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THE RELATIONSHIP BETWEEN DISPOSITIONAL OPTIMISM AND COGNITIVE, PSYCHIATRIC, AND FUNCTIONAL OUTCOMES FOLLOWING TRAUMATIC BRAIN INJURY

A Thesis in

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ABSTRACT

Despite a vast literature on predictors of outcome and recovery following traumatic brain injury, the way in which personality relates to psychological, cognitive, and functional outcomes remains relatively unknown. The present study focused on how the personality trait of dispositional optimism relates to outcomes post-moderate and severe traumatic brain injury (TBI). Given previous findings linking dispositional optimism with successful behavioral, psychological, and physical outcomes after adverse events, disease, and injuries, the current study aimed to examine the relationships between psychiatric symptoms, cognitive ability, and personality factors in predicting functional outcome following moderate and severe TBI. More specifically, it was expected that dispositional optimism would predict long-term functional outcome following TBI. In order to test these hypotheses, 45 individuals who had sustained moderate to severe TBI were recruited through mailings of flyers and letters. Volunteers that chose to be in the study participated in a telephone interview to complete self-report measures on current optimism, psychological distress, cognitive ability, and functional independence levels. Data analyses indicated that dispositional optimism was significantly correlated with psychiatric, cognitive, and functional outcomes, but that it did not account for unique variance in functional outcome. In addition, a significant mediating relationship was demonstrated showing cognitive ability as a mediator for the relationship between psychological distress and functional outcome. Furthermore, the data indicate that dispositional optimism predicts psychological distress, rather than functional outcome. These findings illustrate that higher levels of dispositional optimism in individuals sustaining moderate to severe TBI is related to better psychological, cognitive, and functional outcomes and that this personality trait may be a useful predictor of psychological distress following TBI.

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Chapter 1
INTRODUCTION

One contribution by the field of "positive psychology" is the study of individual differences in "optimism" and perceptions of wellness to better understand their implications on physical and mental health (Seligman, 2002). Optimism is a primary focus of the current study and refers to an individual's expectation of a positive outcome in most situations (Scheier & Carver, 1985). Research in positive psychology has found associations between high levels of optimism with better health and coping strategies, while despair, depression, and hopelessness have been found to be related with illness and death in the general population (Schweizer, Beck-Seyffer, & Schneider, 1999; Seligman, 1975; Taylor, 1991). Little work in this area has been extended to individuals with neurological disorders, where cognitive, emotional, and perceptual processes may have been altered due to injury or disease. This study aimed to extend our understanding of the role of personality factors such as dispositional optimism, on clinical symptoms and outcome following traumatic brain injury (TBI).

Traumatic Brain Injury

In the United States, the approximate incidence of TBI is 2 million per year, with 80,000 of these individuals suffering from some level of chronic disability as a consequence of their injury (Frankowski, 1986; Moscato, Trevisan, & Willer, 1994). The consequences of TBI involve physical disability, emotional disturbances, cognitive impairments, and behavioral problems (Arango-Lasprilla, Rosenthal, Deluca, Komaroff, Sherer, Cifu, & Hanks, 2007; Hellawell, Taylor, & Pentland, 1999; Rao & Lyketsos, 2000; Rassovsky et al., 2006; Vogenthaler, 1987). In addition, many individuals also experience difficulties with psychosocial

and occupational adjustment after their injury (Cifu, Keyser-Marcus, Lopez, Wehman, Kreutzer, Englander, & High, 1997; Oddy, 1984; Ponsford, Oliver, Curran, & Ng, 1995).

In TBI, frontal and temporal injuries predominate, commonly leading to memory deficits, executive dysfunction, motor disabilities, difficulty with information processing, and problems with personality and temperament changes (for review see Bigler, 2001). Due to the frequency of TBI and its long-term effects, research efforts are needed to identify the most effective techniques to treat chronic disabilities (Whyte & Rosenthal, 1993). The consequences of TBI and recovery following injury are often dependent on the location and mechanism of brain injury, pathophysiology, and injury severity.

Mechanisms of Injury in TBI and Pathophysiology

Motor vehicle accidents are the leading cause of TBI in the general population, especially among whites in the United States, accounting for about 50% of all TBIs (Drubach, Kelly, Winslow, & Flynn, 1993; Masson, Thicoipe, Aye, Mokni, Senjean, Schmitt, Dessalles, Cazaugade, & Labadens, 2001; Polen, 1988; Ragnarsson, 2002; Thurman, Alverson, Dunn, Guerrer, & Sniezek, 1999). Falls are the second leading cause of TBI, accounting for 20-30% of all injuries. For individuals aged 75 years or older, falls are the most common cause of TBI. Firearms are the third leading cause of TBI (12% of all TBIs) and are the leading cause of TBI among individuals aged 25-34 years. Gunshot-related, fatal TBIs are higher among men than among women and are more prevalent among African Americans than they are among whites (Langlois, Rutland-Brown, & Thomas, 2006; NIH Consensus Statement, 1999). In addition to these mechanisms, alcohol plays a critical role in TBI; research indicates that alcohol intoxication is present approximately 50% of the time in patients treated for TBI (Brismar,

Engstrom, & Rydberg, 1983; Edna, 1982; Gurney, Rivara, Mueller, Newell, Copass, & Jurkovich, 1992; Zink, 1993)

The types of head injury and progression of the injury are classified by two different stages of pathophysiology: primary and secondary injury. Primary injuries can manifest as focal injuries (e.g., skull fractures, intracranial hematomas, lacerations, contusions, penetrating wounds), or they can be diffuse (as in diffuse axonal injury). Diffuse axonal injury is characterized by extensive, generalized damage to the white matter of the brain (Adams, Doyle, Ford, Gennarelli, Graham, & McLellan, 1989; Smith & Meaney, 2000). Neuropathological and neuroimaging studies in the TBI literature show that diffuse damage is the most common consequence of TBI (Bigler, 2001). Ultimately, primary injuries show significantly less response to therapeutic interventions.

Secondary brain injury (secondary damage, delayed non-mechanical damage) is the consequence of a cascade of pathological processes initiated at the moment of injury (Werner & Englehard, 2007). This cascade can include metabolic processes, such as uncontrollable intracranial hypertension or uncontrolled release of excitatory amino acids. In addition, under the force and rapid deformation associated with brain trauma, axons, which tend to be supple, can become brittle (Smith, Meaney, & Shull, 2003). The consequence of this is focal axonal swelling and disconnection of the axons, leading to permanent damage. Interventions designed to treat secondary injuries targets the cascade of events that follow TBI in order to prevent brain tissue from undergoing further damage (Christman, Grady, Walker, Holloway, & Povilshock, 1994; Povlishock, 1995).

The mechanism of injury and pathophysiology associated with TBI are important to understand when examining outcome due to the fact that prognosis may be differentially

influenced by the source and type of brain lesion. In addition to these predictors, injury severity is another commonly used predictor of outcome following TBI. The following section reviews injury severity measurement and the use of injury severity variables to predict the cognitive and functional consequences of TBI.

Injury Severity and Outcome Prediction

There are a wide range of factors determining injury severity and much of the early clinical work in TBI was organized around attempting to characterize injury severity. One of the most widely used measures of injury severity is the Glasgow Coma Scale (GCS) (Teasdale & Jannet, 1974). The GCS characterizes the severity of brain injury by examining eye opening, motor responsiveness, and verbal responsiveness. The severity of the injury is then deduced by the total number of points an individual receives in the three areas combined with a severe TBI having a score range of 3-8, moderate TBI: 9-12, and mild TBI: 13-15. Numerous studies have now used the initial GCS score to predict cognition (Goldstein & Levin, 2001; Hoofien, Vakil, Gilboa, Donovick, & Barak, 2002; Shores, 1989), later vocational status (Fleming, Tooth, Hassell, & Chan, 1999; Ponsford, Olver, & Curran, 1995; Stambrook, Moore, Peters, Deviaene, & Hawryluk, 1990) and functional outcome (King, Carlier, & Marion, 2005; Sherer, Struchen, Yablon, Wang, & Nick, 2008; Udekwu, Kromhout-Schiro, Vaslef, Baker, & Oller, 2004; Zafonte, Hammond, Mann, Wood, Black, & Millis, 1996).

Another widely used measure of injury severity in TBI is duration of posttraumatic amnesia (PTA). PTA is a period of time immediately following TBI in which the individual is in an acute state of confusion and disorientation (Levin, O'Donnell, & Grossman, 1979; Wilson, Evans, Emslie, Balleny, Watson, & Baddeley, 1999). Individuals in PTA are unable to remember

events that occur after their injury, and PTA is considered to have resolved when continuous memory returns. PTA has been used to predict later cognitive functioning, vocational and social outcomes, and functional status (Brown, Malec, McClelland, Diehl, Englander, & Cifu, 2005; McCullagh, Oucherlong, Protzner, Blair, & Feinstein, 2001; Van der Naalt, Van Zomeren, Sluiter, & Minderhoud, 1999; Zafonte, Mann, Millis, Black, Wood, & Hammond, 1997).

Understanding outcomes and prediction of outcomes following TBI is important to help guide treatment decisions following injury and to gain insight into pathophysiology of TBI. Injury severity measures are a valuable part in the initial assessment of TBI and help in predicting possible deficits that can occur following injury. An area of outcome prediction that is not well researched within the TBI population is the influence of personality traits on outcomes following the injury. Positive personality traits, such as dispositional optimism, could help buffer the detrimental consequences of TBI, and may also prove to be a useful predictor of cognitive, psychiatric and functional outcomes after TBI

Common Sequelae Following TBI

The consequences of TBI can include a variety of symptoms. Among these are physical impairments, such as headaches, fatigue, blurred vision, dizziness, and loss of hearing (Dikmen, McLean, & Temkin, 1989). Some other prevalent outcomes from TBI include changes in cognitive, behavioral, psychological and emotional functioning (Hibbard, 1998).

There is a vast literature examining the various consequences of TBI, though there tends to be a lack of integration of these literatures. The following sections will provide a brief overview of the research documenting some of the aforementioned deficits associated with TBI,

specifically the areas of cognitive and psychiatric symptoms and their association with overall functional outcome.

Cognitive Dysfunction in TBI

Much of the literature examining the consequences of TBI has focused on cognition and there is a very well established literature examining cognitive dysfunction following TBI dating back to the 1950s (Hans-Lukas, Semmes, Weinstein, & Ghent, 1954; Meyer & Jones, 1957; Spalding & Zangwill, 1950). The cognitive impairments associated with TBI have been well documented, with deficits in the areas of arousal, attention, concentration, memory, and language. TBI affects a wide range of cognitive abilities and is one of the most common causes of executive dysfunction (Levine, Robertson, Clare, Carter, Hong, Wilson, Duncan, & Stuss, 2000) due to the fact that a high percentage of individuals with TBI sustain damage to the frontal lobes (Fortin, Godbout, & Braun, 2003; McAllister & Arciniegas, 2002). More specifically, these impairments involve, reduced processing speed, decreased learning abilities, impaired planning abilities, and inability to think flexibly or abstractly (Brown & Gordon, 1999; Lezak, Howieson, & Loring, 2004; Whyte et al., 1993). These executive functions, which are important to everyday independent functioning, can be significantly impaired in the TBI population, causing long-term consequences.

The long-term cognitive outcomes after TBI have remained poorly understood due to limited number of years during follow-up studies. Himanen, Portin, Isoniemi, Helenius, Kurki, & Tenovuo (2006) conducted a 30-year follow up study and demonstrated that cognitive functioning is still chronically compromised in individuals surviving from TBI. What remains

unclear in the literature is whether there are systematic influences of personality and demographic factors on long term outcome.

In predicting cognitive outcome, a number of variables have been found to be correlated with cognitive functioning post-injury. Some of these variables include injury severity (PTA and GCS), pre-injury socioeconomic status (Hoofien, Vakil, Gilboa, Donovick & Barak, 2002), and individual therapy and rehabilitation (Cicerone, Dahlberg, Malec, Langenbahn, Felicetti, Kneipp, Ellmo, Kalmar, Giacino, Harley, Laatsch, Morse, & Catanese, 2006; Cifu, Kreutzer, Kolakowsky-Hayner, Marwitz & Englander, 2003). In addition, demographic variables such as advancing age and minority status have been shown to correlate with poorer cognitive outcomes following TBI (Dikmen, Machamer, Temkin, & Mclean, 1990; Hellawell, Taylor, & Pentlan, 1999; Lannoo, Colardyns, Jannes, & De Soete, 2001, Levin, 1995; Millis, Rosenthal, & Novack, 2001; Novack, Bush, Meythaler, & Canupp; Wong, Monette, & Weiner, 2001; Sherer, Stouter, Hart, et al. 2006). Education level and premorbid aptitude has also been linked to cognitive outcome following TBI (Hanks, Rapport, Millis, & Deshpande, 1999; Kesler, Adams, Blasey, & Bigler, 2000; Novack, Bush, Meyhaler, & Canupp, 2001; Satz, 1993). Improving the understanding of factors that predict cognitive outcomes is of importance, because these factors can aid in informing successful rehabilitation techniques and help improve the recovery process following TBI.

More work is needed in order to examine how personality traits can influence outcomes from TBI, specifically in regards to the possible associations between personality traits and overall cognitive ability following TBI (Leeson, Ciarrochi, & Heaven, 2008). Thus, this study seeks to examine whether positive personality traits translate into better overall cognitive, emotional, and functional outcome after TBI. Though there is a well established literature on

predictors of cognitive outcomes following TBI, there is little research documenting how other factors, including personality traits, influence outcome from brain injury. Given the high incidence of cognitive problems following TBI, and the fact that these problems are highly variable during acute and chronic stages of recovery (Millis et al., 2001), it is critical that other variables determining outcome be examined and integrated to better inform clinical intervention and outcome prediction.

Psychiatric Symptomatology Following TBI

Among the most disabling sequelae of TBI are psychiatric features that occur as a direct consequence of or are exacerbated by the injury. Individuals sustaining TBI have a higher prevalence of psychiatric symptoms compared to the general population (Rogers & Read, 2007). Following TBI, common psychiatric consequences include: major depression (25%), mania (9%), anxiety disorders (11%-70%), psychosis (.7%-9.8%), apathy (10%-60%), and behavioral dyscontrol disorder (5%-70%) (Rao et al., 2000). Somatic symptoms, which may be difficult to dissociate from the consequences of injury, are also observed, including headache, nausea, vertigo, insomnia, fatigue, and dyscoordination. There are few studies in the literature documenting the long-term psychiatric consequences following TBI including detailed descriptions of psychiatric syndromes. Epidemiological research in TBI outcome demonstrates that the incidence of psychiatric disorders following TBI is at approximately 50% (Fann, Burington, Leonetti, Jaffe, Katon, & Thompson, 2004; Koponen, Taiminen, Portin, Himanen, Isoniemi, Heinonen, Hinkka, & Tenovuo, 2002; Silver, Kramer, Greenwalk, & Weissman, 2001).

The longest descriptive follow-up study that has been done to examine the prevalence of psychiatric and personality disturbances was conducted by Koponen and colleagues (2002). The data showed that individuals sustaining TBI were more likely to exhibit depressive episodes, delusional symptoms, and changes in personality.

Even so, the relationship between neurological injury and psychiatric disturbance remains poorly understood. For example, the most common measure in outcome prediction, injury severity, has failed to show a strong association with psychiatric symptomatology after TBI (Fleminger & Ponsford, 2005). Moreover, the precursors to developing psychiatric problems after TBI are unknown. Of note, Curran, Ponsford, & Crowe, (2000) found psychiatric symptoms occurring more often in those with a non-productive coping style (self-blame, avoidance) in comparison to individuals that used active coping strategies. This is of considerable importance to the current proposal, which will examine if personality factors influence outcome after TBI.

In order to gain a better understanding of long-term psychiatric symptoms present following TBI, this study examines a range of psychiatric symptoms including somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. In addition, this study seeks to examine the association of the positive personality trait of dispositional optimism with the psychiatric consequences of TBI.

Long-Term Functional Outcomes in TBI

In general, much of the research examining TBI focuses on acute and post-acute stages of recovery, and there is less research documenting the long-term functional consequences of injury. Significant recovery from TBI usually occurs during the first year following injury and

therefore, much research has been dedicated to understanding recovery processes during this time period (Millis, Rosenthal, Novack, Sherer, Nick, Kreutzer, High, & Ricker, 2001). The long-term outcomes following TBI have proven to be an important area of study due to the high prevalence and chronicity of disability post-injury. The most recent follow-up study by Wood (2008) examined approximately 3000 serious head-trauma cases and found that 52% of the individuals were moderately to severely disabled at approximately 1-year post injury. These findings indicate that for many individuals, head trauma results in significant reduction in independent functioning after the injury.

Functional limitations are the most significant consequences of TBI and can include problems with independence in self care, social integration, employment, and family burden. Dikmen, Machamer, Powell and Temkin (2003) examined functional outcomes 3 to 5 years after moderate to severe TBI finding that TBI resulted in impairments in multiple life domains including: 1. the inability to work or attend school (30%), 2. difficulties performing responsibilities at work, 3. a reduction in the number friends and/or less contact with family and friends (25%), and complete dependence on caregiver in an institutional setting to accomplish daily tasks (10%).

TBI often occurs during young adulthood and therefore the consequences of the injury can have a significant impact on the capacity for independent living, relationships, leisure activities, and employment later in life (Olver, Ponsford, & Curran, 1996). Outcomes following TBI are highly variable and therefore much research has focused on identifying factors predicting or indicating functional outcome. Studies examining functional outcomes up to 3 years post injury have found that outcome may be influenced by injury severity (as previously mentioned), demographic factors, including age, gender, and preinjury education and

employment, as well as post injury cognitive and social factors (Brown et al., 2005; Cattelani, Tanzi, Lombardi, & Mazzuchi, 2002; Dikmen et al., 1995; Fleming, Tooth, Hassell, & Chan, 1999; Godfrey, Bishara, Partridge, & Knight, 1993; Levin et al., 1990; Pastorek, Hannay, Contant, 2004; Rothweiler, Temkin, Dikmen, 1998). Other researchers have corroborated these findings, showing that higher preinjury education is associated with better long-term functional outcomes in employment, social functioning, and community integration (Dawson & Chipman, 1995; Hoofien et al., 2002; Wood & Rutterford, 2006). Tate, Broe, Cameron, Hodgkinson, & Soo (2005) also found that more skilled preinjury employment was associated with better outcome in living skills, relationships, and employment.

The causes for functional disability are multi-factorial, as reviewed above. Within the literature documenting long-term outcomes following TBI, there are few studies that examine cognitive functioning and psychiatric outcomes 10 years or more post injury. In addition, few studies have looked at the relationship of these factors on functional outcome (Ponsford, Draper, and Schönberger, 2008). For example, researchers Tate et al. (2005) and Hoffien et al. (2002) examined long-term outcomes from TBI, but never studied cognitive, psychiatric, and functional outcomes in relation to each other.

Important recent research by Ponsford et al. (2008) measured long-term functional outcome in relationship to current cognitive functioning and psychiatric state. The findings indicated that participants with poorer functional outcome also performed poorly on cognitive measures of information processing speed, attention, memory, and executive function and also showed higher levels of anxiety. As this research indicates, functional outcome following TBI is affected by other common disabling consequences of TBI, such as cognitive deficits and psychiatric outcome. The consequences of TBI tend to be comorbid with one another, and

individuals must cope with the combined burden of cognitive, psychiatric, and functional problems following the injury. Given the high incidence of these consequences, it is useful to improve the understanding of the relationships between these outcomes, specifically with regard to how the common cognitive and psychiatric sequelae of TBI influences later functional outcome.

The consequences of TBI have a profound influence on everyday functioning and independent living. As previously noted, the literature examining TBI has documented significant physical, psychological, and cognitive consequences, but studies examining long-term outcomes tend to be limited by small sample sizes, lack of diversity within the population studied, and a substantial loss of subjects in follow-up. There is need for continued work examining the long-term outcomes in individuals sustaining TBI in order to determine the combination of factors that contribute to patient outcome.

Positive Psychology

Positive psychology examines the areas of subjective well-being, positive individual traits, and positive institutions (Volz, 2000). There is also a focus in positive psychology on the techniques that operate to improve functioning in these areas in order to improve overall health. Positive psychological processes such as optimism and personal control have been shown to serve as a buffer against stressors and maintain psychological and physical health (Taylor, Kemeny, Reed, Bower, & Gruenwald, 2000). Characterizing these "positive" factors that instantiate resiliency provides the opportunity to identify circumstances and characteristics that contribute to resiliency and wellness (Gable & Haidt, 2005).

There is evidence that having a positive personality influences health and recovery from injury and disease across a spectrum of medical disorders (Affleck et al., 2001; Arehart-Treichel, 2006; Ironson et al., 2008; Peterson, Park, & Seligman, 2006; Taylor et al., 2000). What has not been investigated, to date, is the role of positive personality factors in the recovery of cognitive, psychiatric, and functional ability in individuals that have sustained TBI.

Dispositional Optimism

Dispositional optimism is a personality factor referring to generalized positive expectancies that one maintains and these expectancies are believed to lead to good outcomes in most situations. Research has shown that adhering to an optimistic view on life is advantageous to quality of life (de Moor, de Moor, Basen-Engquist, Kudelka, Bevers, & Cohen, 2006; Kung, Rummans, Colligan, Clark, Sloan, Novotny, & Huntington, 2006) and is negatively related to psychosocial distress (Stanton & Snider, 1993).

Optimists have been shown to confront medical, psychological, and physical adversity with successful outcomes in patient populations, such as those diagnosed with epilepsy (Pais-Ribeiro, Martins da Silva, Meneses, & Falco, 2007), breast cancer (Schou, Ekeberg, & Ruland, 2005), postpartum depression (Carver & Gaines, 1987), and spinal cord injury (Gibb, 2004). In addition, Affleck et al. (2001) found that higher levels of dispositional optimism helps one to cope with many medical ailments, such as coronary artery bypass surgery, bone marrow transplantation, arthritis, HIV-positive status, and cancer. Various researchers have corroborated the aforementioned findings that dispositional optimism can play a vital role in behavioral, psychological, and physical outcomes after adverse events (Marshall, Wortman, Kusalas, Hervig, & Vickers, 1992; Taylor, Kemeny, Aspinwall, Schneider, Rodriquez, & Herbert, 1992; Scheier,

Carver, & Bridges, 1994; Scheier, Magovern, Abbott, Owens, Matthews, Lefebvre, & Carver, 1989; Segerstrom, Taylor, Kemeny & Fahey, 1998).

These findings have not yet been established within the TBI population, and the potential benefits of dispositional optimism on the long-term consequences of TBI are unknown. The only work to date examining dispositional optimism within a TBI population examines how it relates to quality of life (Tomberg, Toomela, Pulver' & Tikk, 2005) and depression (Peleg, Barak, Harel, Rochberg, & Hoofien, 2009) following injury. Dispositional optimism has been shown to be predictive of many improved outcomes in a number of medical disorders, but the influence of this temperament on cognitive, psychiatric, and functional outcomes in a group of patients with TBI, remains undetermined. This study examines the associations between dispositional optimism and long-term outcomes following TBI.

Coping Strategies of Optimists

Researchers have credited dispositional optimists' successful outcomes in the face of adversity to their coping strategies. According to Seligman's theory of explanatory style, optimists and pessimists differ in the way in which they explain the causes of events. This then influences how they react, perceive, or are affected by external events (Abramson, Seligman, & Teasdale, 1978).

Lazarus et al. (1981 and 1984) described two different coping strategies that people use in stressful situations; these were problem-focused and emotion-focused coping. Problem-focused involves dealing with the source of stress, and uses action to remove the threat. By doing so, one can move forward to attain the goals that a stressor was interfering with. Emotion-focused coping is the attempt to eliminate emotional distress that is associated with a stressful

situation. Generally, emotion-focused coping occurs more when a person believes that a situation must be endured. For example, one might use denial, avoidance, or even rethink the situation in a more positive light, though nothing is ever actively done to change the situation.

Problem-focused coping is more likely in situations when one believes to see a positive change in a situation. The emotion-focused strategy, of positively reinterpreting a situation, could be used initially but then the next step (whether one endures the situation or actively tries to change it) is important when distinguishing the optimist from the pessimist. A pessimist is more likely to use the emotion-focused strategies of denial, avoidance, or escape in stressful situations while an optimist would rethink the problem or situation in a more positive way, and therefore would be more likely to make a change or solve the problem through active coping efforts, knowing that a positive outcome will be the result (Scheier, Weintraub, & Carver, 1986). Therefore, dispositional optimists should use problem-focused coping. This is supported by prior research demonstrating that favorable expectancies help in continuing or renewing active efforts to attain goals (Scheier & Carver, 1985).

Due to their problem-focused strategies, dispositional optimists cope more effectively with life stressors, such as managing life transitions (Taylor, et al. 1992); dealing with a serious disease (Friedman, Nelson, Baer, Lane, Smith, & Dworkin, 1992), and handling the worry of specific health threats (Stanton & Snider, 1993). Several researchers have found that the problem-focused coping used by dispositional optimists helps in reducing mood disturbances in response to stressors and also decreases feelings of defeat, shame, depression, and anger (Aspinwall & Taylor, 1992; Carver, Pozo, Harris, Noriega, Scheier, Robinson, Ketcham, Moffat, & Cark,1993; Scheier & Carver, 1985; Scheier, Weintraub, & Carver, 1986; Stanton & Snider, 1993; Taylor et al., 1992). Avoidance coping and denial are both associated with worse immune

status in healthy and clinical samples, and therefore the physical benefits that dispositional optimists seem to reap could be due to the lack of detrimental coping strategies (Futterman, Willisch, Zighelboim, Luna-Raines, & Weiner, 1996; Goodkin, Fuchs, Feaster, Leeka, & Rishel, 1992; Segerstrom et al., 1998).

Individuals sustaining TBI that are more optimistic may cope more efficiently with the consequences of their injury. The literature examined here indicates the importance in determining whether dispositional optimism influences long-term outcomes from TBI and also if it is beneficial during the recovery process. If so, individuals recovering from the injury could benefit by learning different coping strategies in order to better manage and reduce the long-term psychiatric, cognitive, and functional outcomes from TBI.

Aims for the Current Study

A primary goal of this study is to examine the relationships between cognitive status, psychiatric symptoms, demographic variables, and personality factors in predicting outcome following moderate and severe TBI. Of specific interest is determining the influence of the dispositional optimism on long-term functional outcome in TBI. Dispositional optimism may influence the psychiatric sequelae, cognitive difficulties, and functional limitations from TBI. The integration of the literatures of the consequences of TBI, such as the development of psychiatric symptomatology, cognitive dysfunction, and functional disabilities, are not well established and are important to understand to better the treatment and long-term recovery of these survivors.

By examining long-term outcome factors and dispositional optimism, the hypotheses for this study are:

Hypothesis 1: Demographic factors and GCS will influence the range of scores in dispositional optimism

Hypothesis 2: It is anticipated that psychiatric and cognitive will correlate and predict unique variance in functional outcome status.

Hypothesis 3: It is expected that higher levels of dispositional optimism will predict fewer psychiatric symptoms and higher cognitive ability post injury.

Hypothesis 4: It is anticipated that dispositional optimism will contribute unique variance for predicting overall functional outcome compared to cognitive ability, psychiatric functioning, and demographic and clinical variables.

Chapter 2

METHOD

Participants

Forty-five individuals were involved in this study, including 25 males and 20 females, 5 of whom identified their ethnicity as African-American and 1 as Asian. Subjects were either former patients treated for TBI at Hershey Medical Center (HMC) or individuals participating in current research studies in the Hillary Laboratory that were previously screened, confirmed to have TBIs, and consented to participate in future studies. Individuals recruited from HMC had a verifiable TBI documented by CT/MRI and all subjects had a GCS score of 12 or lower, indicating moderate to severe injury (mean = 5.65, SD = 3.20). The subjects involved in this research were at least 18 years of age at the time of study, and the mean age for the sample was 34.10 (SD = 12.51). The number of years from the injury to the current follow-up study for the subjects ranged from approximately 1 year to 22 years post injury, with a mean of 7 years (SD = 6.92).

Study Design and Materials

The current study used two methods to recruit subjects for prospective data collection within a TBI population.

1. Recruitment of Study Participants

The first method of recruitment involved a retrospective review of medical charts of former TBI patients listed in the Hershey Medical Center Trauma Database from the departments of Neurology, Neurosurgery, and the Division of Trauma Surgery with ICD-9 codes consistent with TBI. The patient's name and address from the medical charts were used to mail recruitment

letters and flyers about the study, if the individual met the inclusionary and exclusionary criteria for the study.

A second method of subject recruitment involved contacting individuals that were involved in previous TBI research studies in the Hillary Laboratory. These individuals had already given consent to be contacted for future studies, and therefore were called and informed of the opportunity to participate in the current study.

Exclusionary and inclusionary criteria:

Recruitment letters and flyers were mailed to individuals who had sustained TBI, had mailing addresses listed in their medical charts, were over 18 years of age at the time of the mailing, and had a verifiable TBI documented by CT/MRI. All individuals had a GCS score of 12 or lower. Thorough medical chart review was used to rule out significant psychiatric history such as schizophrenia or bipolar disorder and neurological disorders such as epilepsy or cerebrovascular accident. A disproportionate amount of mailings were sent to individuals of ethnic minority status. The mailing process was funded, in part, by a grant from the PSU Graduate School through the psychology department's participation in the PhD Completion Project.

2. Mailings

All individuals that met the exclusionary/inclusionary criteria were initially sent a letter that explained why they were being contacted and introducing them to the goals of the research. Along with the letter was a flyer describing the current study and contained information for interested participants to call a specified number or send an email, if they would want to participate in the research study.

Following this mailing, if an interested subject contacted the laboratory, a "Study Package" was mailed to them. The "Study Package" contained the following:

1. Several surveys/inventories (described below) were enclosed in the Study Package. These materials were completed during a follow-up phone interview after the time of initial patient-to-study coordinator contact.
2. A "Subject Payment Receipt" was included for the participant to sign and mail back in order to receive $30 compensation.
3. A pre-addressed and pre-stamped envelope was included and upon completion all subjects mailed back their self-report questionnaires.

A phone interview, described below, was conducted after the subject received the "Study Package" in order to facilitate contact with individuals living in rural communities, as well as those that may not have access to the medical community, or lack reliable transportation.

Procedure

Prospective Follow-Up Phone Interview

As described above, all interested participants were sent a "Study Package". When initial contact was made, the participant and research coordinator agreed on a time to complete the phone interview. During the phone interview, the interviewer first reviewed a Summary Explanation of Research form and obtained verbal consent to participate before beginning the study. Following consent, the interviewer followed a phone script and facilitated the completion

of the self report measures. The participant completed two self report measures independently with the phone interviewer on the line, and the remaining two questionnaires were administered by the phone interviewer. These questionnaires included:

--The Life Orientation Test-Revised - (Self-administered by participant)

--The Symptom Checklist Questionnaire-90, Revised - (Self-administered by participant)

--The Craig Handicap Assessment Reporting Technique, Short Form - (Administered over the phone by the interviewer)

-- The Telephone Interview for Cognitive Status - (Administered over the phone by the interviewer)

(See *Measures* below for more detailed descriptions)

After completion of these surveys, the interviewer instructed the participant to place each one in a pre-stamped envelope. Participants were informed that their participation would be reimbursed with thirty dollars upon receipt of their completed questionnaires and Subject Payment Receipt.

Measures and Variables

The Life Orientation Test-Revised (LOT-R)

The Life Orientation Test (LOT) is a brief self-report measure of dispositional optimism created by Scheier and Carver (1985). It contains 4-positive expectancy items (e.g., I always look on the bright side of things), 4-negative expectancy items (e.g., I rarely count on good things happening to me), and also 4 filler items. Respondents indicate level of agreement with each item on a 5-point scale with a range from *strongly agree* (1) and *strongly disagree* (5). When scoring the LOT, a high score is interpreted as optimistic (highest possible score is 24) and a low score as pessimistic. The test has acceptable psychometric and discriminate validity properties in relation

to related concepts of locus of control, hope, extraversion, and self-efficacy. Cronbach's alpha for this test is reported to be .73-.81. The LOT-Revised (Scheier, Carver, & Bridges, 1994) was used for the current study. It provides a continuous distribution of scores, therefore people range from very optimistic to very pessimistic.

The variable "Dispositional Optimism" is composed of the total score obtained from the LOT-R questionnaire.

The Symptom Checklist Questionnaire-90 (SCL-90)

The Symptom Checklist Questionnaire (SCL-90) provides an overview of a patient's symptoms and their intensity at a specific point in time. The self-report questionnaire includes 90 items that are scored on a five-point Likert scale. The scales included in the questionnaire are somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The SCL-90 has been shown to have a good reliability and also has high internal consistency. Cronbach's alpha is reported to be .78-.90 (Holi, 2003).

The variable "Psychological Distress" is composed of the Positive Symptom Distress Index on the SCL-90.

Craig Handicap Assessment and Reporting Technique (CHART)-Short Form

The Craig Handicap Assessment and Reporting Technique (CHART) is a multidimensional outcome instrument that measures the degree to which impairments and

disabilities result in handicaps in 6 domains: 1) Physical Independence: ability to sustain a customarily effective independent existence; 2) Mobility: ability to move about effectively in one's surroundings; 3) Occupation: ability to occupy time in the manner customary to that person's sex, age, and culture; 4) Social Integration: ability to participate in and maintain customary social relationships; 5) Economic Self-Sufficiency: ability to sustain customary socio-economic activity and independence and 6) Cognitive Independence. The highest score for each of the 6 domains measured is 100, indicating no handicap or functional limitation. The CHART is one of the official outcome measures of the TBI model systems research databank and is widely used for individuals with spinal cord injury as well. The instrument was designed to be administered by interview, either in person or by telephone and the short-form, used in the current study, takes approximately 15 minutes to administer. Reliability and validity studies have found that the measure has a test-retest reliability coefficient between .80 and .95 (Whiteneck et al., 1992).

The variable of "Functional Outcome" was determined using the sum of the total overall scores obtained from each functional domain assessed in the CHART.

The Telephone Interview for Cognitive Status (TICS)

The Telephone Interview for Cognitive Status (TICS) is a useful screening measure for individuals at risk for cognitive deficits, and avoids the difficulty of trying to conduct an in-person interview. The TICS correlates very highly with the Mini Mental Status Examination (a similar measure of cognitive ability, though administered through an in-person interview) and it

is also able to discriminate mildly demented Alzheimer's disease patients from healthy controls. The TICS consists of 12 items, with a total possible score of 51 (Brandt, Spencer, and Folstein, 1988; Plassman, Newman, Welsh, Helms, & Breitner, 1994).

The variable of "Cognitive Ability" was determined by the total score obtained from the TICS.

Hollingshead Index of Social Position (ISP)

Socioeconomic Status (SES) was initially determined by overall household income, which was asked for during the telephone assessment for functional outcome. Several individuals involved in this study preferred not to answer this question. Therefore, in order to have an approximate level of SES for all individuals in the study, the Hollingshead Index of Social Position (ISP) was utilized to estimate SES based upon the individual's occupation status and education level. More specifically, the ISP gives a score for various occupation categories (i.e. business managers, clerical workers, machine operators, etc.) as well as a score depending on education level. The ISP was then calculated using the following equation: (Occupation score x 7) + (Education score x 4) = ISP (Hollingshead, 1975).

The variable of "SES" was determined by the ISP score.

Chapter 3

RESULTS

Recruitment of Ethnic Minorities

Although this study aimed to recruit individuals of ethnic minority status, only 11% of individuals in the study were from ethnic minority groups. A total of 224 mailings were sent to individuals meeting criteria for the current study. Approximately 55% of these mailings were sent to individuals of minority status and 45% were sent to individuals identified as "Caucasian" in medical records. Forty-four mailings were returned, and taking this number into account, the mailings from the current study had a 15% response rate. Though the majority of mailings were sent to individuals of ethnic minority status, individuals that responded to mailings were primarily not from ethnic minority groups (70%). Therefore, ethnicity was not entered as a demographic variable in the statistical analyses.

Testing Hypothesis 1: Predicting Levels of Dispositional Optimism

The scores on the Life Orientation Tests-Revised (LOT-R) ranged from a 2 to 24, with a mean optimism score of 13.51 (SD = 5.50) in the TBI sample. For males and females specifically the mean optimism scores were 12.92 (SD = 5.75) and 14.41 (SD = 5.22), respectively. In the sample that the LOT-R was standardized on (2,055 college students), the mean optimism score was 14.28 (SD = 4.33) for males and 14.42 (SD = 4.28) for females (Scheier, Carver, & Bridges, 1994). Scores on the LOT-R within the current TBI sample did not differ significantly from the standardized sample.

Hierarchical regression was used to examine the influence of demographic and clinical variables on the range of scores in dispositional optimism. The first step included demographic factors (social position, gender, years of education) and the second step included GCS, days

since injury, and age at injury as clinical variables. When tested, the first step was not significant. However, step 2 demonstrated a significant main effect of clinical factors on dispositional optimism, with GCS and days since injury accounting for the variance in the model. See Table 1.

Table 1.

Hierarchical Regression predicting Dispositional Optimism from Demographic and Clinical Variables

	Step 1			Step 2		
Variables	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
Demographic						
SES	.020	.087	.050	.042	.076	.105
Gender	.585	2.571	.049	1.940	2.290	.163
Years of Education	1.592	.786	.472	1.165	.675	.354
Clinical						
GCS				.612	.329	.339 *
Days Since Injury				.001	.001	.294 *
Age at Injury				.165	.102	.311
R^2		.228			.432	
F for ΔR^2		2.628			3.392 *	

* $p < .05$. ** $p < .01$.

Testing Hypothesis 2: Associations between Psychological Distress, Cognitive Ability, and Functional Outcome.

Cognitive ability and psychological distress were significantly correlated (r (44) = -.541, *p < .001).* Partial correlations were used to test whether psychological distress and cognitive ability predicted unique variance in functional outcome. The correlation between cognitive ability and functional outcome, when controlling for psychological distress, was significant (r

(39) = .338, $p < .038$). The partial correlation between psychological distress and functional outcome, controlling for cognitive ability, was not significant (r (39) = -.114, $p < .495$). Though psychological distress and cognitive ability were significantly negatively correlated, only cognitive ability was significantly correlated with functional outcome when psychological distress was controlled for. Due to this finding, a post-hoc mediation analysis was conducted to test whether cognitive ability mediates the relationship between psychological distress and functional outcome. See *Post-Hoc Analyses* below.

Testing Hypothesis 3: Dispositional Optimism as a predictor of Psychological Distress, Cognitive Ability, and Functional Outcome.

For testing the third hypothesis, multivariate correlations were used in order to determine whether increased levels of optimism were associated with decreased psychological distress and higher cognitive ability post injury. Results revealed that optimism was significantly negatively correlated with psychological distress (r (44) = -.555, $p < .001$). In addition, higher levels of optimism were correlated with cognitive ability (r (44) = .343, $p < .023$). Optimism was also significantly correlated with functional outcome (r (39) = .343, $p < .032$). See Table 2.

Table 2.

Correlations between Variables Used in Analyses

Measure	1	2	3	4	5	6
1. Optimism	--					
2. Cognitive Ability	.34 *	--				
3. Functional Outcome	.34 *	.45 **	--			
4. Psych. Distress	-.56 *	-.54 **	-.33 *	--		
5. Years of Education	.20	.47 **	.38 *	-.39 *	--	
6. GCS	.37 *	.23	.54 **	-.16	.23	--

* $p < .05$, ** $p < .01$.

Variables deleted from matrix due to nonsignificant correlations: SES, gender, current age, days since injury, and age at injury.

Testing Hypothesis 4: Dispositional optimism as a predictor of Functional Outcome

A final analysis tested whether dispositional optimism contributed unique variance for predicting overall functional outcome compared to cognitive ability, psychological distress, and demographic and clinical variables in the current sample. A hierarchical regression was performed with functional outcome as the dependent factor. Demographic and clinical variables that were significantly correlated with functional outcome (See Table. 3) were entered in the first step, next cognitive ability and psychological distress were entered, followed by dispositional optimism.

When tested, only the first step demonstrated a main effect of GCS and years of education on functional outcome, with GCS accounting for much of the variance in the model ($R^2 = .157$, $\Delta R^2 = .213$, $\Delta F(3, 35) = 3.794$, $p < .05$) (See Table. 3). These results indicate that dispositional optimism does not contribute unique variance in the prediction of functional

outcome. Following these findings, post-hoc analyses, see below, were performed to further examine the results from the current study.

Table 3.

Hierarchical Regression predicting Functional Outcome from Dispositional Optimism

	Step 1			Step 2			Step 3		
Variables	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
GCS	1.633	.803	.356*	1.292	.779	.282	1.271	.800	.277
Years of Education	1.247	1.055	.207	.088	1.123	.015	.102	1.146	.017
Psychological Distress				-6.178	5.280	-.212	-5.186	7.067	-.178
Cognitive Ability				1.021	.712	.289	1.000	.732	.283
Optimism							.129	.594	.051
R^2		.213*			.347			.349	
F for ΔR^2		3.794			2.671			.047	

* $p < .05$. ** $p < .01$.

Post-hoc Analyses

Mediation Analysis

Due to the results indicating that psychological distress and functional outcome are significantly correlated, (r (39) = -.33, $p < .05$), and partial correlations demonstrated that controlling for cognitive ability results in a nonsignificant relationship between psychological distress and functional outcome, a mediation model was tested. The model was tested to determine if cognitive ability mediated the relationship between psychological distress and functional outcome. Two regression analyses were performed with functional outcome entered in as the dependent variable for each. In the first regression (Table 4a), psychological distress was

entered in step 1 and cognitive ability was in step 2. The second regression (Table 4b) had cognitive ability in step 1 and psychological distress in step 2. Tables 4a and 4b show the results from the regression analyses and demonstrate that cognitive ability does act as a mediator in the aforementioned relationship. The second regression shows that if psychological distress is entered in second, it does not account for new variance in the prediction of functional outcome. Therefore, cognitive ability accounts for the relationship between psychological distress and functional outcome and is a mediator in this relationship.

Table 4.

Mediation Regression Analyses predicting Functional Outcome from Psychological Distress and Cognitive Ability.

a.

	Step 1			Step 2		
Variables	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
Psychological	-8.603	4.058	-.326 *	-3.179	4.616	-.122
Cognitive				1.140	.529	.381*
R^2		.108*			.210*	
F for ΔR^2		4.496			4.655	

* $p < .05$. ** $p < .01$.

b.

	Step 1			Step 2		
Variables	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
Cognitive	1.339	.440	.447*	1.140	.529	.381*
Psychological				-3.179	4.616	-.122
R^2		.200*			.210	
F for ΔR^2		9.252			.474	

* $p < .05$. ** $p < .01$.

Dispositional Optimism predicting Psychological Distress

The results indicate that optimism is most highly correlated with post-injury psychological distress (see Table 2) and that it does not demonstrate a main effect on functional outcome. Therefore, a separate analysis was conducted to determine whether optimism contributes unique variance in the prediction of psychological distress. For this analysis, an additional hierarchical regression was performed to predict psychological distress. GCS and years of education were entered in the first step, cognitive and functional outcome were entered in the second step, and dispositional optimism was entered in the final step. The results indicate that dispositional optimism, entered in step 3, contributes a significant amount of variance in the prediction of psychological distress and demonstrated a significant main effect ($R^2 = .540$, $\Delta R^2 = .250$, $\Delta F(3, 33) = 16.300$, $p < .001$). See Table 5. This post-hoc analysis illustrates that optimism may have more utility in the predication of psychological distress, rather than long-term functional outcome. Figure 1 illustrates the amount of variance accounted for by dispositional optimism in the prediction of functional outcome versus psychological distress

Table 5.

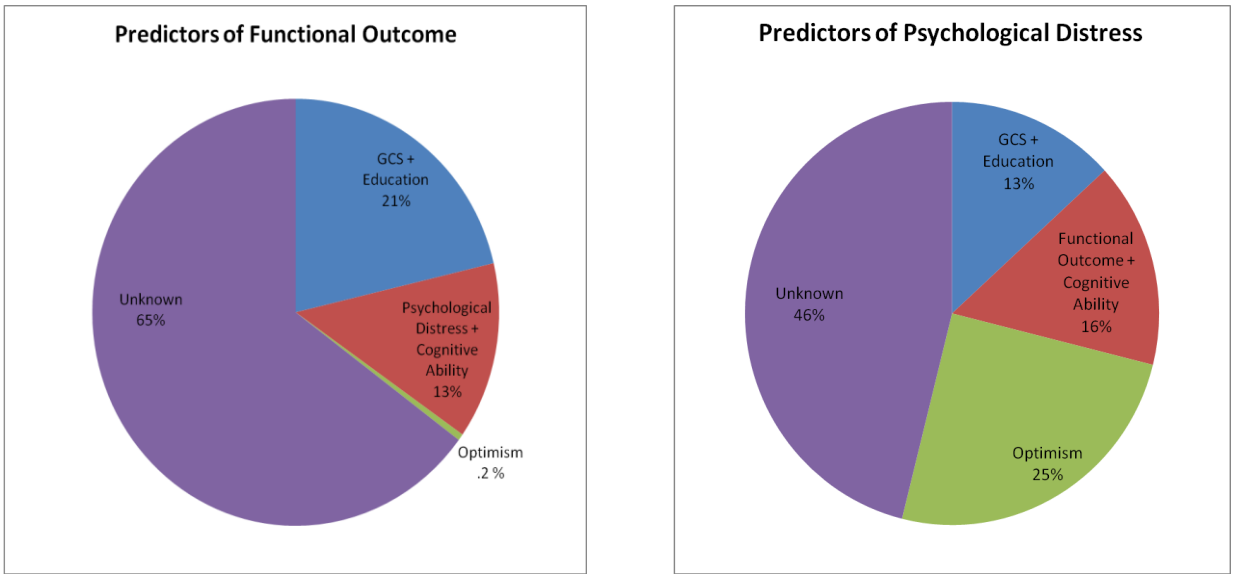
Hierarchical Regression predicting Psychological Distress from Dispositional Optimism

	Step 1			Step 2			Step 3		
Variables	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
GCS	-.020	.026	-.131	.001	.026	.005	.019	.022	.127
Years of Education	-.068	.037	-.305	-.025	.038	-.112	-.027	.031	-.121
Functional Outcome				-.004	.006	-.111	-.001	.005	-.032
Cognitive Ability				-.048	.021	-.420	-.029	.018	-.253
Optimism							-.048	.012	-.575**
R^2		.132			.289			.540**	
F for ΔR^2		2.508			3.433			16.300	

* $p < .05$. ** $p < .01$.

Figure 1.

Dispositional Optimism in the prediction of Functional Outcome versus Psychological Distress



Chapter 4

DISCUSSION

The current study aimed to examine the relationships between psychiatric symptoms, cognitive status, and personality factors in the prediction of functional outcome following moderate and severe TBI. Participants involved in this study completed self-report questionnaires and a brief telephone interview in order to assess outcome after injury. These methods aimed to enroll individuals that are not well represented in this literature through the use of telephone recruitment and data collection. Furthermore, the present study aimed to gain a better understanding of how personality traits, specifically dispositional optimism (DO), relate to psychiatric, cognitive, and functional outcomes following TBI. The results indicate that although DO is significantly correlated with psychiatric, cognitive, and functional outcomes, it does not appear to account for unique variance in functional outcome. Additional post-hoc analyses provide evidence for cognitive ability as a mediator for the relationship between psychological distress and functional outcome and also for DO as a predictor of psychological distress, rather than functional outcome. Overall, the results elucidate the relationship between the consequences of TBI with DO and suggest important clinical implications and directions for future research.

An important goal of the study was to describe levels of DO within a sample of individuals sustaining moderate to severe TBI. Within this sample, levels of DO, for both males and females, did not differ significantly from the normative data for the LOT-R. In addition, results from hierarchical regressions indicate that injury severity, measured by the GCS, and days since injury accounted for significant variance in scores on the LOT-R. This preliminary analysis demonstrated that individuals sustaining more severe injuries and that had fewer days post-injury had lower levels of optimism following TBI.

The second and third hypotheses aimed to better understand the associations between the cognitive and psychological consequences of TBI, as well as the relationship between these consequences with DO. The results indicate that these two variables, cognitive status and psychological distress, are negatively correlated and that each of these variables are associated with functional outcome from TBI. However, partial correlation results indicate that cognitive ability is a mediator in the relationship between psychological distress and functional outcome. Thus, cognitive status and psychological distress do not equally predict unique variance in functional outcome, and rather interact, providing important information for clinical implications, discussed below.

Further examination of the relationships between DO and outcome from TBI provided evidence in support of the third hypothesis: higher levels of DO are related to higher cognitive ability, decreased psychological distress, and better overall functional outcome following TBI. These correlational findings corroborate past research in other patient populations revealing that higher levels of DO predicts better psychological, behavioral and physical outcomes. This study extends this literature by demonstrating that these effects can also be seen within a TBI sample and that higher levels of DO may be related to better performance on brief cognitive task as well.

Data from the current study do not support the hypothesis that dispositional optimism contributes unique variance in the prediction of functional outcome. The results indicate that injury severity is more predictive of long-term functional outcome, compared to demographic variables, clinical variables, psychiatric and cognitive functioning, as well as personality. Although numerous studies have shown that the GCS is a weak predictor of long-term functional outcomes following TBI (Dikmen, Machamer, & Temkin, 1990; Hellawell, Taylor, & Pentland, 1999 Lannoo, Colardyns, Jannes, & De Soete, 2001; Millis, Rosenthal, & Novack,

2001), the current study demonstrates that compared to other variables, the GCS is the best predictor of later functional outcome (mean years post-injury in the current sample was 7 years). Again, these results show that DO, though it is correlated to improved outcomes following TBI, does not contribute unique variance in the prediction of functional outcome. To clarify this relationship a post-hoc regression analysis was performed examining the relationship between DO and psychological distress, rather than functional outcome. The results demonstrated that DO predicts post-injury psychological distress, accounting for a quarter of the variance in later psychological outcome in the current sample. Therefore, although DO is related to better psychological, cognitive, and functional ability following TBI, it appears to be an important predictor variable of psychological distress rather than functional outcome specifically. Taken together with the post-hoc mediation analyses revealing that psychological distress relates to functional outcome by way of the mediator of cognitive ability, the current study offers several clinical implications.

Clinical Implications

Individuals sustaining TBI may also benefit psychologically, cognitively, and functionally from higher levels of optimism, as has been shown within various other patient populations. As part of clinical interventions, there is now work that incorporates training optimism in patient groups with significant medical disorders (Seligman, 1991; Reivich, Gillham, Chaplin, & Seligman, 2005). For example, Seligman (1991) found that DO could be taught to cancer patients with beneficial outcomes by way of targeting coping and attributional styles. These cancer patients, after optimistic training, engaged in active attempts to deal with the stress of their illness using an optimistic explanatory style, instead of focusing on negative

emotions, employing avoidance, or disengaging from active coping. In addition, Kamen-Siegel, Rodin, Seligman, & Dwyer (1991) found that optimism levels could be increased by providing greater personal freedom and control in the lives of 25 elderly men. Ten years later, Reivich and colleagues (2005) corroborated these findings by increasing levels of optimism in patients and decreasing secondary complications due to a medical condition.

The current findings are consistent with prior work demonstrating that DO can act as a buffer against the detrimental consequences of disease and injury. Due to these findings, individuals sustaining TBI that adopt maladaptive coping strategies and appear pessimistic, in denial, or are in avoidance of support services, may be at a greater risk in the long-term to experience greater psychological distress, and possible cognitive and functional impairment. Individuals that exhibit these characteristics post-injury could benefit from psychoeducation about TBI, recovery, and rehabilitation as well as therapy to target specific maladaptive schemas and coping strategies in order to increase levels of optimism and better manage and reduce the long-term psychiatric, cognitive, and functional consequences of TBI.

Although DO did not contribute unique variance in the prediction of functional outcome and rather had more utility in predicting psychological distress, an important mediation model was demonstrated in the current study. This model showed that cognitive ability mediated the relationship between psychological distress and functional outcome. Therefore, these results have important implications for intervention as well. By teaching more effective coping and attributional styles, individuals sustaining TBI could increase their levels of optimism thereby allowing a decrease in psychological distress. According to the mediation model demonstrated in the current study, this decrease in psychological distress may also increase one's cognitive ability and ultimately improve functional outcomes following TBI. Therefore, because these

data may have important implications on future intervention techniques following TBI, it is important to replicate the current findings to demonstrate that this is a consistent relationship across individuals sustaining TBI.

Strengths and Limitations

The present study benefited from multiple recruitment methods, allowing access to individuals sustaining primarily severe TBIs and that were on average 7 years post-injury. In addition, these methods gave individuals the opportunity to participate in research via phone and mail without having to travel. Further, this study examined the relationships between several outcomes following TBI, which have yet to be documented in this literature. The novel findings from the current study add to the understanding of psychiatric, cognitive, and functional outcomes following TBI and further provide evidence about how personality may interact with outcome following moderate and severe TBI.

Despite these strengths, a number of limitations are noteworthy. First, while it was a goal to include under-represented groups in the sample, the current study failed to recruit individuals of ethnic minority status. US minority groups remain understudied in the TBI literature and only a few studies have examined the relationship between minority status and long-term outcome following TBI, though epidemiological studies report that minorities, especially young Black males, are over-represented in TBI (Bruns & Hauser, 2003). In addition, ethnic minorities in the United States have a disproportionately higher rate of disability after traumatic brain injury compared to white Americans, and more specifically African and Hispanic American groups are overrepresented in all disability categories following TBI. There is a clear need to improve the understanding of the long-term consequences of TBI in understudied groups (Wehman, Targett,

Yasuda, McManus, & Briel, 2007). The current study was not able to recruit a substantial representative ethnic minority sample, and therefore this demographic factor was not examined in relation to outcome following TBI. The results from the current study therefore can not be applied to an ethnically diverse sample due to the fact that it is currently unknown whether these findings are generalizable. Individuals of ethnic minority status have not been well represented in clinical research, and in order to fully understand recovery and outcome from TBI, researchers must strive to include these individuals and continue in efforts to understand and overcome barriers of recruitment of these underrepresented groups.

In addition, the structure of this research design does not allow for causal relationships to be determined between variables because correlational analyses were primarily utilized to examine relationships between variables. Furthermore, only current psychiatric, cognitive, and functional statuses were measured and therefore recovery and factors influencing change can not be sufficiently determined. Along with this, DO was measured post-morbidly, making it difficult to determine if this trait is stable or if there are changes pre- and post-injury. This study was also limited by a small sample size, which reduced power in the statistical analyses. Because of these limitations, causal conclusions and generalizations can not be drawn from the current findings.

Conclusion

The findings presented here provide initial support for the relationship between DO and outcome from TBI. Furthermore, DO may differentially influence outcomes following TBI and serve as a better predictor of psychological distress following injury, rather than long-term functional outcome. Future studies should aim to identify other factors that contribute to our understanding of long-term functional outcomes to build upon these findings in order to continue to understand how to best predict outcome and recovery following TBI. With continued

understanding in this area, implementation of rehabilitation and treatment can improve in order to provide the most optimal care to individuals sustaining TBI.

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