2001). Sherman, Strauss, Spellacy, and Hunter (1995) report that cognitive deficits can be feigned if one studies the behavior of those with actual disability and then copies their actions. Hall and Poirier (2001) agree with this statement, but note that keeping the consistency of behavior over time may be hard for a client to continue to carry out. Cognitive malingering detection strategies consist of utilizing the magnitude of error, performance curve, violation of learning principles, floor effects, symptoms validity testing, and forced choice testing (Rogers, 2008). Magnitude of error is based on research that has shown malingerers often do not focus on what answers genuine impaired clients would give. Similar to magnitude of error, performance curve detection strategies use expected patterns that genuine cognitive impairment causes. Both of these can utilize learning principle detection strategies, where a client should get better as they become more familiar with a task (Rogers, 2008). The Verbal Paired Associates subtest of the Wechsler Memory Scale (Wechsler, 2009) can be used to demonstrate this. In this test, the client is read a set of word pairs (i.e., zoo, girl) Once the full list is read, the test administrator re-reads the first of the word pair (zoo) and the client is to fill in the other half (girl). These word pairs are read to the client in three more counter balanced sets, with the client asked at the end of each set to

identify the second word half of the each pair. Learning principles have shown that as the client encounters the word sets repeatedly, they should do better as the subtest progresses (Rogers, 2008). Floor effects and forced choice testing detection strategies exploits the fact that significantly impaired people can perform simple cognitive tasks and malingerers are often unaware of this and thus underperform (Tombaugh, 1996). System validity testing uses the knowledge that chance between two items is 50/50, and thus the client should be getting at least 50 percent of items tested correct (Rogers, 2008).

Emotional issues may consist of change in personality, depression, and or anxiety. These emotional issues can be long standing biological problems or developed after an incident, such as an accident at work. Those attempting to malinger may over report the level of distress they are experiencing or may underreport the level of distress they were experiencing prior to an incident (Rogers, 2008). They may also make up their symptoms completely. Understanding psychopathology symptoms and symptom combinations can help detect feigned emotional disorders. Rare symptoms are those that that are reported by less than five percent of actual clinical populations. Improbable symptoms are those that "have a fantastic or preposterous quality" (Rogers, 2008, p. 19). Symptom combinations may also detect malingering, as malingers may endorse symptom clusters not seen together, such as, grandiosity combined with the need for sleep (Rogers, 2008). Along with unusual symptom combinations, malingerers may endorse a disproportionate amount or severity of symptoms. Malingers can also report obvious symptoms of a disorder, but fail to report subtle symptoms that would also be a part of the impairment. An example of the use of this detection strategy would be the Obvious-Subtle subscale (O-S) of the MMPI-2 (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, and Kaemmer, 1989). Emotional malingering detection also watches to make sure the person's report of

impairment matches their behavior. For example, the Miller Forensic Assessment of Symptoms Test (M-FAST, Miller, 1995) asks a client if he or she has to check under his or her chair for items and then observes the client to see if this is done during the assessment. Also, research has shown what amount of psychological symptoms are typical for various populations (Rogers, 2008). For example, those in the general public will endorse few symptoms, those in outpatient mental health treatment will likely endorse a moderate amount, and inpatient or incarcerated populations will likely endorse a severe amount of symptoms (Rogers, 2008).

The *DSM-IV-TR* cautions that malingering can be similar to other disorders described in the manual. For example, Factitious Disorder, also known as Munchausen's disorder, is known for the faking of physical or psychological symptoms. People with Factitious Disorder fake for attention; whereas, those who are malingering, are faking for external incentive or gain.

The *DSM-IV-TR* recommends evaluating for malingering in at least four instances: (a) the person is referred to you in a "medicolegal context," (b) the person is non-compliant during an assessment or with treatment recommendations, (c) there is a "marked discrepancy" between what is being claimed and the opinion of involved experts, or (d) the person making a claim has been diagnosed with Antisocial Personality Disorder. While people malingering for gain often present in these four instances, Rogers (2008) cautions against using only these criteria to screen for malingering, as research has shown that these criteria alone generates an unacceptable false positive rate.

In an attempt to bolster a claim of disability, one might attempt to gain information to make their claim credible. Bury and Bagby (2002) cite several studies that found people making a malingered claim getting information from the internet. In other cases their attorney will coach them regarding how they should present their symptoms or teaching them about various

malingering measures, such as the MMPI-2, to help them evade over-reporting. Multiple studies have found that a client's understanding of a disorder does not necessarily improve their chances of evading detection, but understanding how a psychometric measure works, does (Bagby, Marshall, Bury, Bacchiochi, & Miller, 2006; Bagby, Nicholson, Buis, & Bacchiochi, 2000; Bagby et al., 1997).

To help evaluate a claim for benefits or damages, Porter and colleagues (Porter, Campbell, Birt, & Woodworth 2003; Porter, Peace & Emmett 2007), recommend using what is referred to as The Four Cs: context, content, characteristics, and corroboration. The Four Cs consist of looking at the motive behind the claim (context), the consistency of the claim over time (content), how it fits with the general pattern of other similar claims (characteristics) and whether or not there is other evidence supporting the claim (corroboration).

Measures Used to Detect Malingering

Literature review for the present study revealed there are over 80 published psychological tests capable of detecting malingering. Some measures were built specifically to detect malingering by a test taker and others were built to assess cognition or emotion, and then were later found to detect malingering. An example of this later type of test is the Wechsler Adult Intelligence Scale (WAIS; Wechsler, 2008). When test results of the Digit Span subscale of the WAIS is compared with the Symbol Span subscale results of the Wechsler Memory Scale (WMS; Wechsler, 2009) both tests scores should reveal similar results, as they both assess memory. If they do not, malingering should be suspected (Rogers, 2008).

As it is not uncommon to develop emotional issues or personality changes as a result of brain injury, Wasylia and Cavanaugh (1989) recommend the addition of personality and psychopathology measures when assessing for malingered neuropsychological issues.

Coinciding with this premise, Rogers (2008) also suggests using instruments with different emotional or cognitive malingering detection strategies. The measures chosen for the present study examine both cognitive and mental disorder issues, and each look for possible inconsistency in the client's report. The Minnesota Multiphasic Personality Inventory-2 (MMPI-2;,1989) validity scale scores look for irregularities in the report of a person's individual symptoms versus what research has found regarding symptomology in personality and psychopathology. Research on memory has found that the human mind has a large ability "to store and retrieve visual information" (Tombaugh, 1996), and thus the Test of Memory Malingering and the Portland Digit Recognition Test work by using the knowledge of how known disabled groups perform on memory tests (Binder & Willis, 1991; Tombaugh, 1996).

The Minnesota Multiphasic Personality Inventory-2

The MMPI has over "10,000 published research references" (Groth-Marnat, 2009, p. 207). McKinley and Hathaway developed the original Minnesota Multiphasic Personality Inventory (MMPI) in 1943. The second version, the MMPI-2, was published by Butcher, Dahlstrom, Graham, Tellegen, and Kaemmer (1989) and is considered to be a widely used measure of personality and psychopathology (Bury & Bagby, 2002; Efendov, Sellbom & Bagby, 2008). It has been validated as a measure to detect malingering, and has in turn been used to validate other measures of malingering (Allen, Conder, Green, & Cox, 1997).

The MMPI-2 was standardized using a sample of 2600 participants who were 18 to 84 years old. There were 1,462 females and 1,138 males (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989). The MMPI-2 was standardized using participants in the following states: California, Washington, Minnesota, Ohio, North Carolina, Pennsylvania and Virginia (Butcher et al., 1989). Publishers of the MMPI-2 felt that this sample, when compared with the 1980 Census,

was representative of the population (Butcher et al., 1989). Participants were recruited by solicitation through the mail. Individuals were paid $15 for their efforts and if both partners in a couple responded, they were given $40 (Graham, 2000). In addition to taking the MMPI-2, they were asked about biographical information and life events. Couples who participated together were also asked the details of their relationship.

The MMPI-2 has 567 "True" or "False" questions that organize into multiple validity and clinical subscales. The clinical subscales are used to measure different psychological issues or disorders as follows: Hypochondriasis, Depression, Hysteria, Psychopathic Deviate, Masculinity/Femininity, Paranoia, Psychesthenia, Schizophrenia, Hypomania and Social Introversion. These scales do not formally diagnose a client with these disorders, but rather they are an indication of impairments. The ten clinical scales can be paired together to form 2-point codes, which allows for greater understanding of how the test taker is functioning (Groth-Marnat, 2009). These 2-point codes are made by looking at the two highest scales that score over 65. Research has compiled likely symptoms, behaviors, personality, interpersonal styles and treatment implications based on these codes. For example, a test taker with elevated hypochondriasis and depression scale sores may repress psychological conflict by attending to their somatic distress, utilize manipulation, may abuse alcohol, be passively dependent, and have a hard time taking personal responsibility for their actions (Grath-Marnat, 2009).

During the initial construction of the MMPI, McKinley and Hathaway realized that due to the way that people consciously or unconsciously wanted to be perceived, they could alter the way they presented on a test (Groth-Marnat, 2009). They constructed four validity subscales, "Cannot Say," "L, " "F," and "K," that were designed to detect the likelihood of deception and truth from the test taker (Groth-Marnat, 2009). The Cannot Say Scale looks at how many items

the test taker left unanswered or marked both True and False for the same item. Not answering 30 items or more invalidates the profile (Butcher et al., 1989). The Lie or L scale measures if the test taker responds in an unnaturally positive way, endorsing such statements as never getting angry or liking everyone they meet (Butcher et al., 1989). Those with elevated L scale scores may be socially conventional, inflexible and have little insight into their own behavior (Graham, 2000). Groth-Marnat (2009) notes that test takers with an elevated L scale should not be perceived as deceptive, but rather viewed with the understanding that they are concerned with being seen in a positive light. The Infrequency Scale (F) score is created when the test taker indicates a number of symptoms that research has shown do not occur often together in psychopathology (Berry, Baer & Harris, 1991). According to Graham (2000), the F scale was developed to discern uncommon ways of responding to the test. The items that load this scale were endorsed by less than 10 percent of the normative population (Butcher et al., 1989). Berry et al. (1991) report that "high F scores may result from extreme psychosis, a 'cry for help,' random responding, or the deliberate exaggeration and/or fabrication of symptoms" (p. 586). Those with an elevated F score will likely have elevated clinical scale scores as well. Research has found that African American, Native Americans and Hispanic populations may have a slightly higher F scale score than their Caucasian counterparts (Graham, 2000). The Correction Scale (K) is similar to the L scale, as it looks at how positive test takers may portray themselves, but in a subtle and more sophisticated manner (Berry et al., 1991). Those with elevated K scores are less likely to endorse items that load with the clinical scales (Butcher et al., 1989). Those with moderate K scores likely have a balance between criticism and ego strength (Graham, 2000).

To address validity issues not covered by the original validity scales, other validity scales have been created and then published. Gough (1947) reasoned that since the K score is an under-

report of symptoms, and the F score is an over-report of symptoms, one should be able to subtract the K raw score from the F raw score and the result should be close to zero, a balance of the two scores. He argues that if the subtraction results in a positive score of 15 or more, it suggests the test taker is reporting an excessive amount of difficulties (Gough, 1950). This is known as the Gough Dissimulation Index or F-K scale. Lachar and Wrobel (1979) constructed the Critical Item List (L&W), which assists in looking for important items that may not have been found or discussed during other areas of an assessment. Lachar and Wrobel identified 111 items in 14 problem areas such as anxiety and tension, depression and worry, and somatic symptoms. The Weiner and Harmon Subtle Obvious Scale (O-S) (1948) was developed to "detect deviant test taking attitudes" by combining items that suggested evident emotional discomfort and items that were not as easy to identify as detecting emotional discomfort (Timbrook, 1993). The O-S scale has been found to be less susceptible to coached malingering than some of other validity scale scores (Rogers, Bagby & Chakraborty, 1993). The Back F Scale (Fb) is similar to the F scale, but it examines how valid the test taker responded on the last 197 items on the test, as the F scale only examines the first two thirds of the test (Groth-Marnat, 2009). The Infrequency-Psychopathology Scale (F[p]) is responsible for distinguishing "between persons with true psychopathology and those who have some psychopathology but are nonetheless faking bad" (Groth-Marnat, 2009, p. 234). The items in the F[p] scale are ones that were answered infrequently by both psychiatric inpatients and persons in the normative MMPI-2 sample (Graham, 2000).

The Variable Response Inconsistency Scale (VRIN) examines if the test taker consistently answers similar questions in the same fashion (Groth-Marnat, 2009). Elevated VRIN scores may indicate "reading difficulties, confusion, intentional random responding or error in

recording responses" (Groth-Marnat, 2009, p16). The True Response Inconsistency Scale (TRIN) looks at how opposite types of items are endorsed (Groth-Marnat, 2009). Elevated TRIN scores indicate the test taker tends to answer in fixed positive or negative direction (Groth-Marnat, 2009). Pared with the L, F, or K score, the VRIN and TRIN can provide insight into an elevated score. For example, if a test taker has a high F scale score and a low VRIN score, one can rule out a random responding as reason for the high F score. If the test taker has a high TRIN score, indicating fixed responding to questions, this would indicate that the profile is invalid and is un-interpretable (Groth-Marnat, 2009). A VRIN or TRIN score of 79 or above indicates an invalid profile.

In support of the present study utilizing both cognitive and emotional detection measures, Miller and Paniak, (1995) as well as Mittenberg, Tremont, and Rayls (1996) found the MMPI-2 to have equivalent utility with neurological populations in examining behavior, emotion and psychiatric questions. A sample studied by Berry, Wetter, Baer, Youngjohn, Gass, Lamb, et al. (1995) revealed that head injured patients seeking compensation scored higher on at least five specific clinical scales than their non-claimant counterparts. However, they stated that those with a severe brain injury might not retain the self-awareness to accurately report their emotions. Lamb, Berry, Wetter, and Baer (1995) urge caution with the use of the MMPI-2 to detect closed head injury as their sample was able to malinger undetected with this measure. To help the MMPI-2 be able to better assess malingered cognitive issues, the Response Bias Scale (RBS) was designed to recognize a negative response bias from clients claiming cognitive issues (Gervais, Ben-Porath, Wygant, and Green, 2007). The RBS would have made a great addition to the current study, but data for it was not available at the time of data collection.

The Test of Memory Malingering

Tom Tombaugh published the Test of Memory Malingering (TOMM) in 1996. It is a measure designed specifically to detect those who are attempting to memory malinger. The TOMM takes approximately 10-20 minutes to administer, and it is given by hand by a psychometrist or Ph.D. (Tombaugh, 1996). The client receiving an assessment is shown a sample trial of two items (Tombaugh, 1996). Each item is a simple picture of an everyday item created specifically for the TOMM. The test taker is shown each picture for three seconds. Then the individual is shown one of the pictures just seen, paired on a page with a distracter item, and asked to identify which picture was just seen. Trial 1 is then started. This consists of showing the examinee 50 pictures for three seconds each. Then, like the sample trial, the client is asked to identify which picture had just been shown. The examiner marks down which picture the client saw, and then gives the client feedback on whether the answer was correct or not. The second trial consists of showing the examinee the same 50 pictures, but in a different order. The examinee is then asked again to identify which of two pictures was just seen, and feedback on correctness or incorrectness given. A third trial, the Retention Trial, can be given if there is further question regarding malingering. This test is given approximately 30 minutes after the first two tests. It is not given like the first two trials in that it does not display the target picture individually, rather the client is moved straight into identifying which picture was seen, when paired with a distracter picture. It should be noted that the present study only utilizes the scores from Trial 1 and Trial 2 and does not use the Retention scores.

Standardization during the development of the TOMM found that scores of 45 or less correct on either Trial 1 or 2 are most likely malingering. If the examiner is still unsure that the client is malingering, a retention trial can be given 15 minutes later. During this test, the examiner does not give another round of 50 pictures, instead they show test panels of two

pictures each and asks the examinee which picture they had seen prior. Research on the TOMM has found that people malingering will often perform worse with each trial given (Tombaugh, 1996).

The TOMM was developed and standardized in several phases (Tombaugh, 1996). In Phase I, a sample of 450 community members, ages 16-84 ($M = 54.8$, $SD = 20.2$), were given a TOMM and the Wechsler Adult Intelligence Scale Vocabulary subtest (WAIS-R; Wechsler, 1981). Data from this initial testing revealed that during the first trial participants were correct in their answer 94% of the time (Tombaugh, 1996). Results rose to 99% during the second trial, showing that people that are not malingering should be getting better at the test the second time it is administered. It was found that the TOMM is not sensitive to education or age (Tombaugh, 1996). During Phase II, feedback to the participant about how he or she was doing was added. During this phase, the TOMM was given to participants who were required to have a neuropsychological assessment at a Veteran's Administrations center, a known traumatic brain injury group, and a college sample asked to malinger (Tombaugh, 1996). Results of each study revealed results supporting the cutoff of 45 or less on each trial.

To counter criticism about simulation design and face validity in the original publication of the TOMM, and to study the effect of coached clients and latency performance, Rees, Tombaugh, Gansler, and Moczynski (1998) ran five additional validation experiments. The first experiment utilized random assignment to malingering and non-malingering conditions. The second experiment involved utilizing known traumatic brain injured clients who were asked to malinger or not malinger. The third experiment analyzed how knowledge of TBI impairment might impact how a malingerer would perform. The fourth experiment looked at the differences in scores between those with known TBI who were in the midst of litigation versus those who

were not. The fifth experiment studied response latencies between malingering and control groups. Each of these studies found the cutoff of 45 on any of the trials to be sufficient. They also found reinforcement for the TOMM's high levels of sensitivity and specificity with hospital outpatients, clients with TBI, and university students. Using different experimental designs of the TOMM, including a computerized version, was also found to be valid.

Other researchers have evaluated the cutoff of 45 or more on the TOMM. Gierok, Dickson and Cole (2005) tested a forensic psychiatric group against a non-forensic psychiatric group with the TOMM. Duncan (2005) tested a group of psychiatric patients both with and without cognitive impairment, and Gavett, O'Bryant, Fisher, and McCaffrey (2005) tested hit rates of adequate performance. Each found support of the TOMM established cutoff. Teicher and Wagner, (2004) tested cognitively intact and cognitive impaired clients. Ashendorf, Counstantinou, and McCaffrey (2004) studied the effects of depression and anxiety on cognition, and Rees, Tombaugh and Boulay (2001) assessed a depressed inpatient sample with the TOMM. They found the cutoff of 45 or less also appropriate to identify malingering.

The TOMM has been compared with the validity scales of the MMPI-2. McCaffrey, O'Bryant and Fisher (2003) found that the TOMM was negatively correlated with the Fb scale, a scale not utilized in this current study. The Fb is a scale designed to detect over report in the last half of the MMPI-2, not covered by the F scale. The TOMM did not positively or negatively correlate with any other validity scale. This suggests the TOMM measures for malingering in a way that the MMPI-2 validity scales do not and is possibly not a good assessment of cognitive impairment. McCaffrey, O'Bryant and Fisher (2003) recommended that both cognitive and emotional malingering be assessed for, as a client could use whichever method would obtain them benefits (McCaffrey, O'Bryant & Fisher, 2003). Contradictory to McCaffrey, O'Bryant and

Fisher's (2003) results, Heinze and Purisch (2001) found the MMPI-2, the TOMM and other

malingering tests to have comparable sensitivity to differing approaches to malingering. Whitney,

Davis, Sheppard and Herman (2008) compared the Response Bias Scale (RBS), Fb, the Fake

Bad Scale (FBS) (also not analyzed in the present study due to data unavailability) along with the

F and F[p] validity scales to the TOMM and another cognitive malingering tests. They found the

RBS to be able to assess neuropsychological impairment similar to the TOMM.

The Portland Digit Recognition Test

The Portland Digit Recognition Test (PDRT) was created in 1991 and has been found to

be "a valid measure of motivation to perform poorly on memory tests" (Binder, 2002, p. 27). The

PDRT is based on the forced choice model designed by Hiscock and Hiscock (1989). It uses 72

items of digit recognition, which are given over 4 trials. The PDRT takes approximately 40-50

minutes to administer and has been standardized to use with clients ages 18 years and older

(Binder & Willis, 1991). Five-digit numbers are read to the client, with one digit being read per

second by the person administering the test. The client is then asked to count backwards aloud

from 20 for five seconds and then given a card with two 5-digit numbers on it. The client is

asked to identify which one of the digit sets is the number that was just read to them. This initial

trial is carried out eighteen times. During the second set of eighteen digits, the same procedure is

completed; only the client is asked to count backwards from 50 for fifteen seconds. After the first

two sets of trials, the client is told that the upcoming sets will get harder. During the next two

sets of eighteen numbers, the client is asked to count backwards from 100 for thirty seconds

(Binder & Willis, 1991). Research has found that clients who are attempting to malinger will

likely do more poorly as the test continues to progress (Binder & Willis, 2002). Past validation

research has shown that even most people with "brain dysfunction" were able to receive high scores; and thus, those with lower scores are believed to be malingering (Binder & Willis, 1991).

The PDRT was standardized by comparing 139 participants (Binder & Willis, 1991). Participants were obtained via Binder's private practice or the Veteran's Administration. There were two main groups, those seeking compensation, and those not. These main groups were broken down into three subgroups each. Minor head trauma seeking compensation, "well documented" brain dysfunction with compensation, and "non-patients who were asked to simulate the effects of a compensable minor head injury in order to obtain financial gain" comprised the compensation group (Binder & Willis, 1991). The no compensation group was made of those with brain dysfunction not seeking compensation, those with a diagnosed affective disorder not seeking compensation and non-patients also not seeking compensation. A score of 72 is a perfect score, over four trials. The groups not seeking compensation did significantly better. After this series of tests, Binder and Willis (1991) felt that scores of 18 or less on the first two trials, 17 or less on the last two trials or a total score of 38 or less on the total trials score of 72 is considered malingering.

The PDRT has been validated by other research. Separate studies by Binder (1993), and Binder and Kelly (1996), looking at patients with known brain dysfunction or head trauma, both with no financial incentive to perform poorly, found that established PDRT cutoffs were valid. Greve, Bianchini, Heinly, Love, Swift, and Ciota (2008) used the PDRT with 29 patients claiming cognitive issues due to exposure to toxin. Their study indicated that failure to reach established cutoff scores may be indicative that the client was malingering. A study comparing a group of known pain patients, to a group of college students found the PDRT an appropriate measure to use with those claiming chronic pain (Greve, Bianchini, Etherton, Ord, & Curtis,

2009). A comparison of a computerized version of the PDRT with the Nonverbal Forced Choice Test, the 21-Item Test, and the Dot Counting test revealed that the PDRT was the only test to find malingerers with greater than chance accuracy and a minimum of false positives (Rose, Hall and Szalda-Petree (1998).

One advantage of the PDRT is that it meets the standards of the Daubert decision (Binder, 2002), which allows an expert witness to review scientific data in a court of law. A drawback of the PDRT is that it cannot differentiate between those malingering for gain and those with Factitious Disorder (Binder, 2002). Knowing whether someone was malingering verses having Factitious Disorder could possibly change the recommendations of the evaluation.

The Memory Attention Concentration Evaluation

A shortened version of the PDRT, known as the Memory Attention Concentration Evaluation (MACE) was developed in a clinic that assesses for mental disability (Smiley, 2000). The MACE differs from the PDRT in the amount of time it takes to complete the test and how the test is administered. The PDRT is given in a combination of audio/visual format and the MACE is strictly visual. The PDRT is given by hand by an administrator, while the MACE is given and scored by a computer. The MACE takes approximately 15 minutes to complete, verses the 45 minutes needed to administer the PDRT. Instead of hearing the 5-digit number read to the client, numbers appear on the computer screen for two seconds. There is then a wait of five seconds and then two 5-digit numbers appear side-by-side on the screen. The client does not count backwards, as the PDRT requires. The client must then push the number 1 or 2 on the computer keyboard to identify which of the 5-digit number they had just seen. The 1 symbolizes the left-hand side of the screen and the 2 symbolizes the right hand side of the screen. The MACE is given in three sets. Each set has nine, 5-digit numbers, instead of the four sets of

eighteen it takes for the PDRT. The next two trials have a longer delay between the time a client

sees the number, and the time that they are asked to decide which number they saw; Trial 2 has a

delay of 15 seconds, and Trial 3 has a delay of thirty seconds. Missing three or more items on the

MACE is considered malingering. The validity of this error rate has only been evaluated with the

unpublished research projects (Jamieson-Turner, 1997; Smiley, 2000). The MACE only requires

that the assessor be present to start the computer program and record the client's set of scores at

the end. Shorter administration time and the administrator not being required to be in the same

room as the client makes the MACE beneficial to the assessment office, as it gives the test

administrator additional time to attend to the case.

The MACE was previously evaluated by Jamieson-Turner (1997) and Smiley (2000). The

manuscript from Jamieson-Turner (1997) was not available for review for the current study, but

was referenced by Smiley (2000). Smiley (2000) states that Jamieson-Turner (1997) validated

the MACE by comparing it to the F validity scale score of the MMPI-2. Smiley reports that the

Jamieson-Turner study used a cut-score of two or more errors on the last two trials of the MACE

and an F Scale score of $\geq$ 90. Their archival analysis revealed a statistically significant

relationship (χ^2 (1, $\underline{N}$ = 224) = 9.77, p < .003, ϕ = .22).

Concerned that using only the F Scale validity score as a sole indication of over-reporting

which may lead to falsely classifying someone as malingering, Smiley (2000) performed a

replication plus extension study using the F-K, The Lachar-Wrobel Critical Items (L&W), and

the Obvious Subtle (O-S) cutoff scores. Smiley changed Jamieson-Turner's (1997) procedure

and used three instead of two for the cutoff score for the MACE. Smiley's (2000) analysis of

results found that the additional over-reporting scales of the MMPI-2 and by increasing the

number missed to three on the MACE, the probability of correctly identifying individuals as

possibly malingering or not malingering using the MMPI-2 F score as a malingering standard increased.

Hypotheses

It is believed that when the specified validity scale scores of the MMPI-2 (F, F-K, F[p], K, O-S, L&W) and the TOMM Trial 1 and Trial 2 scores, indicate over reporting and possibly malingering, the MACE scores will also indicate over reporting and possibly malingering. Specifically, the following are hypothesized:

1. There will be significant correlations among the selected MMPI-2 validity scales (F, F-K, F[p], K, O-S, L&W), the two malingering tests, TOMM Trial 1 and TOMM Trial 2, and the MACE.

2. The MACE test along with the TOMM Trial 1 and Trial 2 and other validity scores of the MMPI-2 (F, F-K, F[p], K, O-S, and L&W) will each contribute significant variance in deciding the best predictor(s) of the MMPI-2 F score.

3. The MACE test with a cut score of ≥ 3 errors will show substantial sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall hit rate when matched to the F scale.

4. The MACE test with a cut score of ≥ 3 errors will show substantial sensitivity, specificity, PPV, NPV, and overall hit rate when matched to the F-K scale.

5. The MACE test with a cut score of ≥ 3 errors will show substantial sensitivity, specificity, PPV, NPV, and overall hit rate when matched to the O-S scale.

6. The MACE test with a cut score of ≥ 3 errors will show substantial sensitivity, specificity, PPV, NPV, and overall hit rate when matched to the L&W scale.

7. The MACE test with a cut score of $\geq$3 errors will show substantial sensitivity, specificity, PPV, NPV, and overall hit rate when matched to the first trial of the TOMM.

8. The MACE test with a cut score of $\geq$3 errors will show substantial sensitivity, specificity, PPV, NPV, and overall hit rate when matched to the second trial of the TOMM.

Method

Participants

De-identified archival data was obtained from a private assessment firm, from 255 individuals referred for disability assessment by DSHS from the years 2009 to 2013. The participant sample consisted of 82 females and 170 males, ranging in age from 18 to 60 years of age, with the mean being 36.9, ($SD = 10.4$).

Procedure

Participants completed an intake form, were given an interview, and then completed a modified for computer testing MMPI-2 and the MACE. Some, but not all clients were also administered the TOMM. The two TOMM trials were given and scored by hand by a psychometrist or psychologist. The interview and tests were not all given in the same order. Depending on the assessment, other tests may have been administered such as the WAIS-IV (Wechsler, 2008), M-FAST (Miller, 2001), or Trails A and B (Reitan, 1958). Data from these other tests were not collected for this study.

In order to determine specificity, sensitivity, PPV, NPV, and hit rates, cutoff scores for MMPI-2 validity scales were researched. Review of other MMPI-2 interpretive manuals revealed the use of multiple cutoff scores for each of the MMPI-2 validity scales. The F cutoff score of 100 from the MMPI-2 Manual for Administration, Scoring and Interpretation, 2nd Edition (2001), and the Greene (2000) Interpretive Manual 98th percentile scores for the F-K ($\geq$15), Lachar-

Wrobel Critical Items (L&W) ($\geq$73), and the Obvious-Subtle scale (O-S) ($\geq$240) were chosen over Smiley's (2000) cutoff scores to provide less likely false positives. The present study chose to add the F[p] validity scale cutoff score for further extension of the Jamieson-Turner (1997) and Smiley (2000) studies. The cutoff score of 100 was chosen for the F[p] from the MMPI-2 Manual For Administration, Scoring and Interpretation, 2nd edition (2001). The cutoffs of 45 or more correct established by Tombaugh (1996) for both the TOMM Trial 1 and Trial 2, and the cutoffs established by Smiley (2000) of three or more errors for the MACE were kept.

Sensitivity [(True Positive/(True Positive + False Negative)] is how likely the MACE is to detect the presence of over reporting/malingering in someone who is over reporting/malingering on the other measure (e.g., F scale). Specificity [(True Negative/(True Negative + False Positive)] is how likely the MACE is to detect the absence of over reporting/malingering in someone who is not over reporting/malingering on the other test (e.g., F scale). PPV [TP/(TP+FP)] is how likely a person who shows a positive test result with the MACE to actually have the characteristic with another test (e.g., F scale). The NPV [TN/(TN+FN)] is how likely a person who does shows a negative test with the MACE to actually not have the characteristic with the other test (e.g., F scale). The overall hit rate is a global measure of the decision-making accuracy of the test. It counts all errors and all correct decisions equally [(True Positive + True Negative/All results (True Positive + True Negatives + False Positives + False Negatives)].

Means, standard deviations, minimum, and maximum scores for the MACE, both TOMM trials, and the MMPI-2 validity scales were obtained.

Results

Three cases were omitted from the data set due to TRIN scores of 79 or higher that indicated that the client had trouble understanding or completing the MMPI-2 measure. Also, due to client distress during the assessment or the client having had previously taken the MMPI-2 from the assessment location, some clients were directed to only complete the MMPI-2 to 370 questions. This resulted in some cases not receiving all of the validity scale scores; however, as stated by Graham (2000, p. 361) "…administration of the first 370 items of the MMPI-2 permits scoring of the standard validity and clinical scales and their subscales."

Means and standard deviations for the MACE, both TOMM trials, and the MMPI-2 validity scales were generated in SPSS. The mean scores were as follows: F scale = 109.54 (*SD* 14.87), L scale = 50.62 (*SD* 9.59), K scale = 36.13 (*SD* 6.45), F-K scale =17.95 (*SD* 11.74), O-S = 224.24 (*SD* 62.88), L&W scale = 68.10 (*SD* 16.09), F[p] scale (M 81.29, *SD* 24.65), TOMM Trial 1 = 40.02 (*SD* 9.02), TOMM Trial 2 = 44.36 (*SD* 9.56), MACE total score/3 = 7.51 (*SD* 1.72). (See Table 1).

In order to test the first hypothesis regarding relationships between the MACE, MMPI-2 and the TOMM, a Pearson Product Moment Correlation matrix was generated. The MACE scores were highly positively correlated with the TOMM Trial 1 scores ($r = .669$, $p <.000$) and the TOMM Trial 2 scores ($r = 672$, $p < .000$) and moderately negatively correlated with the MMPI-2 validity scale scores of F ($r =-.251$, $p <.000$) Obvious-Subtle (O-S) ($r = -.238$, $p < 000$), F-K ($r = -.380$, $p < .000$), L&W Critical Items ($r = -.200$, $p < .000$) and F[p] ($r = .307$, $p < .000$). (See Table 2).

For the second hypothesis, two multiple regressions were conducted. It was hypothesized that the MACE, TOMM Trial 1, TOMM Trial 2, O-S, Critical Items, K, F-K, and F[p] would all contribute to predicting the F scale of the MMPI-2. The F scale was used as the criterion value as

it appears to be the "gold standard" of over reporting/malingering of the MMPI-2 (Heaton, Smith,

Lehman and Vogt, 1978). A stepwise multiple regression analysis showed that the F-K and K

scores best predicted the F scale (R^2 = .488, F(2,96) = 44.82, p < .000). These two scales

accounted for almost 49% of the variance in F, while the rest of the scales did not contribute

enough variance to be included in the entered variables. The F-K scale contributed the most

accounting for almost 46% of the variance in F and the addition of K added only 3% of the

variance. It was found that F-K significantly predicted the F scale with a β =.765, p < .000, and

that K predicted the F scale with a β = .193, p < .022. Again, the other scales did not contribute

enough variance to be counted as predictors.

It should be noted, however, that the F-K scale uses F as part of the scale and that K is

part of the F-K scale; therefore, these two scales would obviously be predicting themselves.

Since TOMM Trial 1 and TOMM Trial 2 were significantly correlated with the MACE (r = .669

and .672, p < .000, respectively), and since these three scales are not part of the MMPI-2, a

stepwise multiple regressions was conducted in order to determine which of these three scales

would best predict the F scale. With this stepwise multiple regression, it was determined that

only the MACE predicted scale F (R^2 = .091, F(1,118) = 12.746, p < 001). It was found that the

MACE predicted scale F with a β = -.313, p<.001. Using these three scales, the MACE

contributed about 10% of the variance of F, and the two TOMM Trials did not contribute enough

variance to be part of the regression.

The final hypotheses predicted high sensitivity, specificity, PPV, NPV, and hit rates from

a Chi-square analysis of the MACE, both of the TOMM trials and MMPI-2 validity scale scores.

A Chi-square analysis of scores on the F Scale and scores on the MACE revealed a significant

difference between scores classified as malingering (>100) and scores classified as non-

malingering (< 100), c^2 (1, N = 252) = 5.59, p < .01, ϕ = -0.149. The sensitivity of MACE:F

Scale was .30; the specificity of MACE:F Scale was .89. The PPV was .94; and the NPV was .17.

The overall hit rate, the percent accurately classified, was .38. (See Table 3).

A Chi-square analysis of scores on the O-S Scale and scores on the MACE revealed a

significant difference between scores classified as malingering ($\geq$ 240) and scores classified as

non-malingering (< 240), χ^2 (1, $\underline{N}$ = 250) = 8.28, p < .000, ϕ = -0.182. The sensitivity of

MACE:O-S Scale was .36; the specificity of MACE:O-S Scale was .36. The PPV was .62; and

the NPV was .58. The overall hit rate, the percent accurately classified, was .59. (See Table 4).

A Chi-square analysis of scores on the F-K Scale and scores on the MACE revealed a

significant difference between scores classified as malingering ($\geq$ 15) and scores classified as

non-malingering (< 15), χ^2 (1, $\underline{N}$ = 236) = 6.59, p < .01, ϕ = -0.167. The sensitivity of MACE:F-

K Scale was .33; the specificity of MACE:O-S Scale was .84. The PPV was .83; and the NPV

was .34. The overall hit rate, the percent accurately classified, was. .47. (See Table 5).

A Chi-square analysis of scores on the L&W and scores on the MACE revealed a

significant difference between scores classified as malingering ($\geq$ 73) and scores classified as

non-malingering (< 73), χ^2 (1, $\underline{N}$ = 229) = 5.58, p < .02, ϕ = -0.156. The sensitivity of

MACE:L&W Scale was .36; the specificity of MACE:L&W Scale was .78. The PPV was .54;

and the NPV was .64. The overall hit rate, the percent accurately classified, was .61. (See Table

6).

A Chi-square analysis of scores on the F[p] Scale and scores on the MACE revealed a

significant difference between scores classified as malingering ($\geq$ 100) and scores classified as

non-malingering (< 100); χ^2 (1, $\underline{N}$ = 210) = 15.59, p < .00, ϕ = -0.272.The sensitivity of

MACE:F[p] Scale was .50; the specificity of MACE:F[p] Scale was .79. The PPV was .41; and the NPV was .84. The overall hit rate, the percent accurately classified, was .72. (See Table 7).

A Chi-square analysis of scores on the TOMM Trial 1 and scores on the MACE revealed a significant difference between scores classified as malingering (≤ 45) and scores classified as non-malingering (> 45); χ^2 (1, $\underline{N} = 119$) = 14.09, $p < .00$, $\phi = -0.344$. The sensitivity of MACE:TOMM Trial 1 Scale was .48; the specificity of MACE:TOMM Trial 1 Scale was .90. The PPV was .89; and the NPV was .46. The overall hit rate, the percent accurately classified, was .60. (See Table 8).

A Chi-square analysis of scores on the on the TOMM Trial 2 and scores on the MACE revealed a significant difference between scores classified as malingering (≤ 45) and scores classified as non-malingering (> 45); χ^2 (1, $\underline{N} = 119$) = 44.86, $\underline{p} < .00$, $\phi = -0.614$. The sensitivity of MACE:TOMM Trial 2 Scale was .30; the specificity of MACE:TOMM Trial 2 was .89. The positive predictive value (PPV) was .76; and the negative predictive value (NPV) was .87. The overall hit rate, the percent accurately classified, was .83. (See Table 9).

Discussion

The MACE is a memory malingering measure that utilizes the malingering detection strategies of floor effects and forced choice testing. This study is important as it provides validation of a memory malingering measure that takes a short amount of time to administer, does not require an administrator to be present during testing, and can easily be administered alongside other tests given on a computer.

The purpose of this study was to validate the MACE by correlating, using multiple regressions, and comparing hit rates of the MACE to validity measures of the MMPI-2, and the TOMM. Jamieson-Turner's (1997) found that the MACE detected malingering clients in similar

rates to the F validity scale score of the MMPI-2. Smiley (2000) performed a replication plus extension of the Jamieson-Turner (1997) study by including the F-K, Lachar-Wrobel Critical items (L&W), and the Obvious Subtle scales (O-S) of the MMPI-2. Archival analysis of Smiley's results found that the additional validity scales of the MMPI-2 and increasing the number missed to three on the MACE, increased the probability of correctly identifying individuals as malingering or not malingering judged by the F scale, F-K scale, Lachar-Wrobel Critical items, and Obvious-Subtle scales of the MMPI-2.

The premise of the present study was that the validity of the MACE would be helped if association with the other instruments were established, if the MACE and other malingering measures predict the F score of the MMPI-2, and if there were good hit rates, specificity, sensitivity, PPV and NPV.

To determine if all of the measures including the MACE were related, a Pearson Product Moment Correlation was calculated. This correlation revealed that Trial 1 and Trial 2 of the TOMM were highly correlated with the MACE. This would be understandable as both are a test of memory malingering. Other scales had a moderate significant negative correlation with the MACE (-.20 to -.38), which indicated a correlation but not a strong relationship between the validity scales of the MMPI-2 and the MACE.

To determine if the MACE was predicted by the MMPI-2 validity scales or either of the TOMM Trials, a step-wise multiple regression was performed. Results indicated that the best predictors of F were F-K and K scales. However, this would be expected since both scales are related to F or K. Therefore, a multiple regression using non MMPI-2 scales was performed. When using the TOMM Trial 1 and Trial 2 and MACE to predict the F scale, surprisingly, the

MACE was a better predictor than either TOMM Trial 1 or TOMM Trial 2 (albeit, the MACE only provided 10 percent of the variance).

In order to detect whether the MACE adequately detects malingering in comparison with the other measures, data was analyzed by determining Chi-squares for significance, overall hit rates, sensitivity, specificity, PPV, and NPV. This revealed that five of the seven Chi-square tests performed had an overall Hit Rate of 50 percent or higher, with some being as high as .83. The low hit rates were unexpected on the MACE:F scales and the MACE:F-K scales. All but one scale had high specificity. Only one analysis, the MACE:F[p] scales reached significance with sensitivity. All scales but one, the MACE:F[p] scale, had high positive predictive value. Only the MACE:O-S, MACE:L&W and MACE:F[p] scales reached a high negative predictive value. It appears that the MACE may be a good overall predictive tool for hit rates, but lacks consistent specificity with the MMPI-2 validity scales and both trials of the TOMM.

This study had several limitations. There were only four cases where the MACE score and the MMPI-2 F scale score did not reach established cutoffs, causing our results to be possibly skewed, which would have impacted sensitivity and PPV (.30 and .94, respectively). In future research it would be important to include the MACE in as many assessments using the MMPI-2 as possible especially when the F scale is below 100.

The MMPI-2, the TOMM, and the PDRT have been validated by testing clients with documented emotional impairment, brain dysfunction or head injury. It is likely that some of the client's assessed in this study had these known impairments, but the data for this was not included for this study. If there could be a differentiation between those with cognitive and emotional impairments utilizing the MACE, it would further lend credibility to using a memory

malingering task to an assessment for emotional malingering. Furthermore, future research using the M-FAST (Miller, 1995), an emotional malingering detection measure that utilizes symptom analysis as part of the malingering assessment may be able to capture those who are malingering psychopathology specifically versus those malingering memory.

Also of possible issue, reading level was not ascertained at the time of assessment. The MMPI-2 is standardized for use with those who have at least 8 years of education (Graham, 2000). The VRIN and TRIN scale scores help screen for those having problems with reading issues. While those clients with a VRIN and TRIN validity score higher than 79 were excluded from this study, there still may be cases whose score may have been impacted by poor reading levels. For future research, a reading assessment and a short intelligent test such as the Wechsler Abbreviated Scale of Intelligence (WASI-2; Wechsler, 2011) may be helpful in determine those who score as maligning were not impaired in taking the MMPI-2 or the malingering tests.

Another possible issue with this study is the MACE, which is a strictly visual, computer given test, was based on the PDRT, a test that requires audio and visual interaction and is given by hand. Although this study did not find that these differences would impact the validity of the MACE, it is possible that it did. The MACE may benefit from future investigation into this.

Another limitation to this study was that the data for the RBS of the MMPI-2 was not available. Literature review revealed the RBS had utility in detecting cognitive issues similarly to the way that the TOMM does. The MACE, since it positively correlated with the TOMM may benefit from future comparison with this scale.

A final concern that was not explored by this study is the impact of the amount time spent by the client at the assessment office. Clients presenting for disability assessment may be tested and interviewed over several hours, which may fatigue the client. This could impact their ability

to perform to their best ability, which may in turn cause them to be suspected in malingering. This would invalidate the MACE as a test to assess memory malingering. The MACE and other malingering tests may benefit from exploration of this.

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Table 1

Means, Standard Deviations, Minimums and Maximums of the MMPI-2 Validity Scale Scores, TOMM Trial 1, TOMM Trial 2 and the MACE.

	Mean	Std. Deviation	Minimum	Maximum
L	50.62	9.59	23	81
F	109.54	14.87	45	120
K	35.13	6.45	30	66
F-K	17.94	11.74	-13	113
O-S	224.24	62.88	-10	348
L&W	68.10	16.09	20	98
F[p]	81.29	24.66	3	120
MACE	7.51	1.72	1.33	9
TOMM 1	40.02	9.02	9	50
TOMM 2	44.36	9.56	3	50

Table 2

Correlations Among the MACE, Seven MMPI-2 scales, and TOMM Trial 1 and TOMM Trial 2

Measures	1	2	3	4	5	6	7	8	9
MACE (1)	_____								
F[p] (2)	.307 **	_____							
Critical Items (3)	-.200 **	.580 **	_____						
F-K (4)	-.380 **	.717 **	.678 **	_____					
O-S (5)	-.238 **	.475 **	.853 **	.703 **	_____				
K (6)	.016	-.274 **	-.542 **	-.573 **	-.618 **	_____			
F (7)	-.251 **	.591 **	.730 **	.735 **	.745 **	-.462	_____		
TOMM2 (8)	.672**	-.260*	-.047	-.259 **	-.026 **	-.144	-.234 *	_____	
TOMM1 (9)	.669 **	-.201*	-.200 *	-.225 *	-.135	-.153	-.244 **	.844**	____

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2 tailed).

Table 3

Chi-Square Analysis of F Scale and MACE

		Non-Malingerer	Malingerer	
		F < 100	F ≥ 100	Totals
Malingerer	M ≥ 3	4	65	69
Non-Malingerer	M < 3	32	151	183
Totals		36	216	252

Sensitivity	0.30	PPV	0.94	
Specificity	0.89	NPV	0.17	
Hit Rate	0.38			

Chi Square	Value	Df	Significance
Pearson	5.59	1	0.02
Continuity Correction	4.68	1	0.03
Likelihood Ratio	6.51	1	0.01
Linear-by-linear Association	5.57	1	0.02
Phi	-0.149		0.02

Table 4

Chi-Square Analysis of the MACE and Obvious-Subtle Scale (O-S)

Criteria Group		Non-Malingerer	Malingerer	
MACE ≥ 3		Obvious-Subtle	Obvious-Subtle	Total
		< 240	≥ 240	
Malingerer	M ≥ 3	26	43	69
Non-Malingerer	M < 3	105	76	181
Total		131	119	250

Sensitivity	0.36	PPV	0.62
Specificity	0.80	NPV	0.58
Hit Rate	0.59		

Chi-Square	Value	Df	Significance
Pearson	8.28	1	0.00
Continuity Correction	7.48	1	0.01
Likelihood Ratio	8.32	1	0.00
Linear-by-Linear Association	8.25	1	0.00
Phi	-0.182		0.00

Table 5

Chi-Square Analysis of the MACE and F-K scale

Criteria Group		Non-Malingerer	Malingerer	
MACE ≥ 3				
		F-K < 15	F-K ≥ 15	Total
Malingerer	M ≥ 3	11	55	66
Non-Malingerer	M < 3	57	113	170
Total		68	168	236

Sensitivity	0.33	PPV	0.83
Specificity	0.84	NPV	0.34
Hit Rate	0.47		

Chi-Square	Value	Df	Significance
Pearson	6.59	1	0.01
Continuity Correction	5.79	1	0.02
Likelihood Ratio	7.08	1	0.01
Linear-by-Linear	6.56	1	0.01
Phi	-0.167		

Table 6

Chi-Square Analysis of the MACE and L&W Critical Items scale

Criteria Group		Non-Malingerer	Malingerer	
MACE ≥ 3				
		L&W < 73	L&W ≥ 73	Total
Malingerer	M ≥ 3	29	34	63
Non-Malingerer	M < 3	105	61	166
Total		134	95	229

Sensitivity	0.36	PPV	0.54
Specificity	0.78	NPV	0.63
Hit Rate	0.61		

Chi-Square	Value	Df	Significance
Pearson	5.58	1	0.02
Continuity Correction	4.89	1	0.03
Likelihood Ratio	5.53	1	0.02
Linear-by-Linear Association	5.56	1	0.02
Phi	-0.156		0.02

Table 7

Chi-Square Analysis of the MACE and F[p] scale

Criteria Group		Non-Malingerer	Malingerer	
MACE ≥ 3				
		F[p] < 100	F[p] ≥ 100	Total
Malingerer	M ≥ 3	34	24	58
Non-Malingerer	M < 3	128	24	152
Total		162	48	210

Sensitivity	0.50	PPV	0.41
Specificity	0.79	NPV	0.84
Hit Rate	0.72		

Chi-Square	Value	Df	Significance
Pearson	15.59	1	0.00
Continuity Correction	14.17	1	0.00
Likelihood Ratio	14.50	1	0.00
Linear-by-Linear Association	15.51	1	0.00
Phi	-0.272		0.00

Table 8

Chi-Square Analysis of the MACE and TOMM Trial 1

Criteria Group		Non-Malingerer	Malingerer	
MACE ≥ 3				
		TOMM1 > 45	TOMM1 ≤ 45	Total
Malingerer	M ≥ 3	4	33	37
Non-Malingerer	M < 3	38	44	82
Total		42	77	119

Sensitivity	0.48	PPV	0.89
Specificity	0.90	NPV	0.46
Hit Rate	0.60		

Chi-Square	Value	Df	Significance
Pearson	14.09	1	0.00
Continuity Correction	12.58	1	0.00
Likelihood Ratio	15.94	1	0.00
Linear-by-Linear Association	13.98	1	0.00
Phi	-0.344		0.00

Table 9

Chi-Square Analysis of the MACE and TOMM Trial 2

Criteria Group		Non-Malingerer	Malingerer	
MACE ≥ 3				
		TOMM2 > 45	TOMM2 ≤ 45	Total
Malingerer	M ≥ 3	9	28	37
Non-Malingerer	M < 3	71	11	82
Total		80	39	119

Sensitivity	0.76	PPV	0.76	
Specificity	0.89	NPV	0.87	
Hit Rate	0.83			

Chi-Square	Value	Df	Significance
Pearson	44.86	1	0.00
Continuity Correction	42.08	1	0.00
Likelihood Ratio	44.85	1	0.00
Linear-by-Linear Association	44.48	1	0.00
Phi	-0.614		0.00

Curriculum Vitae

EDUCATION   Eastern Washington University

- Master's in Clinical Psychology-June 2013.
- Bachelors of Arts in Psychology – Magna Cum Laude June 2010.
  - Minor with Certificate in Drug and Alcohol Counseling.

Idaho State University   September 1991 to June 1993

- Associates Degrees in both Small Business and Marketing.

WORK and PRACTICUM EXPERIENCE

2013 to present   American Behavioral Health Systems   Spokane, WA
                         Provide group education and individual drug treatment.

2012 to 2013   Catholic Charities Counseling Center   Spokane, WA
                         Year long practicum providing individual counseling people who have a variety of different mental health issues, including chemical dependency.

2010 to 2011   Daybreak Youth Services   Spokane, WA
                         Provide drug and alcohol assessments at both inpatient and outpatient locations, juvenile detention, and SMHC's PCCA unit for teens ages 11 through 17.

2009 TO 2010   New Horizon Care Centers   Spokane, WA
                         Completed a 450 hour practicum and then worked part-time as CDPT adult group therapy provider 4 days a week in the Downtown and Valley office locations.

2007 TO 2009   Ferrante's Market Place Café and Shoppe   Spokane, WA
                         Part-time cashier and kitchen help

2003 to 2006   Inland Psychiatry and Psychology, Inc   Spokane, WA
                         Full-time front office receptionist

2002 to 2003   Ada Dermatology   Boise, ID
                         Full-time front office receptionist

1999 to 2002	Grand Avenue Medical	Pullman, WA
	Office Manager	December 1999 to June 2002
	Receptionist	August 1999 to November 1999

Licenses   Washington State Chemical Dependency Professional Trainee CO 60154028. Expires April, 2014.

Awards   Eastern Washington University's Dean Chertok Award 2010 – Psychology Department.This award is presented to one outstanding graduating senior in each department of the College of Behavioral and Health Sciences.

Idaho Psychology Association Tri-State Conference, Sun Valley, ID 2010. Best Undergraduate Poster Presentation Award. Substance Use and Alcohol Expectancies in an Incarcerated Population.

College of Behavioral and Health Sciences Travel Award, 2010. This award of was given to defray the cost of attending the Idaho Psychology Association Tri State Conference.

Clubs and Organizations Psi Chi – The International Honor Society for Psychology

- EWU Chapter President 2009-2010 school year
- EWU Chapter Secretary January 2009 to June 2009
  - Assisted President with running the Psi Chi office.

Research Experience Validation of the Memory Attention Concentration Evaluation (MACE) 2012-2013. Thesis to be defended June 2013.

Criminal Justice Study, 2009-2010. Oral presentation at Eastern Washington University Symposium.

Life Events Study, 2010. Data was presented after graduation.

Substance Use and Alcohol Expectancies in an Incarcerated Population 2009-2010, Presented at the Idaho Psychological Association Tri-State Conference and Eastern Washington University Symposium, poster presentation.

Emotional Intelligence, Cognitive Load, and Malingering, 2009. Oral presentation at Eastern Washington University Symposium.

Other Presentations   Detection of Malingering, Repeat guest speaker in the Psychology
                             of Deception class taught by Casey Lytle 2012 and 2013.

Volunteer Work   New Horizon Counseling Centers, Spring Quarter 2010

- Conducted 1-3 process groups for chemically dependent
  adults on Friday mornings.

Eastern Washington University, Satori Summer Camp, 2009

- Coordinated the schedule of volunteers and assisted Dr.
  Bill Williams with his psychophysiology equipment during
  class time with teenaged students.

Peer Mentor R2R program, Winter Quarter 2008, Spring Quarter
2008

- Taught a weekly seminar class that complimented
  Psychology 100 classes. Winter Quarter was done for
  college credit; Spring Quarter was done as volunteer work.

Odyssey Youth Center, Fall Quarter 2008

- Participated one night a week at the center for LGBTQ
  teens and worked with the 12-17 year old group on coping
  skills.