PERSONALITY AND THE PREDICTION OF OUTCOME FOLLOWING REHABILITATION IN PERSONS WITH ACQUIRED BRAIN INJURIES: THE MILLON BEHAVIORAL MEDICINE DIAGNOSTIC (MBMD)

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Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

August 2008

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Beck, Kelley D. *Personality and the prediction of outcome following rehabilitation in persons with acquired brain injuries: The Millon Behavioral Medicine Diagnostic (MBMD)*. Doctor of Philosophy (Health Psychology and Behavioral Medicine), August 2008, 63 pp., 14 tables, references, 60 titles.

Neuropsychological rehabilitation following acquired brain injury is increasingly recognized as essential with the advancements in research evidence of its effectiveness, particularly as current estimates of disability following the most common forms of brain injury (traumatic brain injury and cerebrovascular accident) are so high. Improvements in predictive capabilities of researchers and clinicians are paramount in designing effective interventions. As many variables associated with outcome following brain injury are not controllable (e.g. severity of the injury, age, education), it is essential that rehabilitation programs design interventions to target those variables that are susceptible to amelioration. While personality factors have been shown to affect outcome in other medical illnesses, only a few studies have examined the influence of personality on outcome following neurorehabilitation for acquired brain injury. The results of these studies have been mixed. This study used the Millon Behavioral Medicine Diagnostic (MBMD) to predict outcome as measured by the Mayo-Portland Adaptability Index (MPAI-4) following brain injury rehabilitation in a heterogeneous sample of persons with acquired brain injuries ($N = 50$). It was hypothesized that specific coping styles scales from the MBMD (Introversive, Dejected, Oppositional), which are based on Millon’s personality system, would predict outcome. Results indicated that both the Introversive and Oppositional coping styles scales accounted for significant amounts of variance in outcome beyond that accounted for by the severity of
the injury alone \((p < .001)\). In both cases, individuals with mild/moderate-
moderate/severe limitations following completion of the rehabilitation program had
significantly higher scores on the Introversive and Oppositional coping compared to
individuals with more successful outcomes. The hypothesis that a dejected coping style
would predict outcome was not supported. Implications for rehabilitation are discussed
in the context of Millon’s personality system.
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ACKNOWLEDGMENTS

I wish to express my sincere appreciation to the many individuals who have contributed to the completion of this composition. First I would like to thank my advisor and mentor, Dr. Susan F. Franks, who provided guidance throughout the process from initial project conception to the final drafting of this work. Her thoughtful critique and clinical acumen as well as her constant support made this project possible. I would also like to thank each of my committee members, Dr. James Hall, Dr. Genie Bodenhamer-Davis, and Dr. Rodney Isom for offering their evaluation of the project, encouragement, and support throughout this process from proposal to defense; each uniquely contributed to the integrity of this work. Additionally, this project would not have been possible without the support of Dr. Floyd McMillan, Dr. Jacqueline Wiebe, and the rehabilitation staff at the Integra Hospital of Plano and Denton Regional Medical Center. I will always be indebted to their generosity of time and resources in assisting with my data collection and generally making this project feasible.

I also wish to thank my family and friends for their unwavering support and patience throughout this doctoral experience. To my husband Brian, who was steadfast in his encouragement and belief in my abilities, I will be forever grateful for his sacrifice in making this experience possible. Thanks also to my parents for their love and constant support. Finally, to the One who gives life, nurturance, challenge, love, and unlimited grace, I would not have had the resources by which to pursue this dream without Him.
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CHAPTER I

INTRODUCTION

Disability Following Acquired Brain Injury

The latest estimates from the Centers for Disease Control (CDC, 2004) show that 34-43 million individuals in the United States have chronic disabilities. Both traumatic brain injury (TBI) and cerebrovascular accident (CVA), or stroke, frequently result in chronic disabilities (Alexander, 1994). While approximately 1.4 million individuals in the United States seek emergency health services following TBI each year, close to 5.3 million Americans have continued long-term needs for assistance with activities of daily living as a result of TBI (CDC, 2008). Similarly, approximately 700,000 individuals experience a stroke each year (American Heart Association, 2005), and nearly 1,000,000 are currently disabled in the United States as a result of stroke (CDC, 2005).

In addition, disability may result from other forms of neurological insult, including various forms of malignant brain cancers and encephalitis (Moorthi, Schneider, & Dombovy, 1999; Sherer, Meyers, & Bergloff, 1997).

The impact of disability following acquired brain injury can be severe and broad. Financial costs associated with neurological injuries are astounding. Estimates from as long ago as 1985 revealed total economic costs approximating 37.8 billion dollars per year for traumatic brain injury alone (Max, Mackenzie, & Rice, D., 1991). According to Khan, Khan, and Feyz (2002), the financial burden of TBI on society is much greater than such financial estimations, due to the impact of lost wages, social services systems costs, and lost wages of family members that must take on the role of caregivers to neurologically impaired individuals.
Economic costs for CVA are similar to those of TBI. Most recent estimates of annual direct and indirect costs of CVA are 65.5 billion dollars annually (American Heart Association, 2008). Of particular concern are recent reports that Medicare payments have been unable to keep up with growing costs of stroke (American Heart Association, 2006). Such serious financial costs may ultimately have poor implications for treatment outcome. It is probable that Medicare and other private insurance companies will continue to examine ways to cut these costs, which may include decreasing length and/or intensity of rehabilitation following brain injury.

Given these economic concerns, it would behoove healthcare professionals to improve ability to accurately predict treatment outcome. If there was a greater understanding of variables associated with successful/unsuccessful outcomes, treatment strategies could be developed that target these variables. This would enable treatment efforts to be streamlined and concentrated on altering those variables that are related to unsuccessful outcomes. While some of these predictors of outcome are not changeable (e.g. severity of the injury, demographic characteristics), it is the contention of this study that other variables, specifically personality characteristics, can be taken into account in developing cost-effective rehabilitation goals and treatment plans.
CHAPTER II
LITERATURE REVIEW
Rehabilitation of Acquired Brain Injury

The importance of neuropsychological rehabilitation following acquired brain injury is increasingly recognized, as such interventions continue to gain research evidence regarding their effectiveness. More specifically, the effectiveness of adult post-acute brain injury rehabilitation (PABIR) has been examined in TBI, stroke, and brain cancer (Adams, Sherer, Struchens, & Nick, 2004; Malec, 2001; Malec & Basford, 1996), with preliminary indications representing positive overall outcomes. However, strong empirical evidence in this area has been limited by methodological factors such as design complexity and the ethical problems associated with acceptable control conditions (Malec, 2001). Thus, randomized control trials are difficult to perform, and much of the research has relied on small, cross-sectional samples (Antonak, Livneh, & Antonak, 1993; Malec, 2001).

The term PABIR is used to describe different forms of post-acute brain rehabilitation programs that focus on rehabilitation after discharge from inpatient settings. Malec and Basford (1996) summarized the different specialized rehabilitation programs referred to under the broad umbrella of PABIR and include the following in order of greatest to least in injury severity: neurobehavioral programs (NP), residential community reintegration programs, comprehensive (holistic) day treatment programs (CDTP), and outpatient community re-entry programs. CDTP has the most complete theoretical and empirical bases of all the forms of PABIR (Trexler, 2000). CDTP programs involve a multi-modal approach that consists of functional treatments, such as
physical, occupational, and speech therapies, as well as addressing psychological aspects of acceptance and adjustment experienced by many patients (Trexler, 2000). In his review of CDTP treatment efficacy for brain-injured individuals, Trexler (2000) concluded that despite the methodological issues presented above, CDTP has been the most well studied of all the forms of post-acute treatment and shows promise with regard to the establishment of more solid empirical validation.

Measurement of Outcome

Defining successful outcome following brain injury rehabilitation has been difficult, particularly when measuring post-acute outcome. Many of the standard measures of acute outcome, such as the Functional Independence Measure (FIM) and Glasgow Outcome Scale (GOS), have been deemed inappropriate for more long-term outcome assessment (Lezak, 2004; Malec, Moessner, Kragness, & Lezak, 2000). FIM and GOS are more global measures of severity and level of functioning, but, as such, do not adequately assess psychosocial aspects of rehabilitation outcome that become prominent in the later stages of recovery (Antonak et al., 1993; Lezak, 2004; Malec et al., 2000). Thus, post-acute measures would benefit from using a broader range of validated outcomes as compared to the traditional acute measurements (Adams et al., 2004).

The World Health Organization (WHO) recently revised its classification system, known as the International Classification of Impairments, Disabilities, and Handicaps (ICIDH-2). This system included three main dimensions identified as Impairments, Activities, and Participation, all of which have been used for defining disability outcome
(Greenwood, 1999). However, Malec et al. (2000) pointed out that the consequences of brain injury often do not easily match the WHO criteria, particularly with regard to behavioral and social realms. Though standards for measurement of disability outcome may exist, difficulty still continues in conforming measurable aspects of acquired brain injury to those standards. Thus methodologies have been limited by the absence of a standard measurement of outcome and disability following brain injury (Malec & Moessner, 2000).

Another area of difficulty involves determining the adequacy of measurement from differing perspectives including those of staff, patients, and patients’ significant others. Williams, Evans, and Wilson (1999) advocated the necessity of measurement from the staff’, patient’s and significant other’s/family’s perspectives as all were of primary importance. However, Adams et al. (2004) emphasized the value of using individuals separate from treatment staff in order to reduce potential bias. Using the Mayo-Portland Adaptability Index (MPAI-4), Malec (2004) compared ratings by staff, patients, and significant others in order to examine the influence of bias for each rating group. His results showed that in general, significant others reported greater levels of disability for patients, whereas patients showed a tendency to underreport or downplay areas of difficulty. Staff tended to report less difficulty in physical and cognitive areas and were generally less reliable in terms of identifying significant adjustment problems in patients. These results reflected various biases existing among these different rating sources.
Predictors of Outcome

Prediction of outcome following rehabilitation, whether acute or post-acute, has been addressed in the literature by many researchers in both traumatic brain injury and stroke rehabilitation. Demographic characteristics such as age, gender, race, and education level have been commonly employed as predictors in many studies (Adams et al., 2004; Alexander, 1994; Goranson, Graves, Allison, & La Freniere, 2003; Hammond, Hart, Bushnik, Corrigan, & Sasser, 2004; Hart, Whyte, Polansky, Kersey-Matusiak, & Fidler-Sheppard, 2005; Kelly, Furie, Shafqat, Rallis, Chang, & Stein, 2003; Liu, McNeil, & Greenwood, 2004; Machamer, Temkin, & Dikmen, 2003; Malec, 2001; Malec & Basford, 1996; Paolucci, Antonucci, Pratesi, Traballesi, Grasso, & Lubich, 1999; Putnam & Adams, 1992; Sherer, Nick, Sander, Hart, Hanks, Rosenthal, et al., 2003; Tate, 1998). Other variables, including type of injury, severity of injury, functional and cognitive status, and self-awareness, have all been used in prediction as well (Crepeau & Scherzer, 1993; Kelly et al., 2003; Malec & Basford, 1996; Malec & Moessner, 2000). The following paragraphs will summarize current knowledge on the relationship between these variables and outcome. Additionally, consideration will be given as to the necessity of using these variables as covariates in the present study.

Age has been related to outcome in both traumatic brain injury and stroke across most studies. In Malec and Basford’s (1996) review of current research findings, they reported that a negative relationship between age and recovery in naturalistic studies existed in multiple studies, and further that studies showing no relationship for age and outcome frequently utilized younger patient samples. Alexander (1993) reported results for stroke patients that were consistent with previous stroke literature, in that older
stroke patients had a more negative functional outcome. Younger age in patients experiencing hemorrhagic and ischemic strokes was also associated with greater functional outcomes (Kelly et al., 2003). Hammond et al. (2004) found that age at the time of injury significantly predicted improvement in communication and expression FIM scores, but it was not a good predictor of decline 5 years post TBI. Age was also found to successfully predict poorer neuropsychological outcome following TBI, where older individuals scored worse on an array of neuropsychological measures. In a study by Putnam and Adams (1992), age was one of the two strongest predictors of long-term outcome following rehabilitation for TBI. Similarly, age at time of injury significantly predicted productivity status following TBI rehabilitation, with younger patients showing greater productivity outcome (Goranson et al., 2003). In contrast to most of the results above, Malec (2001) did not find a significant correlation between age and outcome in their mixed sample of primarily TBI and CVA, which may be related to the relatively young age of their sample. In examining the generally strong relationship between age and outcome, Alexander (1993) explained that age likely includes multiple other variables (such as medical, psychosocial, and psychiatric factors) that have too little association with outcome on their own, but collectively relate to age and underlie the association between age and outcome. Overall, age has been generally related to outcome in persons with acquired brain injuries.

Fewer studies have examined the influence of gender on outcome and results are somewhat inconsistent. Goranson et al. (2003) found that gender was a successful predictor of home integration (tasks such as independent financial management, cooking, housework, and other common daily activities), where females more
successfully adapted to the home environment following TBI as compared to males. In a study by Machamer et al. (2003) the authors found that male gender was associated with a worse neuropsychological outcome as measured by multiple neuropsychological tests and that males reported significantly more psychological distress than females. However, when examining differences in productivity and independence level following discharge, males had better overall outcomes compared to females (Adams et al., 2004). Specifically, males were 3.7 times more likely to be productive and 2.7 times more likely to be independent upon discharge after PABIR. The authors concluded that the reasons for their findings were unclear. These differences in outcome by gender were consistent with other findings where patients did not receive PABIR, but not all previous research has found similar differences between the genders.

The effects of race on outcome following TBI have only recently been studied as variables important in and of themselves. Sherer et al. (2003) found that African Americans were twice as likely to be nonproductive following rehabilitation for TBI as compared to Caucasians after adjustments were made for pre-injury productivity, education, and cause of injury (violent/nonviolent). Similarly, a group comprising the remaining racial minority groups was found to be 2.08 times more likely than Caucasians to be nonproductive after the same adjustments were made. Results of this study indicated that race may often be confounded with other pre-injury variables. Hart et al. (2005) also examined race following TBI and showed that African Americans reported greater differences in social and financial outcomes compared to Caucasians. Overall, these two studies represent small but important gains in knowledge regarding race as successful predictors of outcome following acquired brain injury. However,
though differences between the constructs of race and ethnicity were noted in the literature, no studies to date have examined the differential effect of ethnicity or ethnic identity on outcome following brain injury (Sherer et al., 2003), which represents the need for further investigation.

Education level, often reported in total years of education, has an inconsistent relationship with outcome prediction. While some studies have reported no relationship between education and outcome both in TBI (Goranson et al., 2003; Malec, 2001) and in stroke patients (Adams et al., 2004; Malec, 2001), others have reported some influence of education on various aspects of rehabilitation outcome (Machamer et al., 2003; Malec & Basford, 1996; Sherer et al., 2003). Malec and Basford (1996) in their review reported that only a small number of studies had looked at the influence of education on PABIR, and results were inconsistent. While some studies did show a relationship between education and outcome, others found no such relationship and instead showed that reading ability successfully predicted outcome. A later study by Machamer et al. (2003) found that individuals with lower levels of education had significantly worse neuropsychological and psychosocial outcomes compared to individuals with greater education levels. Similar to Machamer’s results, Sherer et al. (2003) found that individuals with lower levels of education were more likely to have poorer productivity outcomes compared to those with higher levels of education; though as previously mentioned education level was confounded with race in their study.

Overall, these results may indicate that education may be related to neuropsychological outcomes following acquired brain injury, but not necessarily to more global measures of outcome or specific measures of vocational or even psychosocial outcome.
Type of TBI, either violent or non-violent, has also been used to predict outcome in a few studies. Results from the study by Machamer et al. (2003) showed that individuals who were violently injured reported more psychological distress than those non-violently injured. The authors further reported that this finding was consistent with research indicating emotional reactions such as depression and anxiety were common sequelae following trauma. However, results by Malec (2001) did not support the relationship between type of injury and outcome. Type of injury, either violent or non-violent TBI, was not correlated with either independent living status or vocational independence following rehabilitation. Thus, type of injury appears to have an inconsistent relationship with overall outcome and may be more related to psychological outcomes compared to social and community outcomes.

One of the predictors with the strongest relationship to outcome is injury severity. Putnam and Adams (1992) reported that the length of coma/vegetative state was one of the best single predictors of long-term outcome in their sample of TBI patients. Similar results were found by Tate (1998) for the correlation between injury severity and psychosocial outcome. According to Machamer et al. (2003), severity of injury was an important predictor for both neuropsychological and psychosocial outcome following TBI. Results reported by Kelly et al. (2003) showed that initial severity did not predict the amount of recovery during rehabilitation but was a strong predictor of functional outcome after discharge in stroke patients. Their results are consistent with previous research indicating that greater severity of initial disability in stroke patients is associated with poorer functional outcome following rehabilitation (Alexander, 1993). Despite these generally positive associations, a few studies showed no significant
relationship between severity of injury and outcome (Goranson et al., 2003; Malec, 2001). Overall, injury severity generally successfully predicts outcome with or without rehabilitation (Malec & Basford, 1996).

Both functional status and cognitive status have been used to predict rehabilitation outcome in TBI populations. In general, functional status more consistently predicted outcome compared to cognitive status, as most studies have not found a significant relationship between cognitive functioning and outcome (Malec & Basford, 1996). In their meta-analysis of vocational status following TBI, Crepeau and Scherzer (1993) found that with the exception of executive functioning measures, functional measures were a stronger predictor of vocational outcome than cognitive measures. Hammond et al. (2004) in their examination of cognition, communication, and social areas following TBI, however, showed that multiple neuropsychological measures were predictive of the comprehension/expression and social interaction FIM scores. In general, functional status also seems to be related to more long-term recovery following brain injury (Malec & Basford, 1996). Thus, at present, functional status has greater predictive power compared to cognitive status, though results are somewhat mixed.

Self-awareness has recently been investigated as a potential predictor of neurorehabilitation outcome. Brain injury frequently affects an individual’s capacity for self-awareness and accurate self-appraisal, particularly when executive functioning abilities have also been impaired (Crepeau & Scherzer, 1993; Malec & Moessner, 2000). Though there are inconsistencies in results, most studies have generally shown a positive association between self-awareness and outcome where individuals with greater awareness have better overall outcomes following rehabilitation (Malec and
Basford, 1996). Malec and Moessner (2000) showed that lesser impaired self-awareness was associated with superior outcomes in independent living status, goal attainment, and other psychosocial ratings, but it did not successfully predict vocational outcome. However, Crepeau and Scherzer (1993) in their meta-analysis of vocational outcome in TBI found a small relationship between self-awareness and vocational outcome. In reviewing the current evidence on self-awareness, Malec and Basford (1996) endorsed the need for measures with greater reliability, validity, and better standardization. Thus self-awareness appears to have potential as a positive predictor of rehabilitation outcome, though current methods for its assessment need improvement.

After reviewing the latest research on prediction of outcome in persons with acquired brain injury, it appears that the variables with the strongest predictive power continue to be age and injury severity. Additionally, functional status and education level appear to hold promise for reliable prediction of outcome. However, gender, race, type of injury, cognitive status, and self-awareness are all still in need of further research for validation of their prediction abilities. For the present study, injury severity, as measured by the initial Rancho level upon entry into the rehabilitation program, was used as a covariate in the regression models. The Rancho Los Amigos scale is a measure that describes the various stages through which patients typically progress as they recover from brain injury, and it is commonly used in rehabilitation programs to assess severity of behavioral symptoms (Head Trauma Resource, 2005). In addition, age was examined to see if there was sufficient variability to also include it as a covariate in the
models. An inspection of statistical correlation of outcome with education was also made to determine whether education should be entered into the model as well.

**Personality and Outcome**

Assessment of personality is vital in rehabilitation settings, particularly in regard to the delineation of strengths and potential problems that may be encountered during its course (Radnitz, Bockian, & Moran, 2000). Personality and psychosocial factors have been shown to impact outcome in the rehabilitation of spinal cord injury, chronic pain, as well as other chronic illnesses (Cipher, Fernandez, & Clifford, 2002; Cipher, Kurian, Fulda, Snider, & Beest, 2007; Krause & Rohe, 1998; Millon, Antoni, Millon, Meagher, & Grossman, 2001). However, only a few studies have examined the influence of personality on outcome following rehabilitation for acquired brain injury (Malec, Brown, & Moessner, 2004). Improving the efficacy of rehabilitation interventions may be dependent on the ability of researchers to identify characteristics of individuals sustaining successful outcomes from those with unsuccessful ones (Kendall & Terry, 1996), which will likely involve assessment of the relationship between personality functioning and outcome. As previously stated, the research in this area is limited, and most of those studies have used a TBI population; only one study to date has examined personality in stroke patients. A major difficulty in conducting research in this area is the inability to obtain accurate personality ratings post brain injury (Malec et al., 2004), due to the reliance on retrospective accounts of pre-injury personality. Also, there has been some debate in the literature as to whether there is a change in core personality functioning after brain injury. Findings are largely inconsistent with some studies.
reporting personality change following brain injury and others showing no support for such personality changes (Rush, Malec, Brown, & Moessner, 2006). These issues may be partly responsible for the lack of investigation into the influence of personality on outcome as compared to the other predictors discussed above. Other potential reasons for lack of empirical evidence in this area will be discussed following a summarization of existing research on personality and outcome.

Two studies by Tate (1998, 2003) used the Eysenck Personality Questionnaire-Revised (EPQ-R) to examine the connections between personality and outcome. In the first study, prediction of psychosocial outcome by personality variables was not performed due to limitations in sample size. However, none of the personality variables showed significant correlations with psychosocial functioning; only severity of injury showed a significant correlation, indicating that severity of injury may be more important than personality functioning in psychosocial outcome. In a later study, Tate (2003) found that premorbid personality as measured by the EPQ-R was comparable to the age-matched peers from the normative sample. However, changes in personality functioning occurred following the injury at both 6- and 12-month intervals, with significant increases in Neuroticism, Addiction, and Criminality, as well as a non-significant decrease in Extraversion.

Kurtz, Putnam, and Stone (1998) were the first to use the NEO Personality Inventory (NEO PI-R), a standardized and well-normed measure of personality functioning, in testing the stability of personality traits following TBI. The study authors had significant others or relatives of 21 patients admitted for TBI complete a retrospective personality measure within 30 days of injury and again at 6 months post-
injury. They also had a control group of 25 significant others who were associated with patients without a history of neurological impairment complete the measures twice during a six-month period. Results showed that patients scored significantly higher on Extraversion compared to controls on the initial assessment, while no significant differences were found on the final assessment. Patients’ scores on Extraversion also significantly decreased from the initial to final assessment, falling more within the average range and comparable to the control group’s scores. Overall, their findings showed the relative stability of basic personality traits over a six-month period following TBI and were in contrast to results by Tate (2003) using the EPQ-R. In addition, this study did not look specifically at personality as it related to outcome.

Schretlen (2000) also used the NEO PI/NEO PI-R, not as a measure of personality stability but as a measure of the influence of personality on outcome 8 years post TBI. He had both patients and informants rate the patients on a variety of variables including personality on two different forms of psychosocial outcome (social role engagement and behavioral adjustment). He found that none of the NEO variables successfully predicted social role engagement. However, for behavioral adjustment, Neuroticism, Agreeableness, and Conscientiousness all contributed significantly to the regression model, accounting for 57% of the variance in behavioral adjustment ratings. More specifically, lower neuroticism, higher agreeableness, and higher conscientiousness were related to greater behavioral adjustment eight years after TBI. As this study was cross-sectional in nature, it is impossible to determine whether these traits were present prior to the injury, whether they were changed as a result of the injury, or whether a combination may have occurred. Yet these results do provide
support for the hypothesis that personality traits exert an influence on outcome after acquired brain injury.

Two more recent studies explored personality factors in relation to outcome following TBI. Malec et al (2004) used the NEOPI-R to examine the influence of personality on outcome following rehabilitation at 1-year post TBI. Similar to the design used by Kurtz et al (1998), they had both TBI patients and significant others complete the personality measure within several months after the injury and approximately 1 year after the injury. A mixture of participation and independence measures combined through Rasch analysis was used as the outcome measure. Overall, results indicated personality functioning of the TBI participants was in a normal range. Self-ratings of Neuroticism were significant predictors in both the early and long-term outcome models, while no personality variables rated by significant others were significant for either model. Further examination showed that only the Depression component of Neuroticism significantly predicted outcome, with higher depression scores related to worse outcomes. Aben, Denollet, Lousberg, Verhey, Wojciechowski, and Honig (2002) reported similar results for the relationship between Neuroticism and the development of depression in stroke patients. The Neuroticism scale from the NEO-Five Factor Inventory predicted development of post-stroke depression (PSD), and PSD adversely affected rehabilitation outcome in stroke patients. Thus it seems that Neuroticism may indirectly affect outcome in both TBI and stroke populations through its relationship with depression.

In the second study, Rush, Malec, Moessner, and Brown (2004) used pre-injury personality traits in the prediction of outcome for a sample of mild TBI compared to
orthopedic injury; outcome was measured by the Neurobehavioral Functioning Inventory (NFI)- a measure of common issues associated with neurological and behavioral problems. Consistent with results by Malec et al. (2004), both personal and significant other ratings of personality functioning in the mild TBI group were in the normal range as measured by the NEO PI-R. With regard to outcome, significant other ratings of Neuroticism were a significant predictor on the Depression scale from the NFI; thus greater Neuroticism was associated with higher levels of depression, consistent with Aben et al. (2002). In addition, significant other ratings of Agreeableness and Neuroticism were significant predictors of the Aggression scale from the NFI; lower Agreeableness and higher Neuroticism were associated with greater ratings of aggression in patients sustaining mild TBIs. However, the authors indicated that these predictive relationships might be accounted for by similar content in items from the NEOPI-R and NFI. Further, they concluded that personality assessment held little predictive value in the identification of individual characteristics related to successful/unsuccessful rehabilitation outcome following acquired brain injury.

Elmståhl, Sommer, and Hagberg (1996) reported the only study to date exploring the relationship between personality and outcome in stroke patients. The Eysenck Personality Inventory was used along with interview-based coping strategy assessment to predict functioning on activities of daily living (ADLs), motor and cognitive areas, three years following stroke. They found that Extraversion significantly predicted improvement in ADLs one year post-stroke, and there was a nonsignificant trend for Extraversion and improvement 3-years post-stroke. In addition, individuals employing active coping strategies showed greater improvement in ADLs at both one year and
three years post-stroke. These results are interesting in light of prior theory and research regarding coping and psychosocial outcome, which state that problem-focused strategies (active coping) are generally more successful when events are perceived as controllable (Kendall & Terry, 1996; Lazarus, 1993). While much of the sequelae of stroke are not controllable by the individual, adherence to rehabilitation treatments could be considered a problem-focused approach.

In sum, only a few studies have been conducted addressing the influence of personality on outcome in individuals with acquired brain injuries. While some have shown relationships between personality variables and various outcomes (Aben et al., 2002; Elmståhl et al., 1996; Rush et al., 2006; Rush et al., 2004; Schretlen, 2000), others either have not found a significant relationship or the outcomes are of questionable validity (Malec et al., 2004; Tate, 1998). Overall, it appears that greater Neuroticism (or higher levels of Depression), higher levels of Extraversion, and active coping strategies may have some predictive value in psychosocial outcome for persons with acquired brain injuries.

In addition to the issue of potential personality change following brain injury, another likely reason for this overall poor prediction of outcome is the lack of an underlying theoretical framework from which to view prediction of outcome in acquired brain injury (Kendall & Terry, 1996). Thus there is a need for theory-driven research to help illuminate previous associations between predictors and outcome.

Theodore Millon’s Personality Theory

Theodore Millon developed a theory of personality and personality disorders
based on a biosocial-learning model whereby psychological and environmental forces interact to shape personality development (Millon & Davis, 1996). Millon (1990) later reformulated his theory to include contemporary thinking in evolutionary and ecological perspectives and arrived at an evolutionary model of personality. The following description of Millon’s theory is based on the summary provided by Millon and Davis (1996). Four main principles were conceptualized into his model including existence, adaptation, replication, and abstraction. Existence consists of two primary goals: life enhancement and life preservation. Enhancement refers to pleasure derived in life, and behaviors individuals employ to gain satisfaction and happiness. Preservation refers to the avoidance of pain and threat in the individual’s environment. Thus enhancement and preservation are conceptualized as the pleasure-pain polarity, within the principle of existence. The principle of adaptation also includes two dimensions: ecological accommodation and ecological modification, which refer to an individual’s ability to adapt successfully into its environment while still maintaining its own identity apart from the environment. Accommodation refers to a passive style of interaction with the environment, whereas modification refers to an active style individuals use to alter outcomes or events; this is known as the passive-active polarity. The third principle, replication, involves the individual’s ability not only to reproduce, but to evolve with successive generations in order to experience more successful results. Thus replication consists of reproductive individuation and reproductive nurturance, also known as the self-other polarity. Individuation involves a sort of self-actualization process whereby the individual maximizes his or her own potential. Nurturance involves a love and encouragement of others. Finally, the fourth principle, abstraction, contains the
intellective reasoning (thinking)-affective resonance (feeling) polarity. This occurs as individuals develop the capacity for abstraction, both in cognitive and emotional realms, which needs to be expanded into an integrated system.

Millon’s system of personality disorders represents extremes in the preceding polarities, and thus either deficiencies or excesses in specific dimensions (Millon & Davis, 1996). The Millon Behavioral Medicine Diagnostic (MBMD) utilizes his basic system of personality to describe interactional patterns, behaviors, and cognitions exhibited by medical patients (Millon et al., 2001). Each coping style description in the MBMD is a variant of one of the personality disorders described in the Diagnostic and Statistical Manual of Mental Disorders. These personality descriptions were intended to characterize the manner in which individuals typically cope with medical illness and may influence various aspects of the disease process as well as medical outcomes (Millon et al., 2001).

Purpose and Rationale

While no prior research exists using the MBMD in a neurorehabilitation population of individuals with acquired brain injury, there are studies using the MBHI (predecessor to the MBMD) in other rehabilitation populations. Thus in order to narrow the range of predictors, comparisons were made using the original 11 coping styles scales and will be described in the following section.

The Cognitive Dysfunction scale from the MBMD assesses an individual’s perceptions about such cognitive issues as memory impairment, abstract thinking abilities, and confusion (Millon et al., 2001). Correlations between the Cognitive
Dysfunction scale and each of the 11 coping styles scales are presented in the MBMD manual for both raw scores and prevalence scores \((N = 720)\). All of the coping styles scales showed a small correlation with the Cognitive Dysfunction Scale. However, the following scales showed the strongest relationship with Cognitive Dysfunction when examining the prevalence scores: Cooperative \((r = .52)\), Dejected \((r = .46)\), Introversive \((r = .43)\), Inhibited \((r = .42)\), Oppositional \((r = .42)\), and Denigrated \((r = .40)\). The remainder of the coping styles scales each accounted for less than 6% of the variance in Cognitive Dysfunction.

To further examine the relationship between Cognitive Dysfunction and the coping styles scales, a dataset containing MBMD profiles from 125 bariatric patients was examined. Though differences likely exist between extremely obese individuals seeking bariatric surgery and individuals with acquired brain injury undergoing neurorehabilitation, data was used to inform decisions regarding selection of predictors. Correlations between coping styles and Cognitive Dysfunction showed a similar pattern to those reported in the standardization sample. The strongest correlations with Cognitive Dysfunction were noted on the Cooperative \((r = .45)\), Oppositional \((r = .41)\), Inhibited \((r = .39)\), Dejected \((r = .38)\), Introversive \((r = .35)\), and Denigrated \((r = .34)\) scales. To further explore these significant associations, the Cognitive Dysfunction variable was split into two groups using a prevalence score of 60 as the cutoff; Millon et al. (2001) advocated using a cutoff prevalence score of 60 or greater for interpretation of the coping styles scales. Age and education were examined as potential confounds. No significant differences were found between the high and low cognitive dysfunction groups for age, \(t (183) = -1.85, p = .21\). However, chi squared tests revealed a trend
toward a significant effect for education level on the cognitive dysfunction groups, $\chi^2 = 8.79, p = .07$. Thus, education was used as a covariate in the ANOVA models. A series of univariate ANOVAs was performed for all of the coping styles scales to detect differences between the high and low cognitive dysfunction groups. Significant effects of cognitive dysfunction were found for the Introversive [$F(1,177) = 9.2, p = .003$], Dejected [$F(1,177) = 7.13, p = .008$], Respectful [$F(1,177) = 6.11, p = .014$] and Oppositional scales [$F(1,177) = 4.31, p = .039$] after controlling for variance due to education background.

Introversive, dejected, and oppositional coping styles have all been consistently related to the Cognitive Dysfunction scale of the MBMD in both the normative and a clinical bariatric sample. Individuals scoring equal to or greater than 60 on Cognitive Dysfunction also scored significantly higher on the Introversive ($M = 53.0$), Dejected ($M = 44.8$), and Oppositional ($M = 54.3$) coping styles compared to those scoring below 60 for each of these styles ($M = 35.0$, $M = 25.9$, $M = 42.7$, respectively). Individuals characterized by an introversive coping style tend to be passive in regard to their health and therefore unlikely to demonstrate proactive attempts to care for themselves. Results reported by Elmståhl et al. (1996) described above found that active coping was associated with improved outcome in stroke patients. Persons with a dejected style of coping have a generally negative and pessimistic outlook on life, experience hopelessness, and are unable to experience pleasure; they also have a tendency to lack persistence in working on their medical and psychological problems. This corresponds to research showing a relationship between depression and outcome in both TBI and stroke patients (Aben et al., 2002; Malec et al., 2004). Individuals
characterized by an oppositional coping style tend to be unpredictable in adhering to treatment regimes as well as unpredictable regarding mood and attitude. They also may have a general dissatisfaction with their overall health.

Hypotheses

Based on both preliminary statistical examinations and prior research on personality, it is proposed that the Introversive, Dejected, and Oppositional scales be used as predictors of outcome in the present study. The following are the hypotheses of this study:

**Hypothesis 1:** An Introversive coping style will predict outcome as measured by the MPAI-4 Full scale measured as a continuous variable. Multiple regression analysis will be used to examine each of the dependent variables.

**Hypothesis 2:** A Dejected coping style will predict outcome as measured by the MPAI-4 Full scale measured as a continuous variable. Multiple regression analysis will be used to examine each of the dependent variables.

**Hypothesis 3:** An Oppositional coping style will predict outcome as measured by the MPAI-4 Full scale measured as a continuous variable. Multiple regression analysis will be used to examine each of the dependent variables.
CHAPTER III

METHOD

Participants

A retrospective chart review of 50 patients treated at a local outpatient neurorehabilitation program at Denton Regional Medical Center (DRMC) from 2005-2008 was completed. This program is based on the PABIR model described earlier, and it treats a variety of patients who have sustained neurological injury. Many are referred from the hospital’s internal inpatient rehabilitation unit, while others may be referred by local neurologists or recommended for treatment based on neuropsychological evaluation completed by the staff neuropsychologist. Criteria for inclusion in this study included an age of at least 18 years, having completed the rehabilitation program within the past three years, and completion of a valid MBMD. For each patient, demographic data (age, gender, race, marital status, and education level), injury specific information (type of injury, initial and discharge Rancho levels), and relevant data from the neuropsychological test battery (MBMD scale scores) were collected.

Rehabilitation therapists who worked with these patients were also recruited and participated in the assessment of patient outcome. Therapist participants were either rehabilitation staff or behavioral medicine staff who worked with patients in the neurorehabilitation program during the past three years at DRMC. Rehabilitation staff included occupational therapists, cognitive therapists, and speech therapists. Behavioral medicine staff consisted of the staff rehabilitation psychologist, neuropsychologist, and the licensed professional counselor.
Measures

Millon Behavioral Medicine Diagnostic (MBMD)

The MBMD is composed of 165 true/false items and is an updated version of the original Millon Behavioral Health Inventory. Scales include the following domains: response patterns, negative health habits, psychiatric indications, coping styles, stress moderators, treatment prognostics, and management guides. The response patterns scales were designed to identify certain response styles or sets that may influence the reliability and validity of the test results and include the Validity indicator, Disclosure scale (X), Desirability scale (Y), and Debasement scale (Z). Negative health habits scales were designed to measure certain behaviors known to adversely affect medical illnesses and include the Alcohol (N), Drug (O), Eating (P), Caffeine (Q), Inactivity (R), and Smoking (S) scales. Psychiatric indicators were designed to measure psychological issues that may exacerbate the medical illness or interfere/complicate medical treatment efforts; these scales include Anxiety-Tension (AA), Depression (BB), Cognitive Dysfunction (CC), Emotional Lability (DD), and Guardedness (EE). The coping styles scales were based on Millon’s personality theory and designed to assess the ways patients cope with their environment, maximizing reinforcement and minimizing pain both in medical contexts and other aspects of life. These scales were named for the ways in which patients with a specific style would be perceived by healthcare practitioners and include Introversive (1), Inhibited (2A), Dejected (2B), Cooperative (3), Sociable (4), Confident (5), Nonconforming (6A), Forceful (6B), Respectful (7), Oppositional (8A), and Denigrated (8B). Stress moderators were designed to identify cognitive appraisals, resources, and contextual factors that
moderate the effects of personality factors and psychosocial issues on medical illness and treatment. These scales include Illness Apprehension/Illness Acceptance (A), Functional Deficits/Functional Competence (B), Pain Sensitivity/Pain Tolerance (C), Social Isolation/Social Support (D), Future Pessimism/Future Optimism (E), and Spiritual Absence/Spiritual Faith (F). The treatment prognostics scales were designed to identify behaviors and attitudes that may interfere with or improve psychosocial treatment and include Interventional Fragility/Interventional Resilience (G), Medication Abuse/Medication Conscientiousness (H), Information Discomfort/Information Receptivity (I), Utilization Excess/Appropriate Utilization (J), and Problematic Compliance/Optimal Compliance (K). Finally, the management guides are a summarization of all the problem domains assessed by the other clinical scales and include Adjustment Difficulties (L) and Psych Referral (M).

The MBMD uses prevalence scores (PS) in determining cut-off points for each scale; PS were derived from prevalence data in medical populations and, according to the test authors, are a more accurate reflection of differences in prevalence of certain behavioral characteristics in medical patients. A PS below 35 corresponds to an “asset,” PS of 75 to 84 corresponds to a “moderate or present liability,” and PS of 85 to 115 corresponds to a “marked or prominent liability.”

Reliability and validity information are reported in the MBMD manual. Internal consistency measured by Cronbach’s alpha ranged from .47-.89, with a median score of .79. Test-retest reliability was measured on a 7- to 30-day interval, and values ranged from .71-.92, with a median score of approximately .83 (Millon et al., 2001). Estimates of convergent validity are presented for each of the MBMD scales in the manual. As this
study is primarily focused on personality functioning, only the coping styles will be
reviewed. Items on the coping styles scales were primarily derived from items on the
MBHI and Millon Clinical Multiaxial Inventory (MCMI-III). Correlations between the
MBMD coping styles scales and the other Millon instruments previously mentioned
essentially ranged from .55-.75, which according to the test authors is within the
acceptable range considering the complexity of the measures (Millon et al., 2001).

Mayo-Portland Adaptability Inventory (MPAI-4)

The MPAI-4 is a 29-item test developed by Malec (2005) to assess the most
common issues following acquired brain injury. According to the authors it has two
primary intentions: 1) “to assist in the clinical evaluation of people during the post-acute
(post-hospital) period following acquired brain injury …” and 2) “to assist in the
evaluation of programs designed to serve these people.” Items include a range of
physical, cognitive, emotional, behavioral, social, and community reintegration issues
experienced by individuals after brain injury. The scale has been revised 4 times, and
this most recent version includes 3 subscales (Ability Index, Adjustment Index, and
Participation Index). Norms for the MPAI-3 can also be used for the MPAI-4, as the
rating system for the fourth version was based on analysis conducted on the third
version. The MPAI-4 was designed for use in both clinical and research contexts.
Rehabilitation staff, persons with brain injuries and their significant others may all
complete the same version of the MPAI-4, as previous research confirms adequate
reliability from all these perspectives (Malec, 2004).
Rasch analysis was used to examine internal consistency of the MPAI-4 and subscales; it assesses the relationship of each item to the principal measure (Malec, Kragness, Evans, Finlay, Kent, & Lezak, 2003; Malec, 2005). Person reliability and item reliability are important in the assessment of reliability in Rasch analysis; person reliability shows how much items differentiate among different persons, while item reliability shows how much items relate to each other for different persons (Malec et al., 2003; Malec, 2005). The following reliabilities were presented in a study by Malec (2004) comparing ratings by staff, persons with brain injuries and their significant others. Persons with brain injuries had a person reliability of .92 and an item reliability of .96 for the Full scale. Significant others had comparable reliabilities for the Full scale, with a person reliability of .92 and an item reliability of .94. Staff person reliability was somewhat lower (though still in the acceptable range) as it was .86, and item reliability was very strong as it was .98. On the Ability index, all three groups showed acceptable person reliabilities (ranging from .81-.84) and strong item reliabilities (ranging from .93-.98). For the Adjustment index, however, person reliabilities for both individuals with brain injury and significant others were .89 and .86, respectively, while person reliability for staff was low at .76. Item reliabilities for the Adjustment index were acceptable (ranging from .89-.97). Finally, person reliability for individuals with brain injury on the Participation index was low at .74, while those for significant others and staff were in the acceptable range (.82 and .85 respectively). Item reliabilities on this subscale were strong across all groups (ranging from .97-.99). Thus, overall the MPAI-4 and its subscales demonstrate adequate reliability for all rating groups using Rasch analysis.
According to Malec (2005), traditional psychometric properties for internal consistency showed alpha coefficients ranging from .76-.83. Inter-scale correlations ranged from .49-.65 between subscales, with the lowest correlation between the Adjustment and Ability indices and the highest between the Participation and Adjustment indices. Each subscale showed higher correlations with the Full scale as compared to other subscales (ranging from .82-.86). Studies summarized in the manual showed the MPAI-4 correlated moderately with the Disability Rating scale, Rancho scale, various other neuropsychological measures, and the significant other MPAI, thus evidencing predictive and concurrent validity (Malec, 2005).

According to the MPAI-4 manual, T-scores below 30 correspond to comparatively good outcomes, T-scores in a range of 30-40 are suggestive of mild limitations, T-scores in a range of 41-60 correspond to scores of individuals involved in rehabilitation programs and are generally indicative of a range encompassing mild/moderate to moderate/severe limitations, and T-scores greater than 60 are suggestive of severe limitations compared to other individuals with acquired brain injuries.

The MPAI-4 was chosen as the only outcome measure in this study for several reasons. As previously mentioned, there is currently no consensus in the literature with regard to choice of outcome measures in acquired brain injury (Malec, 2004; Malec & Moessner, 2000), particularly with regard to measurement of psychosocial outcome. However, the MPAI-4 represents a significant advancement in outcome measurement for the area of brain injury rehabilitation. It was developed using current multivariate analyses, it has shown good reliability and validity, it has an adequate norm group for reference comparisons, and it includes relevant aspects of brain injury outcomes.
(physical, cognitive, emotional, behavioral, and social adjustment, community reintegration). Additionally, it is brief and can be completed by the patient, significant other, and rehabilitation staff (Malec, 2004). Several commonly employed outcome measures, including the Glasgow Outcome Scale, Disability Rating Scale, Revised Craig Handicap Assessment and Reporting Technique, Supervision Rating Scale, and Rancho Los Amigos Scale of Cognitive Functioning, have all shown significant ceiling effects (Hall, Bushnik, Lakisic-Kazazic, Wright, & Cantagallo, 2001; Hall, Mann, High, Wright, Kreutzer, & Wood, 1996). Additionally Hall et al. (2001) concluded that measures such as FIM, a very common inpatient measure, were not suitable for assessment of community reintegration. Thus, the MPAI-4 was the only measure used in this study.

**Reading Subtest of the Wide-Range Achievement Test-3 (WRAT-3)**

According to the manual, the WRAT-3 is designed to “measure the skills needed to learn reading, spelling, and arithmetic.” The reading subtest involves having individuals read aloud 42 printed words. Thus it is considered a measure of word recognition and pronunciation. The reading subtest provides grade-equivalency scores, suggesting an individual’s performance is comparable to others of that particular grade level. As the MBMD requires a 6th grade reading level in order to administer the test, the reading subtest from the WRAT-3 was used to screen for reading (grade) level.

**Procedures**

Charts from 50 patients in the neurorehabilitation program at DRMC between
2005-2008 were reviewed. Relevant demographic and medical information was collected from the patients’ medical records and neuropsychological evaluations, which included the MBMD scores. Rehabilitation staff that worked with these patients between 2005-2008 at DRMC were recruited to complete the MPAI-4 retrospectively. For each patient, two raters completed the MPAI-4 (one rehabilitation therapist and one behavioral medicine staff). Inter-rater reliability was examined for the MPAI-4 Total score. Pearson correlations for the MPAI-4 Total score were $r = .73$, $p < .001$, indicating adequate overall reliability of therapist ratings. Thus, therapist ratings were then averaged for the Total Score and each subscale. The averages were then converted to T-scores using the National Sample of Staff Ratings reported in the MPAI-4 manual.
CHAPTER IV

RESULTS

Descriptive Statistics

The sample consisted of 50 patients that completed the neurorehabilitation program at DRMC between 2005-2008. Mean age of the sample was 61.6 years ($SD = 15.6$) with a minimum age of 18 and maximum age of 85. Males comprised 56% of the sample ($N = 28$) while the remaining 44% were female ($N = 22$). The sample was 82% Caucasian ($N = 41$) followed by 10% Hispanic/Latino ($N = 5$) and 8% African American ($N = 4$) (see Table 1).

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>56.0</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>44.0</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>41</td>
<td>82.0</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td>African American</td>
<td>4</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Educational composition of the sample included the following: 6% did not complete high school, 20% had a high school degree, 8% had a technical or associate’s degree, 26% had some college work, 22% had a college degree, 6% had some graduate work, 8% had a graduate degree, and 4% did not report education level (refer to Table 2).
Table 2

*Education Level of the Sample (N = 50)*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not complete High School</td>
<td>3</td>
</tr>
<tr>
<td>High School degree</td>
<td>10</td>
</tr>
<tr>
<td>Technical degree</td>
<td>4</td>
</tr>
<tr>
<td>Some college courses completed</td>
<td>13</td>
</tr>
<tr>
<td>College Degree</td>
<td>11</td>
</tr>
<tr>
<td>Some graduate courses completed</td>
<td>3</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>4</td>
</tr>
<tr>
<td>Not reported</td>
<td>2</td>
</tr>
</tbody>
</table>

Marital/relational status of the sample was defined as follows: 12% were single, 70% were married or in a long-term committed relationship, 12% were divorced or separated, and 6% were widowed (refer to Table 3 on the following page).

Table 3

*Marital/Relational Status of the Sample (N = 50)*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>6</td>
</tr>
<tr>
<td>Married/Committed relationship</td>
<td>35</td>
</tr>
<tr>
<td>Divorced or Separated</td>
<td>6</td>
</tr>
<tr>
<td>Widowed</td>
<td>3</td>
</tr>
</tbody>
</table>

Neurological diagnoses for the sample are listed in Table 4. Cerebrovascular
accident comprised the largest portion of the sample at 68% followed by traumatic brain injury at 14%. The remainder of the sample consisted of a variety of other neurological diagnoses at 18%. Injury severity as measured by initial Rancho level upon entering the rehabilitation program ranged from 5.0 to 7.5 ($M = 6.34$, $SD = 0.59$). Rancho level at time of discharge from the program ranged from 5.0 to 8.0 ($M = 6.98$, $SD = 0.64$). A repeated measures t-test was performed to compare rehabilitation progress as measured by initial Rancho level and discharge rancho level. Results showed improvement from patients' entry into the program ($M = 6.33$) through patients' discharge from the program ($M = 6.98$) according to Rancho levels, $t (46) = -7.21, p < .001$.

Table 4

*Frequencies of Neurological Diagnoses in the Sample (N = 50)*

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular Accident</td>
<td>34</td>
<td>68.0</td>
</tr>
<tr>
<td>Traumatic Brain Injury</td>
<td>7</td>
<td>14.0</td>
</tr>
<tr>
<td>Brain Tumor</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Bacterial Meningitis</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Aseptic Meningitis</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Anoxic Brain Injury</td>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>Aneurysm</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Anomia</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Craniotomy</td>
<td>1</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Means and standard deviations for the MBMD coping styles scales were computed and are presented in Table 5. Pearson correlations among MBMD coping styles scales were performed and are presented in Table 6. These correlations ranged from non-significant to strongly correlated, though most were in the small to moderate range. Correlations in the small to moderate range among the coping styles scales were expected given the item overlap between scales.

Table 5

*Mean Prevalence Scores of MBMD Coping Styles Scales (N = 50)*

<table>
<thead>
<tr>
<th>MBMD Coping Style Scale</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introversive</td>
<td>5-110</td>
<td>52.84</td>
<td>25.10</td>
</tr>
<tr>
<td>Inhibited</td>
<td>0-90</td>
<td>53.02</td>
<td>22.80</td>
</tr>
<tr>
<td>Dejected</td>
<td>0-103</td>
<td>28.80</td>
<td>30.33</td>
</tr>
<tr>
<td>Cooperative</td>
<td>5-102</td>
<td>59.30</td>
<td>20.78</td>
</tr>
<tr>
<td>Sociable</td>
<td>10-90</td>
<td>53.62</td>
<td>19.01</td>
</tr>
<tr>
<td>Confident</td>
<td>10-94</td>
<td>55.08</td>
<td>18.69</td>
</tr>
<tr>
<td>Nonconforming</td>
<td>5-70</td>
<td>37.16</td>
<td>18.05</td>
</tr>
<tr>
<td>Forceful</td>
<td>5-72</td>
<td>31.20</td>
<td>18.57</td>
</tr>
<tr>
<td>Respectful</td>
<td>5-98</td>
<td>58.58</td>
<td>23.88</td>
</tr>
<tr>
<td>Oppositional</td>
<td>10-75</td>
<td>54.16</td>
<td>17.27</td>
</tr>
<tr>
<td>Denigrated</td>
<td>5-93</td>
<td>50.92</td>
<td>24.05</td>
</tr>
</tbody>
</table>
Table 6

Pearson Correlations among MBMD Coping Styles Scales (N = 50)

<table>
<thead>
<tr>
<th>Scale</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introversive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Inhibited</td>
<td>.21</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Dejected</td>
<td>.20</td>
<td>.33*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Cooperative</td>
<td>.37**</td>
<td>.19</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sociable</td>
<td>-.18</td>
<td>-.26</td>
<td>-.01</td>
<td>-.31*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Confident</td>
<td>-.12</td>
<td>-.33*</td>
<td>.04</td>
<td>-.30*</td>
<td>.70**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Nonconforming</td>
<td>.14</td>
<td>.05</td>
<td>.01</td>
<td>.09</td>
<td>.09</td>
<td>.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Forceful</td>
<td>.21</td>
<td>.11</td>
<td>.19</td>
<td>-.03</td>
<td>.23</td>
<td>.33*</td>
<td>.40**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Respectful</td>
<td>-.04</td>
<td>-.06</td>
<td>.13</td>
<td>.20</td>
<td>.01</td>
<td>.10</td>
<td>-.10</td>
<td>-.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Oppositional</td>
<td>.30*</td>
<td>.25</td>
<td>.10</td>
<td>.42**</td>
<td>.02</td>
<td>-.06</td>
<td>.52**</td>
<td>.29*</td>
<td>.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Denigrated</td>
<td>.33*</td>
<td>.35*</td>
<td>.43</td>
<td>.48**</td>
<td>-.11</td>
<td>-.13</td>
<td>.11</td>
<td>.10</td>
<td>.09</td>
<td>.47**</td>
<td></td>
</tr>
</tbody>
</table>

* p < .05 (two-tailed).  **p < .01 (two-tailed)

As noted previously, reliability estimates for therapists’ ratings were completed. Pearson correlations for the MPAI-4 Total score were r = .73, p < .001, indicating adequate overall reliability of therapists’ ratings. With regard to the MPAI-4 outcome measure, means and standard deviations were computed (see Table 7) for the Total Scale score as well as each of the 3 indices (Abilities, Adjustment, and Participation). Overall, this sample showed only mild limitations in functioning at time of discharge.
Table 7

*Mean MPAI-4 T Scores (N = 50)*

<table>
<thead>
<tr>
<th>MPAI-4 Scale</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Scale Score</td>
<td>-4-60</td>
<td>38.86</td>
<td>12.05</td>
</tr>
<tr>
<td>Abilities Index Score</td>
<td>-4-61</td>
<td>39.80</td>
<td>10.40</td>
</tr>
<tr>
<td>Adjustment Index Score</td>
<td>19-64</td>
<td>43.38</td>
<td>10.59</td>
</tr>
<tr>
<td>Participation Index Score</td>
<td>19-59</td>
<td>41.82</td>
<td>9.61</td>
</tr>
</tbody>
</table>

Pearson correlations were computed for the MBMD coping styles scales and the Total Scale score from the MPAI-4 (see Table 8). Correlations were modest but most were significant, as 8 of the 11 coping styles scales were significantly correlated with outcome.

Table 8

*Correlations between MBMD Coping Styles and MPAI-4 Total Score (N = 50)*

<table>
<thead>
<tr>
<th>MBMD Scale</th>
<th>MPAI-4 Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introversive</td>
<td>.32*</td>
</tr>
<tr>
<td>Inhibited</td>
<td>.33*</td>
</tr>
<tr>
<td>Dejected</td>
<td>.28*</td>
</tr>
<tr>
<td>Cooperative</td>
<td>.23</td>
</tr>
<tr>
<td>Sociable</td>
<td>-.35*</td>
</tr>
<tr>
<td>Confident</td>
<td>.24</td>
</tr>
<tr>
<td>Nonconforming</td>
<td>.29*</td>
</tr>
<tr>
<td>Forceful</td>
<td>.37**</td>
</tr>
<tr>
<td>Respectful</td>
<td>-.12</td>
</tr>
<tr>
<td>Oppositional</td>
<td>.36*</td>
</tr>
<tr>
<td>Denigrated</td>
<td>.31*</td>
</tr>
</tbody>
</table>

* p < .05 (two-tailed). **p < .01 (two-tailed)
Examination of Hypotheses

A series of multiple regression analyses were performed to evaluate the hypotheses of this study. As discussed above, injury severity, age, and education level were examined to determine degree of relationship with outcome. Injury severity, as measured by initial Ranchos level, was significantly correlated with the MPAI-4 Total Score ($r = -.51$, $p < .001$). However, age was not correlated with outcome ($r = -.06$, $p = .69$), and was thus not entered into the regression analyses. Finally, education level was not significantly related to outcome ($r = -.17$, $p = .25$). Thus, injury severity was the only demographic variable found to have a significant relationship with outcome as measured by the MPAI-4 Total Scale score. Therefore injury severity was entered into the regression analyses that follow.

Stepwise multiple regression analyses were performed for each of the hypotheses using the MBMD coping styles scales as predictors of overall rehabilitation outcome as measured by the MPAI-4 Total Scale score. Results of the regression analyses are shown in Tables 9-11.

For Hypothesis 1, injury severity and Introversive coping were entered as predictors in a stepwise fashion. Model 1 included only injury severity as the independent variable, whereas Model 2 added the Introversive variable to the analysis. Injury severity accounted for 25.6% of the variance in outcome, $F (1, 48) = 16.52$, $p < .001$. The addition of the Introversive variable to the analysis accounted for an additional 8.4% of the variance in outcome beyond that accounted for by injury severity, $F (2, 47) = 12.11$, $p < .001$ (see Table 9).
Table 9

Results of Multiple Regression Analyses for Introversive Coping Predicting Outcome (N = 50)

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Injury Severity</td>
<td>-10.29</td>
<td>2.53</td>
<td>-.51</td>
</tr>
<tr>
<td>Step 2</td>
<td>Injury Severity</td>
<td>-9.97</td>
<td>2.41</td>
<td>-.49</td>
</tr>
<tr>
<td></td>
<td>Introversive</td>
<td>.14</td>
<td>.06</td>
<td>.29</td>
</tr>
</tbody>
</table>

Note. $R^2 = .26$ for Step 1; $\Delta R^2 = .08$ for Step 2 ($p < .001$).

A one-way analysis of variance (ANOVA) was performed on the Introversive variable to examine differences in Introversive levels of coping by degree of outcome. Thus the sample was separated into 4 groups according to MPAI-4 Total Scale score cutoffs for good outcome (T score < 30), outcome indicative of mild limitations (T score 31-40), outcome generally indicative of mild/moderate-moderate/severe limitations (T score 41-60), and outcome indicative of severe limitations (T score > 60). The ANOVA yielded a significant overall result, $F(2, 47) = 3.89, p < .05$, indicating individuals with different overall outcomes following brain injury showed different levels of Introversive coping. Post hoc analyses were conducted using the Tukey a procedure (HSD). Results indicated individuals with good outcomes had significantly lower levels of Introversive coping ($M = 36.50$) than did individuals with outcomes in the mild/moderate-moderate/severe range ($M = 62.88$), $p < .05$ (see Table 12 for results of ANOVA). No other contrasts were significant.

For Hypothesis 2, injury severity and Dejected coping were entered as predictors in a stepwise fashion. Only injury severity accounted for a significant proportion of variance in outcome, $F(1, 48) = 16.52, p < .001$. The Dejected coping variable did not
account for enough additional variance in outcome to enter into the model. As reported in Table 8, correlations between Dejected coping and outcome were weak \((r = .28)\) but significant at the \(p = .048\) level or \(p = .05\) when decimal places were rounded. SPSS requires a \(p\) value less than .05 for a variable to enter into a regression model, thus the Dejected coping variable was not included in the model (see Table 10).

Table 10

Results of Multiple Regression Analyses for Dejected Coping Predicting Outcome \((N = 50)\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>(B)</th>
<th>(SE) (B)</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Injury Severity</td>
<td>-10.29</td>
<td>2.53</td>
<td>-.51</td>
</tr>
</tbody>
</table>

\(Note.\ R^2 = .26\text{ for Step 1.}\)

A one-way ANOVA was performed on the Dejected variable to examine differences in Dejected levels of coping by degree of outcome. The same criteria discussed earlier were used to divide the sample according to overall outcome. Results of the ANOVA showed a trend toward significance, \(F(2, 47) = 2.90, p = .07,\) indicating individuals with different overall outcomes following brain injury showed different levels of Dejected coping. Post hoc analyses were conducted using the Tukey \(a\) procedure (HSD). Results again showed a trend for individuals with good outcomes to have lower levels of Dejected coping \((M = 12.50)\) than did individuals with outcomes in the mild/moderate-moderate/severe range \((M = 40.29), p = .05.\) No other contrasts were significant.

For Hypothesis 3, injury severity and oppositional coping were entered as predictors in a stepwise fashion. Model 1 included only injury severity as the independent variable, whereas Model 2 added the oppositional variable to the analysis.
Injury severity again accounted for 25.6% of the variance in outcome, $F(1, 48) = 16.52$, $p < .001$. The addition of the oppositional variable to the analysis accounted for an additional 9.4% of the variance in outcome beyond that accounted for by injury severity, $F(2, 47) = 14.39$, $p < .001$ (see Table 11).

Table 11

*Results of Multiple Regression Analyses for Oppositional Coping Predicting Outcome (N = 50)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE $B$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 Injury Severity</td>
<td>-10.29</td>
<td>2.53</td>
<td>-.51</td>
</tr>
<tr>
<td>Step 2 Injury Severity</td>
<td>-10.21</td>
<td>2.34</td>
<td>-.50</td>
</tr>
<tr>
<td>Oppositional</td>
<td>.25</td>
<td>.08</td>
<td>.35</td>
</tr>
</tbody>
</table>

*Note. $R^2 = .26$ for Step 1; $\Delta R^2 = .12$ for Step 2 ($p < .001$).*

A one-way ANOVA was performed on the oppositional variable to examine differences in oppositional levels of coping by degree of outcome. The ANOVA yielded a significant overall result, $F(2, 47) = 3.47$, $p < .05$, indicating individuals with different overall outcomes following brain injury showed different levels of oppositional coping.

Post hoc analyses were conducted using the Tukey $a$ procedure (HSD). Results indicated individuals with good outcomes had significantly lower levels of oppositional coping ($M = 45.40$) than did individuals with outcomes in the mild/moderate-moderate/severe range ($M = 61.94$), $p < .05$. None of the other contrasts were significant.
Mean Differences of MBMD Predictors (Per Hypothesis) by Outcome Group (N = 50)

<table>
<thead>
<tr>
<th>MBMD Scale</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introversive</td>
<td>36.50</td>
<td>24.63</td>
<td>52.52</td>
<td>24.59</td>
<td>62.88</td>
<td>21.97</td>
<td>3.89</td>
<td>.03</td>
</tr>
<tr>
<td>Dejected</td>
<td>12.50</td>
<td>19.18</td>
<td>27.39</td>
<td>27.42</td>
<td>40.29</td>
<td>35.59</td>
<td>2.90</td>
<td>.07</td>
</tr>
<tr>
<td>Oppositional</td>
<td>45.40</td>
<td>22.96</td>
<td>52.22</td>
<td>17.72</td>
<td>61.94</td>
<td>8.25</td>
<td>3.47</td>
<td>.04</td>
</tr>
</tbody>
</table>

In order to assess for the potential confound of reading level on the results, the above analyses were repeated after removing cases with WRAT-3 reading subtests scores that were less than a 6th grade level (N = 6). Thus separate multiple regression analysis for each of the hypotheses was performed. Six cases were missing WRAT-3 reading scores, thus the mean for the remainder of the sample was used to replace the missing values. Notably these 6 cases appeared evenly distributed by severity of the injury as measured by the initial Rancho level, which indicates lack of a clear pattern for the missing data and thus provides support for the replacement of these values with the mean for the WRAT-3 reading scores.

Results of the multiple regression analyses using the introversive, dejected, and oppositional predictors were essentially no different after excluding cases based on reading level (see Table 13 below). Models for the introversive and oppositional predictors were both significant, \( F(2, 42) = 10.36, p < .001 \) and \( F(2, 42) = 12.33, p < .001 \), respectively. As in the previous analyses, the dejected coping variable did not account for enough additional variance to enter into the regression model.
Table 13

Results of Multiple Regression Analyses for the 3 MBMD Coping Styles Scales Predicting Outcome after Exclusion by Reading Level (N = 44)

<table>
<thead>
<tr>
<th>Hypothesis, Step</th>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, Step 2</td>
<td>Injury Severity</td>
<td>-9.82</td>
<td>2.56</td>
<td>-.49</td>
</tr>
<tr>
<td></td>
<td>Introversion</td>
<td>.13</td>
<td>.06</td>
<td>.28</td>
</tr>
<tr>
<td>2, Step 1</td>
<td>Injury Severity</td>
<td>-10.12</td>
<td>2.68</td>
<td>-.50</td>
</tr>
<tr>
<td>3, Step 2</td>
<td>Injury Severity</td>
<td>-10.17</td>
<td>2.48</td>
<td>-.50</td>
</tr>
<tr>
<td></td>
<td>Oppositional</td>
<td>.24</td>
<td>.08</td>
<td>.35</td>
</tr>
</tbody>
</table>

Note. \(R^2 = .33\) for Step 2, Hypothesis 1 (\(p < .001\)); \(R^2 = .25\) for Step 1, Hypothesis 2 (\(p < .001\)); \(R^2 = .37\) for Step 2, Hypothesis 3 (\(p < .01\)).

A series of one-way ANOVAs was also performed for each predictor to examine differences in levels of coping by degree of outcome (see Table 14 below). Results of the ANOVA for the Introversion coping variable was significant, \(F(2, 42) = 3.94, p < .05\). Post hoc analyses were consistent with prior results showing individuals with successful outcomes had significantly lower levels of introversion coping (\(M = 33.89\)) compared with individuals with outcomes in the mild/moderate-moderate/severe range (\(M = 63.43\)). As with the prior analysis, the ANOVA for the dejected coping variable showed a trend toward significance, \(F(2, 42) = 2.97, p = .06\). Post hoc analyses showed a trend for lower levels of dejected coping in individuals with successful outcomes (\(M = 13.33\)) compared to those in the mild/moderate-moderate-severe range (\(M = 43.57\)). Finally, results from the ANOVA for the oppositional coping variable showed a trend toward significance, \(F(2, 42) = 2.94, p = .06\); this is in contrast to the prior analysis that showed significant differences between oppositional coping levels for individuals with good
outcomes ($M = 45.40$) compared with those in the mild/moderate-moderate/severe range ($M = 61.94$), $F (2, 47) = 3.47$, $p < .05$. Despite the removal of those 6 cases, means for oppositional coping levels by outcome group showed minimal change. Individuals with good outcomes had lower levels of oppositional coping ($M = 43.67$) compared with individuals in the mild/moderate-moderate/severe outcome range ($M = 61.07$), $p = .056$.

Table 14

*Mean Differences of MBMD Predictors (Per Hypothesis) by Outcome Group after Exclusion by Reading Level (N = 44)*

<table>
<thead>
<tr>
<th>MBMD Scale</th>
<th>Good ($n = 9$)</th>
<th>Mild ($n = 22$)</th>
<th>Mild-Severe ($n = 14$)</th>
<th>MPAI-4 Total Scale score</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introversive</td>
<td>33.89</td>
<td>24.61</td>
<td>52.64</td>
<td>25.16</td>
<td>63.43</td>
<td>23.78</td>
<td>3.94</td>
<td>.03</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dejected</td>
<td>13.33</td>
<td>20.16</td>
<td>28.41</td>
<td>27.62</td>
<td>43.57</td>
<td>36.17</td>
<td>2.97</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oppositional</td>
<td>43.67</td>
<td>23.65</td>
<td>51.86</td>
<td>18.05</td>
<td>61.07</td>
<td>8.84</td>
<td>2.94</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION

This study sought to examine the relationship between personality and outcome following neurorehabilitation in a heterogeneous sample of brain-injured patients. Specifically, the ability of the Introversive, Dejected, and Oppositional coping styles scales from the Millon Behavioral Medicine Diagnostic (MBMD) to predict outcome as measured by the Mayo-Portland Adaptability Index (MPAI-4) in a sample of patients having completed a post-acute brain injury rehabilitation (PABIR) program was investigated.

Generally this study found support for the idea that post-injury personality can successfully predict outcome following completion of a brain-injury rehabilitation program. This is in contrast to prior research showing either no relationship of personality with outcome (Malec et al., 2004; Tate, 1998) or only relationships with specific aspects of outcome (Elmståhl et al., 1996; Rush et al., 2004; Rush et al., 2006; Schretlen, 2000). It is notable that personality variables were able to account for significant variance above and beyond variance accounted for by the severity of the injury alone, which has been shown as one of the strongest predictors of brain injury outcome across studies (Malec & Basford, 1996).

Several possible explanations for the significance of results in this study exist. As has been suggested by Rutterford and Wood (2006), research related to the prediction of outcome following brain injury has not been theoretically based. This has also been the case for the assessment of personality in brain injury. The most commonly used personality measures have included the NEO PI-R and EPQ-R. Though the EPQ-R has
some theoretical basis, the NEO-PI-R was solely empirically derived and has no theoretical underpinnings to assist with clinical interpretation. In comparison, the MBMD is based on Millon’s theory of personality, which is a comprehensive system of personality prototypes. Strack and Millon (2007) emphasized the superiority of utilizing prototypes in the creation of a personality taxonomy compared to a pure description of dimensional traits. They argued that these prototypes are a compilation of dimensional traits, and as such have more clinical utility than factor traits such as those encompassed by the Five Factor Model.

Another potential factor in the significance of these results relates to the use of a more comprehensive measure to assess outcome. The measure chosen for this study, the MPAI-4, was specifically designed to assess a broad range of common issues experienced by patients following brain injury. Items encompass physical, cognitive, emotional, behavioral, social, and community reintegration realms. Therefore in this study outcome assessment incorporates aspects of the whole person as opposed to reliance on a few specific sequelae of brain injury such as degree of cognitive impairment or return to work status.

Finally, the significant results of this study seem consistent with research on the relationship of personality with outcome in a variety of other medical conditions. Personality has been shown to be a strong predictor of long-term outcome in spinal cord injury, both in general psychosocial adaptation and in more global aspects of outcome (Krause & Rohe, 1998). Personality, more specifically the MBMD, has also been shown to predict outcome in a chronic pain population involved in a rehabilitation program (Cipher et al., 2007).
Hypothesis 1

The hypothesis that an introversive coping style would predict outcome as measured by the MPAI-4 in a brain-injured sample was supported. The Introversive coping scale from the MBMD is based on the schizoid personality from Millon’s personality system but is regarded as non-clinical in nature. In order to best understand the composition of the Introversive coper, it is first necessary to examine the schizoid personality style in more detail. Millon (1990) has identified the schizoid personality prototype as a “passive-detached style.” These individuals are considered deficient in the pain-pleasure polarity, such that they are unable to experience life events as either painful or pleasurable (Millon, 1990). In the context of evolutionary theory, organisms are equipped with the ability to experience pain/pleasure so that they will avoid pain-inducing situations (which are often dangerous to the organism), and they will seek out pleasurable situations that often preserve life (Millon et al., 2004). Therefore, it is necessary for individuals to avoid painful situations and engage in pleasurable situations in order to maintain existence. As emotions can be viewed as motivators for action (seek pleasure, avoid pain), the schizoid personality is deficient in its desire to be involved in normal human activities. Schizoid individuals lack the motivation to engage in social relationships, as they do not experience satisfaction from interpersonal interactions. They also do not become distressed by interpersonal conflict. Flat in their expression of emotion, schizoids may seem detached from human relationships and society in general. Thus they are considered to have a passive style of relating to the environment (Millon et al., 2004).

Millon and colleagues (Millon et al., 2001) constructed the Introversive Coping
scale based on the schizoid style from his personality system to represent characteristics of some medical patients in relating to healthcare professionals. The following information on Introverted copers is drawn predominately from the MBMD manual and used in this context for clinical understanding of the scale. Patients scoring highly on the Introverted scale tend to be emotionally flat, introverted, and lack energy. These patients also may be vague when reporting symptoms. They appear to lack concern for their medical problems and thus take a passive approach to dealing with medical issues. It is suggested that healthcare providers give specific and clear directions to these patients, and providers are warned not to anticipate active engagement by Introversive patients in adherence to their treatment recommendations. The manual also notes that an introversive style may be developed by some high scorers as a means of coping with chronic illness or the effects of aging.

In examining how an introversive coping style was related to outcome following brain injury, several interesting points emerge. First, it seems likely that individuals with a passive style of interacting with the environment might also take a passive role in regard to their health. Introversive patients may, therefore, not become actively involved and/or invested in their rehabilitation. Taking responsibility for their own recovery from brain injury may not be within the capabilities of these patients. It has been previously shown that active coping strategies predict improved activities of daily living and quality of life in stroke patients (Elmståhl et al., 1996). Thus it would seem logical that passive strategies be predictive of poorer outcome, as has been established in the results of this study. Second, rehabilitation involves family members as an essential part of the recovery process. Prigatano (1999) has described the necessity of having a strong
working alliance with family during the course of brain injury rehabilitation. Family can serve as an invaluable resource with regard to the assessment and report of patient functioning in the home and community settings. Additionally, family serves as an important resource for the patient in striving toward psychosocial adjustment and return to premorbid functioning. As discussed above, patients with introversive coping styles are introverted and not as concerned with development and maintenance of interpersonal relationships. Given the importance of family relationships to the rehabilitation process and recovery, it is likely that individuals with an Introversive style may be hindered by their lack of social (specifically family) support.

**Hypothesis 2**

The hypothesis that a dejected coping style would predict outcome as measured by the MPAI-4 in a brain-injured sample was not supported. Despite a small significant correlation between the Dejected Coping scale and outcome, the dejected variable did not account for additional variance after controlling for variance accounted for by the severity of the injury. It was originally hypothesized that given the significant relationship between the Dejected Coping scale and the Cognitive Dysfunction scale on the MBMD in the normative and bariatric samples described previously, individuals with actual neurological injuries would also be inclined to score higher on the Dejected Coping scale. However, when the sample was split according to type of outcome (i.e., good outcome, mild limitations, mild/moderate-moderate/severe limitations), none of the outcome groups showed a clinically meaningful elevation on the Dejected Coping scale. Millon et al. (2001) recommend using a prevalence score greater than or equal to 60 as
a minimum for clinically meaningful interpretation. The highest mean prevalence score on the Dejected Coping scale by outcome group occurred in the mild/moderate-moderate/severe group ($M = 40.29$), and it was notably below the cutoff of 60. This is in contrast to the clinically meaningful elevations on both the Introversive and Oppositional coping style scales, which were both above the cutoff score. Overall, these results indicate that individuals with acquired brain injuries do not show elevated rates of dejected coping.

Hypothesis 3

The hypothesis that an oppositional coping style would predict outcome as measured by the MPAI-4 in a brain-injured sample was supported. The Oppositional coping scale is considered a non-clinical version of the negativistic personality in Millon’s theory of personality. Prior to describing how an oppositional coping style may be related to outcome following brain injury, further explication of the negativistic personality is necessary. The negativistic personality prototype, formerly known as passive-aggressive personality, is characterized by Millon as “actively ambivalent,” as they are perpetually in conflict between orientation towards self or others (Millon, 1990). In evolutionary terms, these individuals adapt to their surroundings via modification, which is a process of active transformation of the environment in order to meet personal needs. However, these individuals are in conflict with regard to how to meet these needs. Specifically they have difficulty determining whether to focus on meeting their own needs or appeasing the will/desire of others (Millon, 1990). Negativists therefore are constantly frustrated, never finding one direction to follow, which leads to instability.
of mood and behavioral patterns. For instance, when these individuals attempt to please others, they often feel upset with themselves for these efforts and decide to focus on their own needs instead. Yet as this risks the acceptance and support they need from others, they tend to quickly apologize and return to their focus on others (Millon et al., 2004). Another key aspect in understanding the negativistic personality prototype involves mode of expression of resistance. Generally, resentments tend to be expressed by indirect means as opposed to direct opposition (Millon et al., 2004), hence the prior designator of passive-aggressive.

As previously discussed, the conception of the oppositional coping style by Millon et al. (2001) is grounded in his system of personality, and the term denotes how patients with this style may be perceived by healthcare staff. The following characterization of patients with an oppositional coping style is taken largely from the MBMD manual, which is used clinically for interpretation purposes. According to the manual, individuals that score highly on the Oppositional scale are “unpredictable and difficult.” They appear unhappy and dissatisfied with themselves and their circumstances. These patients tend to have frequent fluctuations in mood that seem unrelated to situational occurrences, and establishing rapport may be especially difficult. Adherence to treatment regimes is likely inconsistent, and they may complain to healthcare providers about their treatment. However, complaints are likely followed closely by apologies (Millon et al., 2001).

As discussed previously with introversive coping, it appears intuitive that individuals with oppositional coping characteristics would be less likely to consistently follow recommendations by the rehabilitation team. Because they lack a consistent
self/others orientation, their behavior will likely fluctuate between pleasing self and
pleasing the team. Over time they may develop resentment toward team members for
their role as authority figures and be less likely to adhere to their rehabilitation program.
Resentment may be expressed by indirect means such as decreased program
attendance or decreased attendance in particular rehabilitation therapies. There may
also be poor follow-through on homework or home exercise assignments and noticeable
disengagement during therapy tasks. Such inconsistency presents unique problems in
the context of brain injury, where consistency is so essential for carryover of new
learning (Parenté & Herrman, 2003). This also holds true for previously mentioned
issues such as regular attendance to rehabilitation therapies and the rehabilitation
program, which is necessary in order to maximize transfer of learning into the home and
community environments.

Implications for Rehabilitation

Results of this study have important implications for development and
implementation of rehabilitation treatment planning. As many variables associated with
outcome following brain injury are not controllable (e.g., severity of the injury, age,
education), it is essential that rehabilitation programs design interventions to target
those variables that are susceptible to amelioration. Since personality styles have been
shown to impact rehabilitation outcome, rehabilitation programs must consider alternate
approaches for dealing with particular personality styles to ensure optimal outcomes.
Psychologists would seem uniquely qualified to assist the rehabilitation team in
understanding the influence of personality on outcome and constructing environments
most conducive to successful outcomes. The following discussion centers on personality-specific approaches in the context of brain-injury rehabilitation.

Millon (1999) has developed therapeutic approaches for specific personality prototypes, which also seem applicable to the non-pathological personality styles measured by the MBMD. These intervention approaches are based on his personality system and seek to integrate techniques from a variety of therapeutic modalities.

Targets for intervention within this framework involve restoring balance within the polarity schema for the particular personality prototype. Thus for the schizoid personality this would involve increasing pleasure and encouraging movement toward the active end of the continuum (Millon, 1999). With reference to the introversive coping style in brain-injured patients, two primary goals emerge. Goal 1 includes increasing active coping responses and limiting psychological/behavioral withdrawal. Goal 2 includes increasing social activity, social support, and adequate family involvement in the rehabilitation process. In order to accomplish these goals, therapeutic interventions should focus on finding pleasurable stimuli to serve as rewards. As these patients are not truly schizoid, the process of finding reinforcers to use in operant techniques should not be too difficult. The rehabilitation team may then use these reinforcers to encourage optimal participation in therapy and completion of home exercise (physical, cognitive, speech, etc.) recommendations. Additionally, incorporation of available family members in the rehabilitation itself may promote increased social awareness and involvement in the patient. Finally, in order to meet goals of increased social activity, patients with Introversive coping styles may benefit from group activities where they are confronted with the need to interact socially. Such groups would vary in design and modality,
ranging from goal-oriented groups where patient focus on completing activities (e.g., cooking) to groups focused more on the specifics of social pragmatics and interaction commonly employed by counselors and psychologists. Generally, it would seem particularly important for Introversive copers to be involved in structured group activities as a part of their rehabilitation.

Individuals with negativistic personality styles necessitate different targets for intervention based on their unique polarity composition. According to Millon (1999), assisting these patients in finding balance within the self-other polarity is a major goal of therapy. He also discussed the need for negativistic individuals to take more of a passive approach in dealing with problems, particularly when issues are somewhat ambiguous in nature. In the current context of rehabilitation, it would seem particularly important for individuals with oppositional coping styles to be involved in individual psychotherapy and/or counseling. This would serve two primary purposes: it would provide the individual an opportunity to work on consistency in interpersonal relationships as well as provide him/her with a sort of ally to assist his/her interactions with the rehabilitation team. As noted earlier, individuals with oppositional coping styles tend to be unpredictable in their interactions with others, alternating between pleasing self and pleasing others. Individual psychotherapy would provide an opportunity to explore their ambivalence (and the consequences thereof) while also providing coping skills training in such areas as assertiveness. Psychotherapy would also provide an outlet for the expression of frustration and anger, such that it can be dealt with in the context of the therapeutic relationship instead of being expressed maladaptively to the rehabilitation team. Finally, problem-solving techniques should be developed in such
patients to encourage reflection prior to action. This would assist them in taking a more passive approach to problems, allowing for time to explore options in responding to issues and gathering all needed information in order to make informed decisions prior to acting. Additional possibilities for improving adherence in oppositional patients entail perception of control. Because oppositional copers feel the need to be in control, the rehabilitation team should consider allowing these patients to have an active role in their treatment planning. Other means of increasing patients’ perceptions of control might include giving them options in scheduling of their therapeutic day or providing choices in specific therapeutic activities.

**Study Limitations**

There are several limitations of the current study. One of the most significant limitations involves the reliance on therapists’ retrospective accounts in rating patients on outcome up to three years post-injury. Attempts were made to produce more accurate ratings by having two therapists rate each patient, and correlational analyses among raters were reasonably adequate at $r = .73$. However, retrospective assessments by individual team members are not ideal due to the decrease in retention of details over time. Future studies should consider incorporation of outcome assessments by the team as a unit at the time of discharge to provide more accurate evaluation. Also, having additional reporting sources (such as family and patients themselves) on which to compare outcome ratings would provide a more thorough evaluation of patient outcome.

Also, the use of only one outcome measure potentially limits the accuracy of
results. Though the MPAI-4 was developed to be a comprehensive measure of brain injury outcome, including additional measures of outcome would provide more reasonable assurance of the validity of patient outcome. Along similar lines, the use of the initial Rancho level as the only measure of injury severity is potentially problematic. Most studies have used other measures of injury severity including length of coma, posttraumatic amnesia, and/or Glasgow Coma Scale scores. Malec and Basford (1996) discuss the difficulty of accurate measurement of initial injury severity based purely on record review or patient/family report and recommend the use of more reliable measures such as loss of brain volume as indicated by computed tomography (CT) scans. Such ideal measures of injury severity were not possible in this study as it retrospectively collected demographic and patient variables from medical charts. Initial Rancho level was believed to best approximate severity of the injury at the time of program entry. None of the other measures listed above were available at the time of data collection.

It is possible that this data may have been confounded by the presence of aphasia, which is fairly common in stroke populations. There were no means to completely screen for the presence of severe aphasic syndromes that might interfere with patient’s valid completion of the personality measure. Speech therapy assessment data was not available during data collection. However, several methods were employed to attempt to screen this data for potentially invalid protocols. The validity indicator on the MBMD is composed of two highly improbable items, and a positive score may indicate inadequate reading abilities, confusion, or random responding. Thus the validity indicator was used to screen for invalid protocols, though this does not
guarantee accurate comprehension of all items by each patient. Additionally as noted earlier, the WRAT-3 was used to screen for 6th grade reading level. The statistical examination of results was then performed with the total sample \((N = 50)\) and again with those showing less than a 6th grade reading level \((N = 44)\) with no significant difference in prediction capabilities observed.

Finally, there may be some limitations in the generalizability of the results due to the composition of the sample. Specifically, this sample was heterogeneous but largely composed of CVA (68%), which was followed by only 14% TBI. Future studies should examine CVA and TBI separately to parcel out any differences accounted for by type of injury. The restricted age range of the sample may also limit generalizability of results. Mean age of the sample was 61.6 years of age \((SD = 15.6)\) with 68 percent of the sample falling within the 46-72-year-old age range. Also, patients in this sample underwent rehabilitation at varying points in time since the onset of their injury. Thus the results of this study are also vulnerable to possible history and maturation effects.

**Directions for Future Research**

Replication of current findings, of course, is always beneficial, particularly as the results of this study depart somewhat from the literature in this area. In addition to replication, it would be interesting to investigate the impact of adherence on patient outcome. Adherence to treatment recommendations has been associated with outcome in other chronic medical diseases and has also been shown to mediate the relationship between personality and outcome in chronic pain patients (Cipher et al., 2007). Thus it
would be interesting to examine the potential relationships between adherence, outcome and personality in a brain-injured sample.

Also, as understanding and prediction of outcome in brain-injury improve, the focus of future research should shift to the investigation of treatment. Specifically, rehabilitation programs should design interventions that take into account personality styles. Researchers would then be able to measure the efficacy of such interventions and maximize patient outcomes. Rehabilitation programs might also be able to streamline treatment and improve cost-effectiveness in an era of increasing patient need and decreasing financial resources.
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