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Perceived Self-Efficacy in Individuals with Moderate-to-Severe Brain Injury: The Effects of Rehabilitation Outcomes and Depression

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Philadelphia College of Osteopathic Medicine

Department of Psychology

PERCEIVED SELF-EFFICACY IN INDIVIDUALS WITH MODERATE-TO-SEVERE
BRAIN INJURY: THE EFFECTS OF REHABILITATION OUTCOMES AND
DEPRESSION

By Leena A. Patel

Submitted in Partial Fulfillment of the Requirements of the Degree of

Doctor of Psychology

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**PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY**

Dissertation Approval

This is to certify that the thesis presented to us by Leena A. Patel on the 11th day of May, 2017, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

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Abstract

Brain injury represents a major public health issue in the United States, accounting for a largely underestimated figure of 2.5 million cases in 2010. The pervasive effects of this chronic medical condition contribute to a growing economic burden, as the physical, cognitive, behavioral, and emotional sequelae of brain injury demand long-term care for those with moderate-to-severe brain injuries. The Centers for Disease Control and Prevention recently proposed new recommendations for improvements in monitoring the incidence of and research on brain injury. The goals of this public health initiative are to better inform health service delivery and ultimately improve quality of life for those affected, as well as their loved ones.

In addition to improved quality of life, community reintegration is a primary goal of brain injury rehabilitation. Engagement in rehabilitation is largely dependent upon an individual's level of impairment, as well as other personal factors. For example, research examining the relationship between targeted interventions and community participation has established support for the protective effects of self-efficacy, or personal belief in one's abilities to achieve a desired goal. Additional research on the importance of self-efficacy to psychological health has provided further support for the protective effects of this construct against depression and anxiety. Therefore, further research into the relationship between rehabilitation outcomes, psychological health, and self-efficacy is necessary to inform recommendations for improving health service delivery and quality of life for this vulnerable population.

The aim of the present study is to examine factors that may be related to self-efficacy in persons with moderate-to-severe brain injury who receive treatment at a long-

term postacute brain injury program. The implications of this research include baseline assessment of self-efficacy in this sample that could potentially inform future staff training and overall clinical practice geared towards cultivating self-efficacy in persons with brain injury. The primary limitations of this study are its small sample size and constrained external validity. Despite these limitations, more research is necessary to understand the role of psychological protective factors in brain injury rehabilitation and to inform strategies for improved health service delivery and increased quality of life.

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Chapter One: Introduction

Statement of the Problem

Brain injury is a major public health issue in the United States. The Traumatic Brain Injury Act of 1996 was established as law by Congress, mandating the Centers for Disease Control and Prevention (CDC) to undertake responsibility for preventing and reducing the incidence of *traumatic brain injury* (TBI) in the United States (Bell, Taylor, & Breiding, 2015). Since its inception, the TBI Act has been amended and renewed three times. In its nearly 20-year history, it stands as the only federal program dedicated exclusively to efforts to address the needs of individuals who have sustained a TBI and their loved ones (Corrigan, 2015). The CDC's National Center for Injury Prevention and Control is responsible for conducting research to describe and monitor the burden of TBI and its outcomes (Bell et al., 2015). It also identifies strategies for prevention and implements education initiatives to promote safety awareness. As the field of brain injury treatment evolves, the CDC has responded by revising its strategy for measuring and reducing the public health burden of TBI in the United States. Reducing the injury burden in the population through preventive strategies and ensuring the delivery of care that maximizes the health and quality of life for brain injury victims remain the ultimate goals of public health regarding injury prevention (CDC, 2014). However, challenges to reaching this goal persist.

A recently published report to Congress from the CDC (2014) indicated the existence of a critical gap in research on brain injury rehabilitation and service delivery. The CDC proposed specific recommendations for improvements in these domains in an

effort to enhance the quality of life for individuals living with brain injury. Among the recommendations were improvements in both TBI rehabilitation research and service delivery. This report came at a crucial time, when the personal, societal, and economic impact of brain injury continued to increase. In 2010, the CDC estimated that TBIs accounted for approximately 2.5 million emergency department (ED) visits, hospitalizations, and deaths in the United States, either as an isolated injury or in combination with other injuries. Of this estimated total, about 87% were treated in and released from EDs, 11% were hospitalized and subsequently discharged, and approximately 2% died. It is regrettable that these statistics largely underestimate the actual occurrence of TBIs in the greater population, for they fail to account for untreated individuals, those seen in outpatient or office-based visits, or those who received treatment at a federal facility (e.g., individuals in the U.S. military, or seeking care at a Veterans Affairs hospital) (Faul, Xu, Wauld, & Coronado, 2010).

The annual cost of TBI deriving from lost productivity and wages, continued health maintenance, and long-term care was reported as \$22 billion in a study by Yasuda, Wehman, Targett, Cifu, and West in 2001. This figure starkly contrasted with the most recent estimate of economic costs at \$76.5 billion in 2010 (Sahler & Greenwald, 2012). *Quality of life* (QoL) in the brain injury population is marked by a reduction in both physical and emotional functioning (Beseoglu, Roussaint, Steiger, & Hanggi, 2013). Community reintegration and the restoration of quality of life after brain injury remain the primary goals of rehabilitation. Through intensive care, individuals have the opportunity to learn compensatory skills to accomplish daily tasks independently, engage

with friends and family, and actively participate in their community (Cicerone & Azulay, 2007).

The concept of *self-efficacy*, or a person's belief in their ability to perform an action and achieve outcomes that are consistent with their expectations, may contribute to recovery after injury (Connolly, Aitken, & Tower, 2013; Cicerone & Azulay, 2007). For example, the perception of greater self-efficacy has proved significantly related to physical, social, and emotional quality of life in adolescents with chronic conditions, such as diabetes and cystic fibrosis (Cramm, Strating, Roebroek, & Nieboer, 2013). However, individuals with TBI often have limited *self-awareness* or insight into their current functioning. Self-awareness is a necessary prerequisite for advanced *metacognitive* functions, such as self-efficacy and overall self-evaluation. Therefore, it is imperative for rehabilitation efforts to address deficits in self-awareness through targeted, individualized treatment.

To be effective and yield positive outcomes, brain injury rehabilitation must be comprehensive, holistic, and individualized (Cicerone, Mott, Azulay, & Friel, 2004). For example, Cicerone et al. (2004) examined the effectiveness of an intensive, structured rehabilitation program that addressed cognitive and psychosocial impairments in individuals with brain injury. This program was compared to standard *neurorhabilitation* involving physical, occupational, speech, and neuropsychological therapies. A total of 56 participants with TBI comprised the sample. The structured program consisted of cognitive rehabilitation that focused on increasing awareness and learning compensatory strategies for cognitive deficits, communication skills training,

psychotherapy, family support, and involvement in therapeutic work to prepare participants for educational or vocational opportunities.

Compared to standard neurorehabilitation, the structured program was more effective in increasing community participation and integration (Cicerone et al., 2004). The main measures of outcomes were the Community Integration Questionnaire (CIQ), the Quality of Community Integration Questionnaire (QCIQ), and pre and postintervention neuropsychological data. The CIQ measured various aspects of integration including home and social integration, as well as productivity. The QCIQ examined individuals' subjective satisfaction with their level of community integration, and satisfaction in cognitive functioning as it related to their everyday functioning. Pre and postintervention neuropsychological data were derived from performance across measures of attention and processing speed, memory, and executive functioning. Although both groups demonstrated significant improvement on the CIQ, members of the cognitive rehabilitation program were more than twice as likely to show clinical benefit on the CIQ, and demonstrated improvement in overall neuropsychological functioning compared to the standard neurorehabilitation group.

In addition, satisfaction with community functioning was unrelated to community integration after treatment (Cicerone et al., 2004). Satisfaction with cognitive functioning made a significant contribution to posttreatment community integration. The researchers concluded that this finding might reflect the mediating effects of perceived self-efficacy on functional outcome. Self-efficacy may be enhanced by interventions that help individuals understand environmental and task demands, provide training that improves understanding of how to use their abilities successfully, and offer feedback to correct

individuals' inaccurate personal or causal attributions for unsuccessful personal goal attainment. Self-efficacy beliefs are also mediated by self-regulatory processes such as self-monitoring, goal setting, cognitive self-appraisal, and affective self-evaluation, all of which are central components of the structured program examined in the study.

Research has found that about 40% of people with TBI are able to return to work by one or two years postinjury (Van Velzen, van Bennekom, Edelaar, Sluiter, & Frings-Dresen, 2009). Employment enhances QoL by promoting a sense of wellbeing and community integration (O'Neill et al., 1998). *Comorbid* psychiatric disorders are also associated with poor functional outcomes and deficient QoL (Ponsford, 2013). For example, depression reduces QoL, negatively impacts ability to function in society, and impedes productivity, all of which contribute to delays in recovery (Guillamondegui et al., 2011). Rehabilitation interventions focused on building social, cognitive, and emotional coping skills, and a sense of mastery through achieving treatment goals, may contribute to increased perceived self-efficacy, which may in turn influence rehabilitation outcomes and quality of life. Increased focus on the relationship between physical and psychological health to improve psychological response to acute injury may enhance self-efficacy and patient recovery in clinical practice (Connolly, Aitken, & Tower, 2013). In general, greater understanding and awareness of the health effects, psychological protective factors, and available rehabilitation services that may improve quality of life are imperative to reduce the personal, social, and economic burden of this injury.

Chapter Two: Literature Review

Brain Injury

The most current statistics on brain injuries estimated that in 2010, approximately 2.5 million people sustained a TBI annually in the US (Faul et al., 2010). However, this figure is an underestimate; it does not include a large number of people who remain untreated, nor persons treated in outpatient or office-based visits, individuals who received care at a federal facility (e.g., individuals serving in the U.S. military or veterans who sought care at a Veterans Affairs hospital) (CDC, 2014). Between 2001-2010, rates of TBI-related emergency department (ED) visits increased by 70%, hospitalization rates increased by 11%, and death rates decreased by 7%. The reasons for the drastic increase in ED visits and modest decrease in death rates remain undetermined. One explanation for the latter may be lower rates of motor-vehicle crashes, which represents the leading cause of TBI-related deaths. Growing awareness of TBI from media coverage and legislation regarding safety precautions, among other factors, may explain why more people seek care, hence the increase in ED visits.

ABI/TBIs represent a major public health crisis in the United States and other industrialized countries (Dumont, Gervais, Fougeyrollas, & Bertrand, 2004). The staggering costs associated with the long-term disabilities these injuries cause are borne by individuals, families, society, and the professionals and institutions of medicine and rehabilitation. Recent estimates suggest that between 3.2 and 5.3 million Americans (1.1–1.7 % of the US population) currently live with TBI-related disability (Roebuck-Spencer & Cernich, 2014). Advances in emergency evacuation procedures, neurosurgical and rehabilitation techniques, and more effective medications are among

the reasons for increased survival rates postinjury (Yasuda, Wehman, Targett, Cifu, & West, 2001). Economic costs are significant, approximately \$6 billion for direct costs associated with acute medical care and rehabilitation and \$22 billion for indirect costs, including lost productivity and wages, ongoing health maintenance, and long-term care.

Definition of brain injury. Brain injury is most typically categorized as *acquired brain injury* (ABI) and traumatic brain injury (TBI). An acquired brain injury (ABI) is a general term referring to brain injury that occurs after birth and that does not result from hereditary, congenital, or degenerative conditions, or that is induced by birth trauma (Parvaneh & Cocks, 2012; Elbaum & Benson, 2007). Types of ABI are differentiated by whether the source of injury was internal or external. Examples of internally sustained ABIs include stroke, anoxia, and hypoxia. The most common example of an externally sustained ABI is traumatic brain injury (TBI), which occurs when any external physical force is applied to the head and compromises brain functioning, resulting in physical, cognitive, behavioral, and emotional deficits postinjury (Roebuck-Spencer & Cernich, 2014).

Brain injuries are also be categorized as closed-head or penetrating injuries. Closed-head injuries do not result in penetration of the skull. They can be caused by external force applied to the brain, or when the brain is shaken inside of the skull. Conversely, a penetrating brain injury is characterized by penetration of an object through the protective skull and into brain tissue. Brain injury severity is classified as mild, moderate, or severe, based on the clinical presentation of an individual's neurologic signs and symptoms (CDC, 2014). Brain injuries are also be classified according to degree of severity. The Glasgow Coma Scale (GCS) is a commonly used assessment tool

that provides a measure of the severity of brain injury, with total scores ranging from 3 (*extremely severe brain injury*) to 15 (*near normal*) (Elbaum & Benson, 2007). Based on scores from the GCS, brain injuries are classified as *severe* with scores ≤ 8 , *moderate* with scores ranging from 9–12, and *mild* with scores ≥ 13 (Roebuck-Spencer & Cernich, 2014).

Mild TBI (mTBI) is most commonly defined by a GCS score of 13–15, loss of consciousness (LOC) of less than 30 minutes duration, and posttraumatic amnesia (PTA) of less than 24 hours (Roebuck-Spencer & Cernich, 2014). A concussion is an example of a mild brain injury and is defined as a brief loss of consciousness that may or may not result in a period of memory loss, or amnesia. In the first few days following mTBI, commonly reported cognitive complaints include slowed processing speed, problems with recall, and reduced attention (Griffen & Hanks, 2014). These symptoms may be due to the actual brain injury, but other causes may include injury-related pain and psychological distress. Although subtle neuropsychological changes may be evident following mTBI, these changes typically resolve within three months. Research on functional outcomes as measured by a global measure of outcome post-TBI known as the Glasgow Outcome Scale (GOS) indicates that individuals who have sustained mTBI have good short- and long-term outcomes.

Conventional definitions of moderate to severe TBI include a LOC exceeding 30 minutes, PTA longer than 24 hours, and a GCS of 9 - 12 for moderate severity and 3 - 8 for severe severity (Griffen & Hanks, 2014). Following injury, persons with severe TBI may proceed through a series of stages, including coma, vegetative state, minimally conscious state, confused state (PTA), and recovery. Although all individuals with

severe TBI have some period of coma, most will never enter a vegetative state, and how many will be in a minimally conscious state at some point during recovery is unknown. A person in a minimally conscious state demonstrates inconsistent awareness of the environment and follows command inconsistently; this state is typically a temporary phase of recovery. Persons with TBI subsequently become responsive but confused. They often experience retrograde amnesia, in which they are unable to recall events for a period of time prior to the head injury. For patients in vegetative and/or minimally conscious states, the duration of these states varies greatly. Many people with moderate TBI may never experience coma, and none are in coma at hospital admission. Vegetative and minimally conscious states are not associated with moderate TBI, unless there is deterioration due to some late-occurring complication, such as intracranial bleeding. However, all patients with moderate or severe TBI experience a confused state.

Some of the most common neurobehavioral symptoms of moderate-to-severe TBI include irritability, dizziness, sensitivity to noise, and blurred vision (Griffen & Hanks, 2014). Moreover, individuals who have incurred moderate-to-severe TBI may experience apathy or lack of initiative, as well as extreme fatigue. The most common cognitive deficits affecting persons with moderate-to-severe TBI include impairments in attention, processing speed, and learning and memory.

Brain injury affects people of all ages, genders, races/ethnicities, and incomes and is a leading cause of death and disability, accounting for approximately 1.7 million annual cases in the United States (Roebuck-Spencer & Cernich, 2014). The leading causes of TBI (ranging from most to least common) are falls, motor vehicle-related injuries, blows to the head from or against objects, assaults, and miscellaneous or

unknown causes. Many risk factors are associated with TBIs. Age is one, with the highest rates of TBI in children under age four, adolescents between 15 and 19, and adults over 65. The highest rates of TBI-related hospitalization and death occur in adults age 75 and older. TBI is the leading cause of death for individuals under age 44 in the United States. Gender is another known risk factor, with males experiencing higher rates of TBI than females. One explanation for this disparity is that men are more often exposed to high-risk situations (both occupationally and recreationally) and vehicle-related accidents than are women. Furthermore, socioeconomic status and race/ethnicity are associated with high TBI risk. Individuals from low-income families and members of minority racial/ethnic groups are more likely to sustain a TBI, with the latter group being more likely to die from such injuries. Additional TBI-related risk factors are a history of alcohol/substance use and a history of prior TBIs.

A brief review of the neurophysiology of the human brain corroborates the complexity of brain injury. Billions of cells called *neurons* comprise the brain (Elbaum & Benson, 2007). Each neuron is composed of a cell body or *soma*, a thin fiber known as the *axon*, and tree-like branches called *dendrites*. Neurons throughout the brain communicate with one another through electrochemical messages, or neurotransmitters, transmitted from one neuron to the next. Injury to the brain can cause axons to twist, stretch, or break, resulting in *diffuse axonal injury*. The result is compromised communication between neurons, and reduced overall cerebral efficiency.

Physical, behavioral, emotional, and cognitive sequelae following brain injury. Brain injury affects individuals in multiple domains of functioning, and leads to debilitating deficits. Physical deficits such as paralysis and other motor impairments are

the most overt signs of injury. However, behavioral, emotional, and cognitive impairment are just as debilitating as physical deficits in terms of functional living and quality of life. The most commonly reported behavioral problems relate to changes in mood or emotional state (Yasuda et al., 2001). Personality changes are a common consequence of injury and often affect relationships with friends and loved ones (Parveneh & Cocks, 2012). Cognitive limitations are more widespread, impacting a range of functioning. The cognitive domains most likely to be affected in brain injury include executive functioning, memory, attention and processing speed, language, speech, and visuospatial perception. Brain injuries also impair learning, requiring intensive cognitive rehabilitation (Sander & van Veldhoven, 2014). Moderate-to-severe brain injuries often cause impairments in executive functions, which include the cognitive processes that underlie goal-directed behavior, such as self-monitoring, initiation, planning, goal-setting, and self-awareness, or insight into one's current state (Bewick, Raymond, Malia, & Bennett, 1995; Sohlberg & Turkstra, 2011). Of these operations, self-awareness is of paramount importance; it is a necessary prerequisite that influences other advanced executive functions.

Self-awareness is closely related to executive functions in the discipline of neuropsychology (Toglia & Kirk, 2000). At the core of executive functioning is *metacognition*, which facilitates knowledge about one's cognitive capacities and the ability to self-monitor (Bewick et al., 1995). Metacognitive knowledge comprises knowledge of specific aspects of cognitive processes, task characteristics, and strategies in different areas of functioning (Toglia & Kirk, 2000). It also encompasses self-understanding of one's capabilities and limitations. Therefore, deficits in executive

functioning engender disturbances in metacognitive aspects of self-awareness and self-regulation.

Self-awareness in brain injury. Overall, a positive correlation exists between severity of brain injury and degree of impaired self-awareness (Sherer & Fleming, 2014). Individuals who retain intact awareness of their difficulties are often active in their recovery process, but patients with deficits in self-awareness have difficulty comprehending postinjury changes and how they impact daily living skills (Elbaum & Benson, 2007). In addition, Kelley et al. (2014) found impaired self-awareness in individuals with brain injury who underreported cognitive symptoms and overreported work and home functioning five or more years postinjury. Gender differences in self-awareness are also present in the brain injury population, with females demonstrating greater self-awareness (Niemeier et al., 2014). However, a definitive explanation of such differences remains unknown.

Localization of brain functioning has gained prominence with advancements in neuroimaging. Disagreement exists regarding whether self-awareness is localized or distributed throughout the brain (Toglia & Kirk, 2000). However, two specific brain regions have demonstrated increased neural activity in response to tasks requiring this aspect of metacognition, specifically the *anterior medial prefrontal cortex* and the *posterior cingulate cortex* (Sherer & Fleming, 2014). This finding is consistent with the view that self-awareness is at the core of executive functioning, which is regulated by the *frontal lobe*. Self-awareness is a crucial part of recovery post-TBI, as it facilitates a clear understanding of one's ability to make gains in treatment. Self-evaluation of one's individual capabilities to achieve is commonly known as self-efficacy, which is

inextricably linked to self-awareness.

Theoretical Framework

Social Cognitive Theory. Self-awareness is closely related to the concept of self-efficacy in social psychology (Toglia & Kirk, 2000). The concept derives from Albert Bandura's *Social Cognitive Theory* (SCT), which conceptualizes learning, behavior, and development as the acquisition of knowledge through cognitive processing of information from both internal and external sources (Sigelman & Rider, 2012; Olson & Hergenhahn, 2008). At the heart of this theory is an emphasis on the motivating and self-regulating role of cognition in human behavior. Bandura (1988) emphasized that observational learning, or the process of observing a model's behavior, is crucial for behavior change. In their classic "Bobo" doll study, Bandura, Ross, and Ross (1961) demonstrated that children learn aggressive behaviors through observation of models exhibiting similarly aggressive behavior. Nursery school children were exposed to a video of an adult model who hit an inflatable "Bobo" doll with a mallet while shouting phrases such as, "Sock him in the nose" and "Hit him down" (Bandura, et al., 1961, p. 576). Children then observed the adult model either receive praise, suffer punishment, or incur no consequences following the aggressive behavior (Sigelman & Rider, 2012). Children who saw the model either receive praise or avoid consequences imitated comparatively more aggressive behaviors than the children who observed the model punished. However, when the children who witnessed punishment were later asked to reproduce the model's behaviors, it was evident they learned just as much as the children who observed the other two outcomes. Bandura used the term *latent learning* to refer to this phenomenon, in which learning occurs but is not reflected in behavior. Performance

of a behavior is dependent upon the type of consequences that follow. Behaviors are more or less likely to be imitated depending on whether the consequences are reinforcing or deterring, respectively. This phenomenon is termed *vicarious reinforcement*.

Bandura also emphasized the concept of human agency, which refers to an active process of conscious planning and intentionality of actions that influence future outcomes (Olson & Hergenhahn, 2008). His theory accounts for human psychosocial functioning through a causal model known as *triadic reciprocal causation* (Bandura, 1988). In this model, the relationships between behavioral, cognitive, and other personal factors and the environment are bidirectional interacting determinants that influence psychosocial functioning. These individual factors, however, can be modified in order to improve adaptive functioning. Three central aspects of the theory are especially pertinent to such change: developing competency through mastery modeling, strengthening people's belief in their capabilities, and developing self-motivation through the establishment of goals.

The first step in building competencies is *modeling*, which is a form of observational learning in which another's actions are observed in order to learn skills (Bandura, 1988). This type of learning is instrumental in the development of skills and competencies. Complex skills are broken down into smaller, more manageable components and subsequently modeled and recorded on videotape as simple steps. However, skill attainment remains incomplete without personal confidence.

Self-efficacy

According to Bandura (1994), "perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people

feel, think, motivate themselves and behave.” *Perceived self-efficacy* is a subjective belief or confidence that one has the necessary capacity to use one’s skills to accomplish a desired goal and to overcome potential obstacles. Self-efficacy is conceptualized as “perceived,” because it depends upon an individual’s subjective views of her/his chances of success (Spiegler & Guevremont, 2010).

The subjective element of self-efficacy is crucial for executing newly acquired skills, and by extension to self-regulated behavior, motivation, and effort (Olson & Hergenhahn, 2008). Confidence in one’s abilities can facilitate taking on new and challenging tasks, investing effort, and persevering when faced with barriers (Warner et al., 2014). Self-efficacy arises from various sources, including personal accomplishments and failures, as well as the successes and failures of others who one views as peers. Verbal persuasion from others to either engage in or cease a behavior may also contribute to perceived self-efficacy, but may only exert temporary effects; one’s direct or vicarious experience with success and failure most influence one’s choices. The four main sources of affirmation for perceived self-efficacy are mastery experience, vicarious experience, verbal persuasion, and physiological and affective states. Bandura considers *mastery*, or direct experience of achieving success in a given task, as the most powerful source of self-efficacy beliefs. Vicarious experience refers to the belief in one’s own ability to succeed based on observation of models achieving success in a task (Spiegler & Guevremont, 2010). Through verbal persuasion, people come to believe they can succeed, which contributes to increased self-efficacy. People may also develop self-efficacy from their level of emotional arousal. For example, high arousal indicates increased anxiety and therefore low self-efficacy, while low arousal reflects confidence

and high self-efficacy.

People's beliefs about their abilities can impact their lives in numerous ways (Bandura, 1988). For example, such beliefs can influence choices, effort and perseverance, and resilience in the face of adversity. Bandura postulated that the level of perceived self-efficacy determines whether one attempts a task, the effort one exerts to achieve the task, and the time one spends on the task (Spiegler & Guevremont, 2010). A stronger sense of perceived self-efficacy indicates that an individual is more vigorous and persistent in the face of adversity. Those with a strong sense of self-efficacy tend to focus on mastery of tasks, while those with a weak sense are plagued by self-doubt, which hinders performance and achievement of goals. Overall, the more one believes in his/her abilities, the more likely one will initiate and persist in activities and produce desirable outcomes.

The majority of research on perceived self-efficacy has examined its role in the regulation of motivation, action, and affective arousal (Bandura, 1989). For instance, general self-efficacy predicts medication adherence, physical activity, effective pain management, and disease management (Cramm et al., 2013). Bandura (1977) also maintained that self-efficacy can affect the nature and persistence of engagement in protherapy behaviors. More recent investigations of self-efficacy involve its influence on cognitive functioning (Bandura, 1989). As human motivation is generated by cognitive activity, volitional actions require intact cognitive abilities, such as planning, reasoning, and judgment, all of which are higher order executive functions regulated by the frontal lobe. People motivate themselves and guide their actions by anticipating likely outcomes of future actions, setting goals, and planning how to achieve those goals. Such intricate

cognitive activity is conducted by the frontal lobe of the brain. In individuals with brain injury, such self-regulatory functions are disrupted, which impacts motivation and goal-directed behavior.

Two common conceptualizations of self-efficacy are judgments and perceptions of one's capabilities, and one's sense of control in attaining desired outcomes (Toglia & Kirk, 2000). Belief in one's ability to carry out a task depends on understanding one's abilities and limitations. Perceived self-efficacy may not always accurately reflect one's real self-efficacy (Olson & Hergenbahn, 2008). When this self-understanding is compromised, judgments and beliefs are often distorted, potentially resulting in over or underestimation of one's true abilities and a sense of loss of control (Toglia & Kirk, 2000). One means that individuals with TBI have used to cope with such challenges is through social comparison to others similar to them (Arenth, Corrigan, & Schmidt, 2006). During periods of acute distress following brain injury, individuals may engage in downward comparison, which entails comparing themselves to other people whom they consider worse off. Doing so enables individuals to regard their own status more positively. Individuals with brain injury surveyed one to six months postdischarge from inpatient rehabilitation reported both upward and downward social comparison associated with positive emotions. However, the effect of either upward or downward comparison can be influenced by other factors, including depression, low self-esteem, and low perceived control. The literature therefore suggests that social comparison may represent a mediating factor in adjustment for individuals with TBI. In addition, it is not uncommon for individuals to compare their postinjury level of functioning to prior levels of functioning. Myles (2004) discussed approaches to understanding and treating the loss

of a sense of self after brain injury. That loss may be understood in terms of experiencing a sense of self-estrangement, negative self-evaluation, emotional distress, and denial of changes in functioning. It is a crisis of the conceptualized self, which involves verbal content that individuals use to define and describe themselves. *Acceptance and Commitment Therapy* (ACT) (Hayes et al., 1999) has emerged as a crucial treatment approach, to guiding the survivor to both adjust to postinjury changes in functioning and to develop a new self-concept.

Self-efficacy and chronic health conditions. Self-efficacy beliefs affect cognitive, emotional, and motivational processes, thereby influencing a variety of health-related and rehabilitation outcomes (Cicerone & Azulay, 2007). Both cross-sectional and longitudinal analyses have found that self-efficacy plays a major role in facilitating improved health-related outcomes such as quality of life for a variety of chronic disorders, including heart and lung disease, diabetes, cystic fibrosis, and osteoarthritis (Cramm et al., 2013; Cramm, Strating, & Nieboer, 2013; Marks, Allegrante, & Lorig, 2005). For example, in a meta-analysis of the influence of self-efficacy beliefs on functional outcomes both before and after joint replacement surgery, postoperative self-efficacy was associated with functional outcomes such as longer distances walked, walking speed, frequency and repetition of exercise, and disability (Magklara, Burton, Morrison, 2014). Self-efficacy also positively influenced pain-related disability, compliance with discharge instructions, locomotion recovery, and quality of life (Connolly et al., 2013). In particular, high self-efficacy is strongly associated with improved QOL and less frequent use of healthcare services in people suffering from long-term disability.

Self-efficacy and brain injury. Early work on self-efficacy and TBI indicated that the enduring cognitive, behavioral, emotional, psychiatric, and interpersonal effects after brain injury can contribute to the development of learned helplessness, which negatively impacts self-efficacy beliefs (Moore & Stambrook, 1995). Individuals with TBI may succumb to self-limiting beliefs about their capabilities. A vicious cycle develops, in which such beliefs remain unchallenged, opportunities for growth are further restricted, outcomes are suboptimal, and overall quality of life is diminished.

In addition, TBIs resulting in damage to executive functions impair personal characteristics like initiative and will, which are core components of self-efficacy (Dumont et al., 2004). However, some individuals with brain injury may develop compensatory strategies to effectively engage in their recovery through intensive neurorehabilitation. Although research examining the relationship between brain injury and self-efficacy is limited, there exists some support for the utility of self-efficacy in facilitating recovery in this population. Cicerone et al. (2008) found that individuals with brain injury enhanced self-efficacy through a holistic cognitive rehabilitation program that encompassed an emphasis on interventions for cognitive deficits, emotional difficulties, interpersonal behaviors, and functional skills, and provided performance feedback and active self-evaluation. Activities embedded in the program were specifically designed to promote metacognitive processes, including self-appraisal, prediction, self-monitoring, and self-evaluation, all of which are essential components of perceived self-efficacy. Additional research has also demonstrated that individuals with high self-efficacy can identify effective methods to utilize both internal and external

resources to achieve maximum rehabilitation outcomes (Man, Soong, Tam, & Hui-Chan, 2006). These resources included self-management training and cognitive-skills training.

In their review of the literature, Connolly et al. (2013) reported that immediate feedback using social and verbal persuasion during a memory retraining intervention increased self-efficacy in patients with acute head injury. Another example supporting the effectiveness of performance feedback involved a study that examined the effects of varying trainer–trainee interactions on self-efficacy outcomes in persons with brain injury. In this pretest/posttest randomized clinical trial of 83 participants, Man et al. (2006) observed that face-to-face interaction with a therapist providing immediate and direct feedback about performance of problem-solving tasks enhanced self-efficacy more than a computer-assisted training program. This finding implies that human interaction is a crucial component in promoting self-efficacy in persons with brain injury. One limitation of this study was that the authors neglected to specify what performance feedback entailed, aside from, “immediate and personal feedback on successful performance that was likely to facilitate positive self-appraisals of efficacy...” (p. 966). However, Leber and Jenkins (1996) recommended audio- or videotaped feedback and direct feedback by the therapist as strategies to address self-awareness deficits in patients with brain injury. This approach to feedback is consistent with Bandura’s mastery modeling approach, in which behaviors are broken down into manageable steps to facilitate learning.

Accordance to theories of self-efficacy, people learn about themselves from others through both social comparisons and direct interactions (Man et al., 2006). Research validating the effectiveness of demonstration, role-playing, coaching, and

performance feedback in face-to-face intervention is crucial for rehabilitation programs, so therapists can provide vicarious experiences to patients and model execution of effective strategies, which are essential means of enhancing self-efficacy.

In their examination of the relationship between self-efficacy and life satisfaction, Cicerone and Azulay (2007) reported that perceived self-efficacy for the management of cognitive symptoms evinced a strong and consistent association with life satisfaction and subjective quality of life post-TBI. Moreover, self-efficacy mediated the relationship between community functioning and life satisfaction. Such findings underscore the urgency for neurorehabilitation services to address patients' self-efficacy beliefs in conjunction with treatment of their physical and cognitive limitations.

Multiple Goals of Rehabilitation Following Brain Injury

Following TBI, individuals progress through different stages in which they come to terms with their injury. According to the five stages of grief proposed by Elizabeth Kubler-Ross (1969), individuals undergo periods of denial, anger, bargaining, depression, and acceptance after loss. Likewise, brain injury victims experience a sense of loss of self as a result of their injury, as well as a range of emotions, including shock, denial, anger, depression, accommodation, and acceptance. Addressing that emotional upheaval is a necessary step in restoring patients' quality of life.

Zahn and Littman (1989) outlined three crucial steps for individual with brain injury to surmount in order to forge a meaningful new direction post-injury. The steps identified include giving themselves permission to mourn the loss of their pre-injury personality, identifying aspects of their personality that are functionally intact and those that are no longer available, and replacing their expectations with a more realistic

assessment of their future capabilities. Such a process is facilitated through intensive cognitive-behavioral therapy that treats the neurocognitive sequelae of brain injury in conjunction with the emotional and physical aspects.

Following brain trauma and depending on the level of severity, an individual may proceed through an intensive phase of medical rehabilitation succeeded by longer term rehabilitation. The overarching goal of *comprehensive brain injury rehabilitation* (CBIR) is to enable those with TBI to resume participation in family, work, and community life (Malec, 2014). This model of care is based on a transdisciplinary approach, in which interventions are individually designed not only to reduce impairments, but also to adapt family, social, and environmental systems to facilitate the individual's reintegration into the community. Impaired self-awareness is a common barrier to rehabilitation goals following brain injury. Individuals with impaired self-awareness experience difficulty in fully engaging in treatment, because in their minds, they are unimpaired.

Community participation in brain injury. As the incidence of brain injury continues to climb, community reintegration remains the ultimate objective of neurorehabilitation. This goal is especially important, not only for individuals to live with increased independence and to use their skills productively in society, but also to reduce economic burden (Parveneh & Cocks, 2012). Most definitions of community participation include relationships with others, the degree of independence in one's living situation, and engagement in meaningful activities (Salter, McClure, Foley, & Teasell, 2011). Because the frontal lobe region of the brain regulates self-awareness, damage to this area has been found to negatively impact social participation (Dumont, Gervais,

Fougeyrollas, & Bertrand, 2004). Therefore, one of the primary goals of neurorehabilitation is to facilitate increased community participation, with a focus on developing self-awareness through consistent feedback and support (Malec, 2014). Rehabilitation goals should strive to improve self-awareness to the extent that individuals can effectively participate in their rehabilitation, to set realistic goals for themselves, and to maintain safety by avoiding behaviors that place them at risk of harm.

In addition to improving the frequency of community participation, another overarching goal of rehabilitation is to improve functional living ability. A growing body of literature supports the efficacy of *cognitive rehabilitation* in accomplishing these very goals, which is defined as “a systematic, functionally oriented service of therapeutic activities that is based on assessment and understanding the patients’ brain–behavioral deficits” (Cicerone et al., 2000, pp. 1596–1597). The overarching goal of this therapeutic approach is to target specific cognitive and behavioral deficits to improve daily functional living skills, including vocational capacity. Much like the notion of mastery modeling in Bandura’s SCT, in which actions are broken down into manageable steps with guided instruction, cognitive rehabilitation utilizes task analysis as a teaching strategy for learning multistep actions. The skill to be learned is analyzed and subsequently divided into components that can be taught and measured. For example, a task analysis for brushing one’s teeth entails: 1. Get toothbrush, 2. Wet toothbrush, 3. Apply toothpaste, 4. Move toothbrush around teeth, 5. Rinse mouth, 6. Put away toothbrush and toothpaste.

Return to work. One view of community participation involves the performance of life habits, or everyday activities and social roles that an individual considers valuable in their unique sociocultural environment (Dumont et al., 2004). Employment is a crucial

aspect of community participation. Rates of return to work in the TBI population are quite low, often below 30% (Yasuda et al., 2001), which can be attributed to a variety of factors, including physical, cognitive, and emotional limitations.

Postbrain injury, individuals who are unable to return to their preinjury occupation may experience a range of negative effects, including poor health, social isolation, and mental health disorders, such as anxiety and depression (Cancelliere, 2014). It is estimated that rates of unemployment for individuals with TBI range from 18% to 88% (Tsaousides et al., 2009). Some of the factors known to facilitate return to work and employment maintenance after TBI include injury severity, type of impairment, age at injury, current age, education level, work history, preinjury income, postinjury neuropsychological functioning, and vocational rehabilitation. Detecting such factors can identify at-risk individuals who may benefit from rehabilitation services (Cancelliere, 2014).

Typical neurorehabilitation services include physical, occupational, speech, and neuropsychological therapies. However, intensive cognitive rehabilitation has been found to be more effective than standard rehabilitation in increasing community participation in those with brain injury. Cicerone et al. (2004) developed a program to enhance awareness and to facilitate development of compensatory strategies for cognitive deficits. *An intensive cognitive rehabilitation program (ICRP)* was compared to a *standard rehabilitation program (SRP)*. The participants included 56 individuals diagnosed with TBI who were considered medically stable, independent in basic self-care skills, such as feeding and toileting, and having the cognitive ability to participate in treatment. Participants were at least 18 years of age and demonstrated language

expression and comprehension adequate for participation in verbally based interventions. Regarding severity of injury, the majority of participants (89%) had sustained moderate-to-severe TBI; the remaining 11% had sustained mTBI. Of the total sample, 27 participants were screened and selected for the ICRP. These participants presented with significant cognitive limitations, including impaired self-awareness, which affected their ability to resume preinjury activity levels and/or employment. The remaining participants received SRP, which primarily consisted of physical, occupational, speech, and neuropsychologic therapies based on individual needs, medically prescribed treatment, and the treatment team's clinical recommendations. Both ICRP and SBP treatment took place at the same postacute brain injury rehabilitation setting.

Participants from the ICRP received cognitive group treatment that emphasized executive functioning (e.g., planning, problem solving, adapting to unexpected situations), metacognitive functioning (e.g., self-monitoring, cognitive self-appraisal, affect regulation), and interpersonal group process (e.g., giving and receiving feedback) (Cicerone et al. (2004). Outcome measures included community integration, satisfaction with both community and cognitive functioning, and neuropsychological functioning. The effects of the ICRP indicated clinically significant results for community integration. Improvements in neuropsychological functioning were also found for the experimental group, specifically in the domains of attention and processing speed and immediate-memory recall. Participants who received ICRP did not report greater satisfaction with community functioning, but satisfaction with cognitive functioning was strongly related to participants' level of community integration posttreatment, and this relationship was most apparent in participants who received the ICRP. The authors concluded that the

relationship between satisfaction with cognitive functioning and community integration may derive from participants' perceived self-efficacy regarding their functioning, rendering it a crucial psychological protective factor in functional outcomes after TBI rehabilitation.

Self-efficacy and community participation. Predictors of community participation in brain injury have traditionally examined sociodemographic factors such as age, and gender, and neuropsychological assessments reflecting cognitive measures of severity and impairment (Dumont et al., 2004). In addition, one personal factor, resiliency, which is differentiated into three distinct components, namely initiative, will, and self-efficacy, has also been associated with increased community participation following brain injury. In one study, Cicerone and Azulay (2007) investigated the relationships between community integration, activity-related satisfaction, self-efficacy beliefs, and perceived quality of life (QoL) in persons with TBI living in the community. The researchers hypothesized that activity-specific satisfaction and perceived self-efficacy would predict perceived QoL, and that self-efficacy would mediate the relationship between community functioning and QoL. The study included 97 adults who had sustained a TBI at least six months earlier who lived in the community, with or without assistance (Cicerone & Azulay, 2007). The study also included participants' demographic variables in the analyses, including gender, time post-injury, severity of brain injury, and vocational status. The majority of participants were male, had severe brain injury ($n = 57$), and unemployed ($n = 57$). Time since injury ranged from 6 to > 75 months. Outcome measures included community functioning, activity-related satisfaction, life satisfaction, and self-efficacy. Cicerone and Azulay found that gender

and time since injury made the greatest contributions to predicting global life satisfaction, but productivity contributed to life satisfaction somewhat less. Satisfaction with both productivity and leisure/social activities contributed to global life satisfaction. However, the single greatest contribution to the prediction of global life satisfaction was perceived self-efficacy, particularly regarding the management of cognitive symptoms. In addition, the researchers discovered that perceived cognitive self-efficacy mediated the relationship between community integration and global life satisfaction. Thus, the results of this study bolstered the significance of this psychological protective factor in TBI-rehabilitation outcomes.

Employment-related and general self-efficacy also corresponded to higher quality of life in persons with TBI (Tsaousides et al., 2009). Individuals who are more confident in their abilities to manage the demands of employment and of life in general report higher quality of life. The literature provides clear support of the positive influence of perceived self-efficacy on community participation in persons with brain injury.

However, a pre and postmorbid history of psychiatric illness, such as depression, is an additional barrier to successful neurorehabilitation outcomes. Although the overarching goal of neurorehabilitation is to restore individuals to pre-injury functioning to the extent possible, depression often impedes the recovery process.

Depression Following Brain Injury

Comorbid affective disorders are quite common in brain injury, with depression the most prevalent (Underhill et al., 2003; Clark, 2014). Results of a systematic review of the prevalence of depression post-TBI indicated rates as high as 30%. In a large-scale study of the association between brain injury and depression, brain injury was a

significant predictor of depression in children with brain injury and concussion (Wylie, Gjelsvik, Linakis, & Vivier, (2013). The prevalence of depression in American children is a staggering 15%, despite adjustment for such known predictors as age, race, ethnicity, family income and structure, maternal mental health, child health, and developmental achievement. Such research implies that brain injury elevates the risk for depression, and directs attention to the importance of monitoring symptoms to facilitate early diagnosis and intervention in brain injury rehabilitation programs. Perhaps the most important implication of this research will result in rehabilitation interventions that cultivate self-efficacy early in a brain-injured child's life to mitigate depression and promote community participation.

Functional outcomes for individuals with comorbid TBI and depression tend to be poorer than for those without depression (Clark, 2014). This relationship is maintained even after controlling for injury severity. Depression may contribute to poorer functioning through diminished motivation or compliance with rehabilitation and/or may reflect the emotional response to changes in functioning and participation following injury.

Quality of life in brain injury. Depression has also been consistently associated with subjective quality of life post-TBI. For example, Underhill et al. (2003) conducted longitudinal research investigating the relationship between depression and life satisfaction in individuals with TBI over a three-year period postinjury. The researchers hypothesized decreased life satisfaction reported by participants diagnosed with depression compared to those without depression. A total of 324 participants were included in the study, and assigned to one of two groups (depression vs. no depression),

depending on whether they were diagnosed with depression. Participant characteristics included more males than females, more unemployed than employed, and more with moderate-to-severe brain injury.

The main outcome measure was the Life Satisfaction Index I-A (LSI-A), which assessed enthusiasm for life, mood, and congruence between desired and achieved goals (Underhill et al., 2003). Participants were interviewed by telephone at 24, 48, and 60 months posthospitalization. In the 24-month interview, 90 (27.8%) participants reported a diagnosis of depression; 234 (72.2%) reported no such diagnosis. Participants completed the LSI-A at the 24-, 48- and 60-month interviews. The authors found that participants from the depression group consistently reported lower life satisfaction than those without depression at each interval. Therefore, depression represents a major problem for individuals with TBI, and the provision of assessment and treatment is crucial.

Although there are currently no standard practice recommendations regarding specific pharmacological or psychological interventions for depression in persons with TBI, cognitive-behavioral therapy (CBT) is commonly used. Khan-Bourne and Brown (2003) have reported the effectiveness of adaptations of this approach for use with this population. The authors contend that one of the unique characteristics of CBT that renders it effective for treating brain-injured individuals is that it provides therapists with a variety of tools, creating a potential for flexibility in accommodating individual differences and limitations. Zahn and Littman (1989) proposed using a cognitive-behavioral framework to help patients to reconceptualize and redefine their functional identity in response to a traumatic brain injury, not just to reduce frequency and severity

of symptoms. This approach to treatment involves individuals with a brain injury reorganizing how they view and define themselves, their place in the world, and their predictions about their future selves and functional capacity.

Attention to positive psychological factors such as resiliency has increased in the face of mounting evidence supporting its role as an essential construct involved in psychological interventions to address emotional deregulation. Self-efficacy is important for emotional quality of life, as it involves positive and negative emotions (Cramm et al., 2013). High levels of self-efficacy may facilitate better coping when faced with stressful situations arising from chronic health conditions, which may reduce stress and increase positive emotions. Moreover, Man et al. (2006) cited research indicating that individuals who are undergoing training and have high self-efficacy exhibit low anxiety, positive affect, and efficient work styles. Positive affect associated with high self-efficacy may also contribute to more affirmative perceptions of quality of life. In contrast, Tahmassian and Moghadam (2011) found negative relationships between specific domains of self-efficacy and depression and anxiety in students between the ages of 14 and 20. For example, total, physical, and academic self-efficacy most strongly correlated with depression, while total, physical, and emotional self-efficacy related to anxiety.

Purpose of the Study

Self-efficacy is imperative for overcoming the challenges and demands presented by a chronic condition such as brain injury. The purpose of this study was to examine both functional and psychological outcomes in individuals with ABI/TBI who participate in treatment at a postacute brain injury rehabilitation program. This study evaluated whether functional ability, percentage of annual rehabilitation goals completed, and

depression are associated with perceived self-efficacy in those with brain injury.

Research on the relationship between self-efficacy and these combined variables has yet to be conducted in a long-term postacute rehabilitation setting. Therefore, the current study aimed to investigate this relationship in the context of individuals with ABI/TBI.

Chapter Three: Research Question and Hypothesis

1. What factors are associated with perceived self-efficacy in individuals with ABI/TBI?

Hypothesis: It is hypothesized that depression, percentage of annual rehabilitation goals completed, and Mayo Portland Adaptability Inventory-4 (MPAI-4) Total Score are associated with perceived self-efficacy. In particular, a higher number of goals completed and greater functional ability will be correlated with moderate-to-high levels of perceived self-efficacy. In addition, moderate-to-severe depression will be correlated with low levels of perceived self-efficacy.

Research on the relationship between depression and self-efficacy in individuals with brain injury indicated that those with higher self-efficacy were less emotionally distressed (Brands, Köhler, Stapert, Wade, & van Heugten, 2014). Examining the influence of self-efficacy on community integration in participants with brain injury, Cicerone et al. (2004) found that perceived cognitive self-efficacy mediated the relationship between community integration and global life satisfaction. The current study hopes to add to the growing body of literature on the positive role of self-efficacy in brain injury rehabilitation outcomes.

Chapter Four: Methods

Design and Design Justification

The current study reflected a cross-sectional research design that included both archival and collected data from individuals diagnosed with ABI/TBI. The data derived from individuals enrolled in Bancroft NeuroRehab's (BNR) Brain Injury Services' comprehensive inpatient-rehabilitation day-treatment facility. BNR serves patients with moderate-to-severe brain injuries, providing a variety of neurorehabilitation services, including physical therapy, occupational therapy, speech therapy, cognitive therapy, and/or psychotherapy. Persons served typically reside in supportive community living with 24-hour staff monitoring, and attend a day program Monday through Friday from 9 am to 3 pm. Residential and community activities are often scheduled on the weekend to maintain and promote community participation. This facility gathers data on all residents throughout their time enrolled in the brain injury program. Data from individuals across BNR's residential program sites in central and southern New Jersey were de-identified before analyses in this study.

Participants and Setting

The convenience sample for this study was drawn from a clinical population; each participant was enrolled in BNR's rehabilitation treatment program. In the current sample, 21 participants completed the study. A total of six participants were removed from the study, due to either incomplete data ($n = 3$) or receptive language difficulties ($n = 3$). Table 1 provides an overview of the participant characteristics in the current sample.

Table 1 *Participant Characteristics*

		<i>n (%)</i>			
Gender	Male	14 (66.7)			
	Female	7 (33.3)			
Race	Caucasian	20 (95.2)			
	African American	0 (0)			
	Asian	1 (4.8)			
			<i>M</i>	<i>(SD)</i>	<i>Range</i>
Age		47.14	(8.8)	31-61	
Education		13.38	(2.0)	11-18	

Inclusion and Exclusion Criteria

The participants who were eligible for this study included: (a) both male and female patients with moderate-to severe brain injury between the ages of 18 and 65; (b) at least one year post-injury; (c) fluent in English; (d) who currently receive rehabilitation services from Bancroft NeuroRehab (this age range was chosen to accommodate those individuals who are most likely to be employed or actively involved in the community). Participants also: (e) were assessed using the clinician-rated MPAI-4; (f) had a current working *Individual Rehabilitation Program (IRP)* with explicitly defined goals and objectives, and an indication (*Met/Unmet*) by the clinical team that the goals had or had not been achieved. Individuals were excluded from the study if older than age 65, unable to communicate verbally, through writing, or by other assistive means, or evinced receptive language difficulties. Furthermore, participants were excluded if they had

comorbid and life-threatening chronic diseases (e.g., cancer, amyotrophic lateral sclerosis (ALS), Parkinson's disease, Huntington's disease).

Measures

The constructs of interest included perceived self-efficacy, functional ability (i.e., ability, adjustment, and community participation), percentage of annual rehabilitation goal completion, and depression. Retrospective objective data were derived from the Mayo-Portland Adaptability Inventory-4 (MPAI-4) Total Score, which is comprised of three indices (i.e., MPAI-4 Ability Index, MPAI-4 Adjustment Index, and MPAI-4 Participation Index), and percentage of annual goals completed. The subjective measures included in the current study were the PHQ-9 and the Self-Efficacy for Symptom Management Scale.

Self-Efficacy for Symptom Management Scale. This scale is a 13-item measure to assess the ability of patients to manage common challenges associated with TBI (Cicerone & Azulay, 2007). The authors adapted a measure developed by Lorig (1996) that was originally used with people with chronic medical disability. The Self-Efficacy for Symptom Management Scale comprises three subscales that relate self-efficacy to performing self-management behaviors. The first subscale (SEsoc) measures self-efficacy in obtaining help from the community, family, and friends to perform everyday activities and in seeking emotional support. The second subscale, (SEcog), evaluates self-efficacy in the management and compensation of cognitive symptoms. The third subscale, (SEemot) concerns self-efficacy in managing depression, and was modified to reflect a general emphasis on managing emotional symptoms, such as feeling frustrated or overwhelmed. Each item is preceded by the question "How confident are you that you

can...,” with responses on 10-point scale, from 1 = *not at all confident* to 10 = *totally confident*. Items from each subscale are summed to obtain a subscale score, and all three subscales are summed for a total score. In the present study, the total score will be used, rather than each of the individual subscale scores. The three subscales relating to self-efficacy to perform self-management behaviors had the highest intercorrelations within a large sample of persons with diverse disabilities, and contained items that appear most meaningful for individuals with a neurological disability. Scores ranging from 13-59 indicate *Low Self-Efficacy*, from 60 -114 *Moderate Self-Efficacy*, and from 115 - 130 *High Self-Efficacy*. The measure will be modified to enhance participants’ ability to accurately respond to items on the rating scale. The 10-point Likert rating scale currently includes only two descriptors, specifically 1 = *Not at all Confident* and 10 = *Totally Confident*. Additional descriptive anchors will be added to amplify the range of numerical ratings. These will include 2-3 = *Not very Confident*, 4-5 = *Somewhat Confident*, 6-7 = *Confident*, 8-9 = *Very Confident*. Permission to modify the scale was granted by Dr. Keith Cicerone.

Mayo-Portland Adaptability Inventory-4 (MPAI-4). The MPAI-4 is a measure used in the clinical evaluation of individuals’ current functional abilities during the postacute period following brain injury (Malec, 2005). In addition, it is used to evaluate rehabilitation programs serving this population. One of this instrument’s strengths is the range of people who may complete it, including professional staff, individuals with brain injury, and their significant others. When professionals complete the measure, scoring is most useful with consensus of the rehabilitation team. Multiple clinicians rating the same individual should discuss the scoring until agreement about the most appropriate scoring

is achieved. The clinical team at BNR utilizes this team approach to annual MPAI-4 assessment for persons served.

The fourth edition of the MPAI comprises three subscales, the Ability Index, the Adjustment Index, and the Participation Index that address commonly encountered physical, cognitive, emotional, behavioral, and social difficulties postinjury (Bellon, Malec, & Kolakowsky-Hayner, 2012). The 13 items of the Ability Index measure impairment associated with mobility, hand function, vision, hearing, dizziness, verbal and nonverbal communication, information retrieval, problem solving, memory, speech, and attention/concentration. The 12 items comprising the Adjustment Index assess anxiety, depression, irritability/anger/aggression, pain/headache, fatigue, mild symptom sensitivity, social contact, and impaired self-awareness. The Participation Index contains eight items that evaluate an individual's ability to initiate tasks, interact with friends and other people who are not family, care for themselves, manage the responsibilities of their home, their employment status, financial management, and the independent use of transportation.

The MPAI-4 totals 35 items; the first 29 items in the scale represent the individual's current functioning, and the remaining six detailing pre and postinjury information that may pose challenges for ongoing rehabilitation (Bellon et al., 2012). Items are scored on a scale of zero to four (Bellon et al., 2012). A score of zero denotes the absence of functional disabilities in the domain assessed by the item. A score of one reflects mild impairment and, with appropriate assistance, functioning is generally normal. A score of two indicates that an individual's impairment interferes with the particular activity/domain assessed by an item less than 25% of the time. A score of

three indicates impairment 25% to 50% of the time, and a score of four indicates impairment that interferes most of the time. Although previous versions of the MPAI used between four and six rating categories for each item, the current use of five rating categories proved the most reliable.

The cumulative raw scores for each of the MPAI-4 indices and the MPAI-4 Total Score can be converted to *T-scores* (Malec & Lezak, 2008). Data are available from two samples, the National sample ($n = 386$) and the Mayo sample ($n = 134$). Data from both samples were obtained for adults with ABI. In the National sample, data were based on staff ratings from the Learning Services Corporation, Rehab Without Walls, and Mayo-Rochester, which are neurorehabilitation settings. Data for the Mayo sample were derived from ratings by staff and by persons with ABI (self-report) and their significant others, evaluated exclusively at Mayo-Rochester. *T-scores* between 40 and 60 are considered average or typical of individuals involved in outpatient, community-based, or residential rehabilitation following brain injury. Scores between 40 and 50 correspond to the mild-to-moderate range in terms of overall severity; scores between 50 and 60 fall within the moderate-to-severe range. *T-scores* above 60 indicate severe limitations, even in comparison to other persons with brain injury. *T-scores* between 30 and 40 reflect mild limitations, and scores below 30 represent relatively good outcomes.

The clinical utility of the MPAI-4 has been heavily researched in the brain injury population. In consequence, it is effective in predicting outcomes of vocational interventions and comprehensive day treatment, as well as in determining the level of outpatient brain injury rehabilitation necessary for patients (Malec, 2004). The psychometric properties of the MPAI-4 have been well established through careful research (Bellon et al., 2012). Multivariate, Rasch, and traditional psychometric analyses

(Cronbach's $\alpha = .89$; person reliability = .88; item reliability = .99) established satisfactory internal consistency and reliability. Moreover, satisfactory internal consistency resulted regardless of the rating source (rehabilitation staff vs. patient vs. family and significant others) (Malec, 2004). Through Rasch analysis, the three subscales have demonstrated good reliability when completed using ratings from professional staff, patients, and significant others (Person reliability = .94; Item reliability = .99). Therefore, it is recommended that the measure be completed by at least two sources to yield an accurate assessment of an individual's functioning.

For the present study, clinician-rated items from each of the MPAI-4 Indices and MPAI-4 Total Score were analyzed as a measure of ability, adjustment, and participation. At BNR, MPAI-4 scores derive from a clinical consensus of the treatment providers for persons served. Data on the MPAI-4 are collected biannually at Bancroft for each person served. Data are first collected at the start of each individual's IRP year, and again six months later. For the present study, the dataset analyzed included MPAI-4 scores collected at the start of each participant's IRP year.

Individual Rehabilitation Plan (IRP). An IRP is an individualized treatment plan developed for patients enrolled at Bancroft NeuroRehab's long-term postacute brain injury program. It lists each individual's clinical team members, including the clinical case manager, residential manager, program director, and nurses. Depending on individuals' unique treatment needs, the document may also identify specialized staff from psychology, cognitive therapy, physical therapy, speech therapy, and occupational therapy. It also documents the names of patients' guardians and families/significant others. Additional information documented in the IRP includes cognitive strengths and

weaknesses based on annual neuropsychological testing, which are considered when designing goals and objectives across domains. The IRP also includes the individual's subjective quality-of-life scores based on the World Health Organization-QOL (WHOQOL) Index. In addition, each individual's goals and objectives from the previous calendar year are included, as well as information from clinicians reporting whether they were achieved.

An annual meeting takes place to determine each individual's rehabilitation goals, which are developed by both the patient and the professional staff comprising his/her clinical team, and defined by clinical consensus. These goals apply to day program, as well as residential and community persons served. Each individual has an interdisciplinary health and wellness goal. These goals are monitored and evaluated throughout the year and modified as needed. Information about patients is documented in the plan, including date of birth, date of injury, date of admittance to the program, and the individual's current level of support/supervision based on their functioning. Clinician's ratings of individual goal completion are also provided as a means of goal monitoring. Goal completion was defined as *Met* or *Unmet*. Only goals designated as *Met* in IRP are considered completed; goals designated as *Unmet* are considered incomplete. Based on the number of goals for each participant and the total of goals completed, a percentage is calculated representing annual goal completion. For example, two of three goals met indicated 67% of annual goals completed.

Patient Health Questionnaire (PHQ-9). The PHQ-9 is a self-report questionnaire that includes items from the original PHQ's mood module (Raad, 2013). The instrument is intended to both diagnose the presence of depressive symptoms and

characterize the severity of depression. The PHQ-9 comprises nine items that are rated in relation to frequency of symptom occurrence in the past two weeks. Responses are rated 0 = *not at all*, 1 = *several days*, 2 = *more than half the days*, and 3 = *nearly every day* (responses in the shaded areas of the score sheet are associated with depression, generally scores of 2 or 3). A single question rates how difficult problems have made it to do work, take care of things at home, or get along with other people, using a four-tier scale (*not difficult at all to extremely difficult*).

In a study by Fann et al. (2005), a PHQ-9 cutoff score of > 12 reflected the best screening criteria for *Major Depressive Disorder* (MDD) in individuals with TBI. Cook et al. (2011) established the following severity ranges for individuals one-year post brain-injury: *Minimal*: 0-4, *Mild*: 5-9, *Moderate*: 10-14, *Moderately severe*: 15-19, and *Severe*: > 20. Excellent test-retest reliability within seven or fewer days of initial assessment ($r = 0.76$) emerged for persons with TBI. The PHQ-9 has excellent convergent validity with two commonly used depression measures, namely the self-report Symptom Checklist Depression Scale (SCL-20) and the clinician-rated Hamilton Depression Rating Scale HAM-D.

Procedure

Permission to conduct this study was obtained in writing from the Interval Review Boards at Philadelphia College of Osteopathic Medicine (PCOM) and BNR. Furthermore, BNR approved the use of established patient data and the collection of additional data from persons served in the brain injury program. A list of potential participants was obtained with support from the senior neuropsychologist at BNR.

Persons were categorized according to those with/without guardians. First, participants without guardianship were approached to complete the informed consent process in order to participate in the study. Legal guardians of persons under guardianship were contacted via telephone and/or e-mail/standard mail to obtain assent to participate. Once assent was obtained, participants completed informed consent. Following informed consent, all participants completed the Self-Efficacy for Symptom Management Scale. All data were de-identified and stored in a locked filing drawer before entry in a database. IRPs and archival data (MPAI-4, PHQ-9) were reviewed and the acquired information was similarly de-identified and entered in a database. IRPs and de-identified archival data from a neuropsychological score database were analyzed, along with collected scores on The Self-Efficacy for Symptom Management Scale. All data collected as part of the present study are stored at BNR for future research.

Chapter Five: Statistical Analyses and Results

To test the hypothesis that functional ability, percentage of annual rehabilitation goals completed, and depression are associated with perceived self-efficacy, bivariate correlations were conducted. This analysis is a statistical procedure that expresses a relationship between two variables. Prior to the analysis, SPSS was used to test the assumptions of normality and homogeneity of variance to ensure feasibility of the analysis.

The current study hypothesized a negative correlation between depression and perceived self-efficacy. In particular, it was predicted that moderate-to-severe depression scores (PHQ-9 = 10-20+) would correlate with low perceived self-efficacy (Self-Efficacy for Symptom Management Scale score = 13-59). Moreover, a negative correlation was hypothesized to exist between MPAI-Total scores and perceived self-efficacy. Stated specifically, moderate-to-low MPAI-Total scores (*T-score* of 50 and below) were expected to be associated with moderate-to-high levels of self-efficacy (Self-Efficacy for Symptom Management Scale score = 60-130). The current study also predicted that percentage of annual goals completed would positively correlate with perceived self-efficacy. A higher percentage of goals completed ($\geq 75\%$) would correlate with moderate-to-high levels of self-efficacy (Self-Efficacy for Symptom Management Scale score = 60-130).

Statistical analyses were conducted using SPSS version 24. Prior to the analyses, the assumptions of normality and homogeneity of variance were examined via parametric tests. The Kolmogorov-Smirnov test indicated that participant age, $D(21) = 0.198$, $p < .05$, and years of education, $D(21) = 0.323$, $p < .05$, were both significantly abnormal.

Variance describes the extent to which a group of numerical results diverge from their average, or mean. Levene's test for equality of variances was found to be nonsignificant, indicating that the homogeneity of variance assumption was tenable, suggesting equal variance across variables. Descriptive statistics for each variable are summarized in Table 2.

Table 2
Descriptive Statistics of Clinical Variables

Independent Variables	Mean	SD	Range
MPAI Total Score	48.43	5.02	41-59
MPAI Ability Index Score	48.33	7.52	35-60
MPAI Adjustment Index Score	48.10	4.56	41-55
MPAI Participation Index Score	48.57	5.66	41-62
Rehabilitation Goals Completed (%)	68.83	24.88	0-100
PHQ-9 Score	4.81	3.65	0-14
Dependent Variable			
Perceived Self-Efficacy Score	99.43	20.07	55-130

A series of bivariate correlations were conducted between demographic, rehabilitation, and psychological-related variables in order to determine relationships among MPAI-4 scores (Total; Ability, Adjustment, Participation Indices), percentage of annual rehabilitation goals completed, PHQ-9 scores, perceived self-efficacy scores, age, and years of education completed. The variables of gender and ethnicity were not included in the analyses, because the homogenous sample predominantly consisted of Caucasian males. Table 3 presents the results of the analyses.

Table 3
Pearson Correlations Between Clinical Variables and Non-Clinical Variables

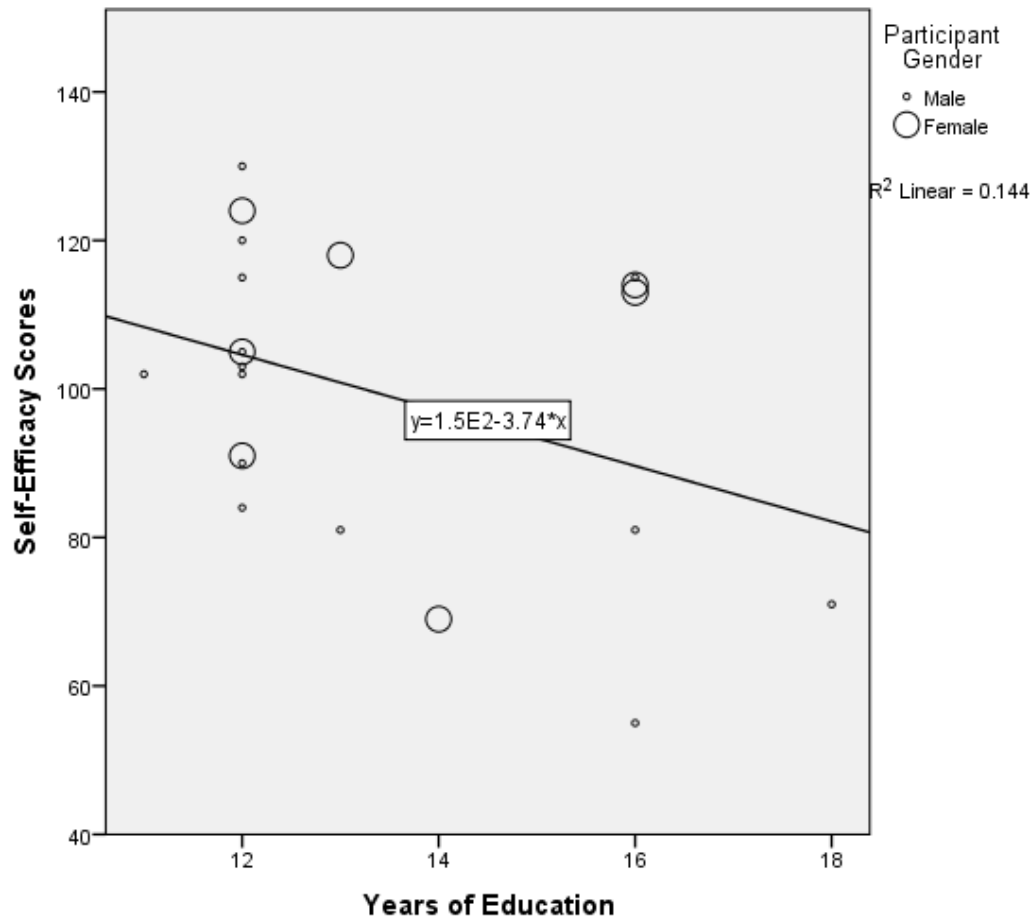
Participant Age	Perceived Self-Efficacy
<i>Pearson Correlation</i>	.084
Sig. (one-tailed)	.359
Years of Education	
<i>Pearson Correlation</i>	-.380
Sig. (one-tailed)	.045
MPAI Total Score	
<i>Pearson Correlation</i>	.061
Sig. (one-tailed)	.397
MPAI Ability Index Score	
<i>Pearson Correlation</i>	.020
Sig. (one-tailed)	.466
MPAI Adjustment Index Score	
<i>Pearson Correlation</i>	.023
Sig. (one-tailed)	.461
MPAI Participation Index Score	
<i>Pearson Correlation</i>	.207
Sig. (one-tailed)	.184
Percentage of Rehab Goals Completed	
<i>Pearson Correlation</i>	-.251
Sig. (one-tailed)	.136

PHQ-9 Scores

<i>Pearson Correlation</i>	-.237
Sig. (one-tailed)	.150

Based on these analyses, there were no statistically significant correlations found between the dependent variable (perceived self-efficacy scores) and independent variables (participant age, MPAI Total Scores (MPAI Ability Index Scores, MPAI Adjustment Index Scores, MPAI Participation Index Scores), percentage of annual rehabilitation goals completed, or PHQ-9 scores). A statistically significant negative correlation was found between perceived self-efficacy scores and years of education, $r = -.380, p = < 0.5$. Graph 1 below depicts this relationship in a grouped scatterplot. This finding indicates that moderate-to-high perceived self-efficacy was associated with a lower level of education in this sample. The mean education completed by participants was $\bar{x} = 13.38$; the mean perceived self-efficacy score was $\bar{x} = 99.43$, which falls within the moderate range of self-efficacy.

Graph 1. Grouped Scatterplot: Relationship Between Self-Efficacy and Education Level
Grouped by Gender



Chapter Six: Discussion

Summary and Integration of Findings

The primary goal of the present study was to examine the influence of functional ability, annual rehabilitation goal completion, and depression on perceived self-efficacy in individuals with ABI/TBI. It was hypothesized that greater functional ability and increased percentage of annual goals completed will correlate with moderate-to-high perceived self-efficacy. It was also hypothesized that moderate-to-severe depression would correlate with low perceived self-efficacy. Based on the results of statistical analyses, these hypotheses were not supported in the present study. However, an unexpected relationship emerged between years of education completed and perceived self-efficacy. Higher levels of self-efficacy were associated with fewer years of completed education in the sample. The dearth of research on high vs. low levels of educational achievement and self-efficacy poses a challenge to drawing accurate conclusions based on this significant finding in the present study. One study, however, examined the impact of self-efficacy on positive youth development, and concluded that high academic achievers often perceive low academic self-efficacy (Tsang, Hui, & Law, 2012). South Asian cultural beliefs appeared to play a role in this particular study; consequently, generalizing this finding to other cultural groups, including the present sample, is problematic,

Bandura's (1993) *collective school efficacy* may account for the significant relationship discovered by this study, since a system of learning in which rehabilitation staff promote self-efficacy through instructional methods may be crucial to fostering self-efficacy among those with ABI/TBI. According to Bandura (1993), the relationship

between education and self-efficacy involves not only the individual but also teachers and parents. For example, “collective school efficacy” he claimed, required that “Teachers operate collectively within an interactive social system rather than as isolates. The belief systems of staffs create school cultures that can have vitalizing or demoralizing effects on how well schools function as a social system” (Bandura, 1993, p. 141). This notion emphasized the importance of systems in cultivating self-efficacy. In the context of the school systems, teachers and other staff confront the challenge of creating learning environments conducive to building and maintaining self-efficacy in students through various instructional methods. Similar processes may be at work in other systems in which learning is emphasized, such as brain injury and speech therapy, psychotherapy, cognitive rehabilitation, and peer and staff social interactions. At BNR, the culture of teaching persons served about functional and emotional recovery postinjury is at the core of rehabilitative care. The collective efficacy engendered through the program may account for the relationship between education and self-efficacy in the present study.

In addition, the degree to which people with higher levels of education experienced a decrease in their self-efficacy may reflect individual reactions to their new postinjury selves. Individuals with higher levels of education, defined as beyond high school, face functional impairments that increase their dependence upon others for support. For example, they may require various levels of assistance with completing *instrumental activities of daily living* (IADLs), leaving them feeling less efficacious. In contrast, those who are high school educated and without postsecondary educational achievement may not experience the same degree of inefficacy for various reasons, including contentment with an average range of achievement. Moreover, people with a

more extensive education may have greater intellectual awareness of their changed functioning compared to their counterparts with less education because of their higher cognitive reserve, which may engender more positive insight and a decreased sense of helplessness (Fortune, Walsh, & Richards, 2016).

In factoring gender into the relationship between years of education and self-efficacy (see Graph 1), it remains important to examine how gender may be tied to achievement. In historical terms, many more males than females pursue hands-on types of employment, which often does not require post-secondary education. The graph clearly depicts a cluster of males with 12 years of education demonstrating a moderate-to-high range of self-efficacy. Some differences may exist in types of employment between higher and lower educated males, particularly in this sample, that may affect expectations for successful rehabilitation. In addition, there may be other unidentified factors that affect self-efficacy beliefs in males. Sustaining an injury and coping with postinjury adjustment may be different for less educated males compared to those who have achieved higher levels of education, and therefore have higher expectations for themselves in terms of career achievement.

As an example, the graph depicts males with 16 and 18 years of education evincing lower levels of self-efficacy compared to men with 12 years of education completed. Women with 12, 13, and 16 years of education had comparable levels of self-efficacy, falling within the moderate-to-high range. The findings that women with varying degrees of education had moderate-to-high levels of self-efficacy, that men with 12 years of education had the same range of self-efficacy, and that men with the highest educational achievement had the lowest self-efficacy may reflect that men with higher

levels of education may have higher self-expectations, which are often compromised after injury, resulting in lower overall self-efficacy. Men with lower education may be more open-minded regarding deficits post-injury; therefore, self-efficacy may not evince as steep a decline as in men with higher levels of education and greater self-expectations of recovery post-injury. However, these hypotheses should be interpreted with caution, since the present sample was limited in terms of size and gender distribution, limiting the potential generalization of results.

From a cognitive-developmental framework, Jean Piaget's (1936) theory of *concept formation* adds importance to the relationship between self-awareness and self-efficacy. According to his theory, self-awareness and critical thinking skills develop via progression through his proposed stages of development. The ability to engage in meta-analytic activity (to think about one's thoughts) is central to self-awareness (the ability to stand back, observe and evaluate oneself). Such high-order thinking reflects executive functioning ability, which can be compromised by ABI/TBI. However, cognitive rehabilitation techniques for executive dysfunction that can promote new learning through neuroplasticity (Barman, Chatterjee, & Bhide, 2016), metacognitive strategy, and problem-solving training for executive disorder are the mainstays of therapy for cognitive deficits in persons with TBI.

Furthermore, Bandura's causal model known as *triadic reciprocal causation*, which explains human psychosocial functioning, may elucidate the relationship between education and self-efficacy found in the present study (Bandura, 1988). In this model, the relationships between behavior, cognitive and other personal factors, and the environment are bidirectional interacting determinants that influence psychosocial

functioning. These individual factors can be modified in order to improve adaptive functioning. Children acquire academic skills early in life through the school system, which affords them opportunities to develop self-efficacy through mastery modeling, through achievement experiences and feedback from teachers that strengthen their belief in their capabilities, and by developing self-motivation through the establishment of personally meaningful goals. These three opportunities are central aspects of the theory that are especially relevant to agentic change. As children progress in life, they continue to encounter situations that contribute to maintaining, developing, or decreasing their self-confidence. The bidirectional relationship between their behavior, cognition, environment, and other personal factors significantly defines their level of self-efficacy to accomplish goals. These interacting factors are presumed to persist into adulthood, and may change over time based on new learning experiences and life events. For example, sustaining a brain injury may alter the interaction between how the person behaves, thinks, and feels postinjury compared to their premorbid functioning. In this crucial transition, personal factors such as resiliency or learned helplessness determine functional outcomes postinjury. For example, TBI can affect a person's self-awareness (cognition) and how he or she responds to treatment (behavior) and other personal factors (e.g., gender, age, education, resources) can shape or impact self-efficacy.

This study endeavored to provide a better understanding of the possible relationships between various rehabilitation outcomes, psychological factors, and perceptions of self-efficacy in individuals with ABI/TBI. These findings may be useful in designing interventions that cultivate self-efficacy in long-term postacute injury settings, such as BNR; such targeted intervention may improve functional rehabilitation outcomes

(Cicerone et al., 2008). The current study addresses important components involved in designing interventions to cultivate and enhance self-efficacy in those with brain injury, which are based on information gleaned from previous studies investigating interventions to promote self-efficacy in neurorehabilitation settings. Those interventions examine cognitive deficits, emotional difficulties, interpersonal behaviors, and functional skills, provision of performance feedback, active self-evaluation, and contrasting interaction with human trainers with computer programs (Cicerone et al., 2008; Man et al., 2006).

The current study also raises awareness regarding the importance of advocacy in brain injury rehabilitation. An enhanced understanding of specific rehabilitation-related outcomes that contributes to increased self-efficacy may inform the design and implementation of targeted services to facilitate development of this personal protective factor.

Limitations

The results of the present study were affected by some limiting factors. The major limitation of this study is the small sample size ($n = 21$), which may have contributed to nonsignificant findings concerning the clinical variables in the present study. Despite persistent efforts to recruit participants, inherent factors contributed to such a limited sample size. These factors included a relatively small pool of possible participants from which to recruit for the study, difficulties contacting with legal guardians regarding assent, eligible individuals declining participation, inaccessibility due to nonattendance or absence from the day program, and removal of participants from the study. The sample was limited to 21 participants by these constraints. Moreover, the sample was predominantly Caucasian, and nearly 67% of participants were male.

Together, the sample size and demographic characteristics represent major limitations to the study's external validity. Another potential limitation derived from utilization of archival data. Most of the data used in the study consisted of information obtained from measures administered by a variety of students, interns, postdoctoral fellows, and clinicians. This variability creates the potential for human error within the database, as the study investigator did not have control over data entry and most aspects of administration of measures. The possibility of error during assessment and data entry will make it difficult to ensure uniformity and accuracy of the results.

An additional limitation concerns the results' potential for generalization. The data analyzed derive from a single rehabilitation program, BNR; no other rehabilitation programs contributed data for analysis. In addition, the participants represented a convenience sample of individuals with a history of moderate-to-severe brain injury. Individuals with mild brain injury were not included in the analyses conducted, and no conclusions based on the results obtained can be drawn regarding the relationship between self-efficacy and mild brain injury (i.e., concussion).

In addition, results obtained from self-report measures (i.e., PHQ-9, Self-Efficacy for Symptom Management Scale) may not be accurate due to the possibility of impaired self-awareness, which is common in the ABI/TBI population (Schmidt, Fleming, Ownsworth, Lannin, & Khan, 2012). As a result, the possibility exists that individuals could have over or underreported symptoms. Because the construct of self-awareness was not controlled for in the present study, it may constitute a potential confounding variable.

One noteworthy aspect of the present study is that the mean PHQ-9 score of the participants was approximately 5, which reflects a mild degree of depression-related symptomatology. Some hypotheses accounting for such a low score in this sample relate to limitations in participants' self-awareness of their emotional functioning arising from the sequelae of injury to the brain itself and compromised ability to engage in metacognitive processes. Another reason for such a low score may reflect the measure itself, which represents a limitation of the current study. In regard to the assessment of depression in a brain injury population, future research may consider alternative measures that offer closed-ended rather than open-ended responses, such as those offered on a Likert scale. This consideration is especially important, given that the range of qualitative descriptors on a continuum require intact abstract thinking ability, which is often compromised in brain injury (Vas, Spence, & Chapman, 2015). Because individuals with brain injury typically utilize concrete rather than abstract thinking skills, a scale offering concrete response choices such as a simple *YES/NO* choice may better capture the construct under measurement.

The Geriatric Depression Scale (GDS) is a well-known scale used to screen for depression in older adults (Gana, Bailly, Broc, Cazauvieilh, & Boudouda, 2016). It is a 30-item self-rating measure that requires *YES/NO* responses about how the respondent has been feeling over the past week. One point is allotted for each affirmative response, with total scores categorized as normal, mild, and moderate-to-severe. The cut-off score is 11; higher scores are indicative of depression. A unique aspect of the GDS is that it does not measure somatic symptoms, which can often be over-endorsed in certain populations, such as individuals with ABI/TBI. Future research utilizing the GDS with a

brain injury population may capture the social aspects of self-efficacy better than other measures of depression, like the Symptom Checklist Depression Scale (SCL-20), the Hamilton Depression Rating Scale HAM-D, and the Patient Health Questionnaire-9 (PHQ-9).

Another possible limiting aspect of the study relates to the types of rehabilitation goals included. Rather than examine progress on goals as measured by the IRP, which are specific to individual's rehabilitation and treatment, it may be worthwhile examining goals that are personally meaningful to the individual as opposed to a prescribed goal by their treatment team.

Future Directions

Although the findings did not yield significant outcomes regarding the clinical variables involved, future research in neurorehabilitation settings may build upon the present study in order to inform staff training procedures that enhance awareness of the importance of facilitating self-efficacy in persons with brain injury. Future research may consider controlling for potential confounding variables, such as impaired self-awareness in individuals with ABI/TBI. As the current study has examined self-efficacy in relation to specific rehabilitation outcomes and depression in ABI/TBI, there are numerous additional opportunities for further exploration of this construct.

One potential avenue for future research on factors related to self-efficacy involves years postinjury, which was not included as a nonclinical variable in the present study. Subsequent research may reveal an interaction between age and years postinjury. Younger people may have higher expectations and greater optimism about recovery soon after their injury that increase self-efficacy, but older people may have low initial self-

efficacy that tends to decrease with time. Furthermore, research may explore the effects of the interval postinjury and neurorehabilitation on personal motivation to pursue personal, academic, and vocational goals. Another variable absent from the current study is individuals' premorbid functioning. The impact of one's level of premorbid functioning on perception of self-efficacy is an important consideration for additional research. Perhaps individuals with higher premorbid functioning have greater ability to regulate emotion and strong coping skills, which together serve to maintain or bolster self-efficacy postinjury. The factors responsible for such proposed relationships are worth exploring through continued research endeavors into brain injury neurorehabilitation.

Future endeavors may also examine self-efficacy in single cases, because there is a movement towards single-case design as opposed to group research in persons with chronic illness. In addition, the impact of targeted interventions, such as cognitive rehabilitation, on levels of perceived self-efficacy in individuals postinjury is important to examine. Investigation of the role of self-efficacy on rehabilitation outcomes through longitudinal research would also provide useful information on possible changes in perceptions of ability over time. Furthermore, exploration of additional psychological factors, such as learned helplessness and resiliency, may also identify unique personality traits that account for progress in brain injury rehabilitation.

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