TRAUMATIC BRAIN INJURY AND ITS RELATIONSHIP WITH EXECUTIVE FUNCTIONING AND SOCIAL PROBLEM SOLVING

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I would like to dedicate this dissertation to my family and my wife, Agnes Haggerty. They have been a source of constant support, and have shown an amazing willingness to endure the long process of graduate school with me.
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ABSTRACT

Traumatic Brain Injury and its Relationship with Executive Functioning and Social Problem Solving

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Traumatic brain injury affects the lives of millions of Americans and costs billions of dollars. For this reason, it is an important task for researchers to gain an understanding of variables that are related to traumatic brain injury and social outcomes in patients who have suffered one. This study reviewed the research literature in an attempt to gain an understanding of variables that have been identified as strong predictors of social outcomes in this population. The purpose of this study was to replicate the findings of some of the research; specifically that social problem solving mediates the relationship between executive functioning and community integration within a TBI population. It was also examined if social problem solving was significantly related to the quality of life of TBI patients. Results supported the hypothesis that social problem solving was correlated with self-reported quality of life in patients who had suffered a TBI. However, the data did not support the hypothesis that social problem solving mediated the relationship between executive functioning and community integration. While executive functioning was related to community integration, there was no significant relationship between executive functioning and social problem solving.
Traumatic Brain Injury and its Relationship with Executive Functioning and Social Problem Solving

The Center for Disease Control estimates that in 2003, approximately 1.5 million Americans experienced a traumatic brain injury. Of those 1.5 million, 290,000 were hospitalized and 50,000 died. Males between the ages of 15 and 24 were most at risk for sustaining a traumatic brain injury, and about one third of those hospitalized had lasting impairments (Langlois, Rutland-Brown, & Thomas, 2004). By the late 1990s, 5.3 million Americans were permanently disabled due to the long-term consequences of traumatic brain injury (Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999), and the total annual cost of traumatic brain injury in the United States was estimated at $56.3 billion (Thurman, 2001). This includes the high cost of long-term rehabilitation programs, which can reach $4 million per patient (NINDS, 1989).

With such high human and economic costs of traumatic brain injury, it is important to better understand specific variables that may significantly influence recovery efforts. As much of the existing literature on traumatic brain injury rehabilitation programs focuses on interventions for mild injuries, there is need for better understanding of factors that influence success after more severe injuries. The present study was designed to examine several of these factors, including executive functioning and social problem solving, and to test their impact on the well-being of patients suffering from more severe traumatic brain injuries. Background information about traumatic brain injuries will be presented first, with particular attention to the symptoms and challenges facing injured patients. This description will be followed by discussion of social problem solving and community integration – two domains of psychosocial functioning that are
associated with recovery from traumatic brain injury. The results of the present study will then be presented and integrated with extant work.

Definition and Classification of Traumatic Brain Injury

A traumatic brain injury involves cerebral damage that occurs after birth, and is not directly related to a developmental disorder or a progressive damaging of the brain. Traumatic brain injury refers to a specific form of acquired brain injury that is the result of a sudden trauma. The damage to the neural tissue can either be the direct result of the trauma itself, or due to secondary side effects of the trauma.

Traumatic brain injuries are classified by severity into one of three categories: mild, moderate, or severe. How best to classify brain injuries is debated, and several classification systems have been developed, but classification into one of the three categories is usually based upon the following four criteria: Glasgow Coma score, duration of loss of consciousness, duration of alteration of consciousness, and the severity of post-traumatic amnesia (Kay, Harrington, Adams, Anderson, Berrol, Siracuse et al., 1993). Glasgow Coma scores can range between 3 and 14 (or 15 if the modified version of the scale is being used), with lower scores representing deeper states of unconsciousness. Scores are determined by analyzing the patient’s eyes response (1-4 points), verbal response (1-5 points), and motor response (1-5 or 1-6 points). A person is usually identified as having a mild TBI if their coma score falls between 13 and 15, they lost consciousness for less than 30 minutes, the alteration in their consciousness lasted less than 24 hours, and their posttraumatic amnesia was less than 24 hours.

To be identified as having suffered a moderate TBI the patient’s coma score should fall between 9 and 12, their loss of consciousness should be greater than 30
minutes but less than 24 hours, the alteration to their consciousness should have lasted longer than 24 hours, and post traumatic amnesia should be greater than 24 hours but less than 7 days. Finally, to be classified as having a severe traumatic brain injury the patient’s coma scale should be between 3 and 8, they should have lost consciousness for longer than 24 hours, the alteration in their consciousness needs to have been longer than 24 hours, and their post traumatic amnesia should be greater than 7 days.

Common Problems in Traumatic Brain Injury

Before attempting to understand variables that may influence the rehabilitation of patients with traumatic brain injuries, it is important to gain an understanding of some of the difficulties facing those patients. For that reason, this study will outline several of the deficits that patients who have suffered traumatic brain injuries frequently must overcome. Not only do these deficits have a significant impact of the quality of life of these patients, but they have an impact on the way they perceive the world. It is beyond the scope of this study to explore all of the complications that face this patient population, and as such this not an exhaustive list. The problems described below are among the most common, or are directly related to their quality of life.

Pain. Pain is recognized as one of the more common symptoms of patients with traumatic brain injury. Previous research has found that between 22% and 95% of patients who suffer a traumatic brain injury will experience a chronic pain condition (Uomoto & Esselman, 1993). Headaches are the most common pain condition seen in individuals with traumatic brain injury, and these are often accompanied by a variety of symptoms such as fatigue and sensory disturbances (Nicholson & Martelli, 2004). Chronic pain can become an obstacle in rehabilitation, as it can prevent patients from
engaging in certain positive behaviors. For example, chronic pain can interfere with the treatment of psychological disorders, and can negatively impact daily functioning (Teh, Morone, Karp, Belnap, Zhu, Weinger, & Rollman, 2009). Chronic pain can also lead to social isolation, further limiting the community integration of these patients, limiting their access to services, and decreasing their overall quality of life (Kraaimaat, Bakker, Janssen, & Biklsma, 1996). Existing work thus appears to indicate that chronic pain may serve as a barrier between traumatic brain injury patients and community integration.

Prior research has also found that the perception of pain is related to psychological variables such as self-appraised problem-solving ability. Specifically, lower self-appraised problem-solving ability has been associated with higher reported pain levels, depression, and perceived disability (Kerns, Rosenberg, & Otis, 2003). Chronic pain patients are also more likely to experience fear of social interaction, fear of new environments, and fear of illness and death, relative to those without pain (Asmundson, Norton, & Jacobson, 1996). Elevated anxiety and depression contribute to deficits in attention and memory; among patients with traumatic brain injury, psychological distress may exacerbate existing cognitive problems (Schnurr, & MacDonald, 1995). Although chronic pain is a common complaint after traumatic brain injury, the impact of chronic pain on the psychological experiences of this patient population is not yet well understood. Findings from samples of patients with chronic pain suggest that it would be worthwhile to investigate the effect of chronic pain on well-being indicators in traumatic brain injury.
Attentional disturbances. Both traumatic brain injury patients and their therapists commonly report that patients experience difficulty sustaining attention, ignoring distractions, and processing incoming information with sufficient speed (Olver, Ponsford, & Curran, 1996; van Zomeren & van den Burg, 1985). Ziino and Ponsford (2006) demonstrated that the reaction time of individuals with a traumatic brain injury is significantly slower than non-injured persons. In the same study, patients with traumatic brain injuries were more likely than non-patients to make mistakes when presented with complex tasks that relied heavily upon working memory. These studies suggest that patients with traumatic brain injuries show slower reaction times, due in part to their difficulty maintaining attention. The authors of these studies hypothesized that due to patients’ inability to maintain attention, they had difficulty encoding more complex data into their working memory.

Difficulty maintaining or alternating attention is an important variable when working towards community integration. Being part of a community involves a variety of complex social situations and problems, and patients must be able to successfully navigate these challenges. However, Murray and Byrne (2005) showed that individuals with attention deficits might be particularly challenged by problems that require abstract reasoning. This research examined the cognitive skills needed to solve what they described as Insight Problems. These are problems that require people to challenge and change their own assumptions, thereby adapting their way of thinking (Ansburg & Dominowski, 2000). An example of an insight problem presented to participants was, “Suppose you are asked to describe how to throw a ping-pong ball so that it will travel a short distance, come to a dead stop and then reverse itself.” The answer to the question is
to throw the ball up into the air, but this requires many people to rethink their assumption of throwing the ball forward. Although this type of adaptive thinking is likely difficult for patients with traumatic brain injuries, it is required for successful social problem solving and community reintegration in this population.

The results of the study showed that the ability to switch attention was positively associated with the ability to solve insight problems (Murray & Byrne, 2005). This may mean that solving insight problems requires the switching of attention back and forth between alternative solutions. Interestingly, the ability to maintain attention was not as important as the ability to switch attention back and forth. Patients with brain injuries, who often have difficulty with switching attention, may have difficulty solving complex problems because they cannot switch their attention back and forth between solutions. A deficit in attention may therefore lead to poorer community integration and a lower quality of life for patients who have sustained traumatic brain injuries.

Frontal lobe damage/disinhibition. A common area of the brain injured during an accident is the frontal lobe. The frontal lobe is responsible for a variety of executive functions, including inhibition. Not surprisingly, following a traumatic brain injury many patients have difficulty inhibiting their behaviors, especially patients who have suffered injury with a frontal lobe focal point. Due to this deficit, patients often experience difficulties when faced with choice or ambiguity (Burgess & Shallice, 1996). The ability to inhibit behavior, or cognitive control, is needed when a situation is ambiguous or a high probability response is not appropriate. Cognitive control is critical for completing goal directed behaviors, and a weakness in this area can have a significant impact on an individual’s quality of life (Stuss, Shallice, Alexander, & Picton, 1995). Research
examining frontal lobe damage demonstrates that individuals who suffer from such
damage show impaired functioning on a Stroop task (Teh, Morone, Karp, Belnap, Zhu,
Weiner, & Rollman, 2009) – a task that captures difficulty inhibiting an initial response.
These findings highlight the deficits that limit patients’ ability to engage in goal directed
behavior and adapt to their social environments.

Like the ability to maintain attention, frontal lobe skills like inhibition have been
strongly linked to problem-solving ability. For example, individuals with frontal lobe
lesions are significantly worse problem solvers than are members of the general
population (Channon, 2004). Such findings once again illustrate an obstacle that patients
with traumatic brain injuries must face when attempting to include themselves into their
community and increase their quality of life.

**Employment-related difficulties.** A component of community inclusion, and of
perceived quality of life, is the ability to obtain and maintain employment. The cognitive
and emotional deficits that result from a traumatic brain injury can interfere with ability
to perform a variety of vocational roles, and estimations of unemployment after a brain
injury range as high as 70% (McCrimmon & Oddy, 2006). In addition to the practical
difficulties of being unemployed (such as fewer financial resources and decreased health
options), unemployment is also strongly correlated with global quality of life
measurements (Corrigan, Bogner, Mysiw, Clinchot, & Fugate, 2001; Kreuter, Sullivan,
Dahllöf, & Siösteen, 1998). Individuals who are able to maintain employment following
a traumatic brain injury report significantly higher levels of life satisfaction than those
who are not (Corrigan, Bogner, Mysiw, Clinchot, & Fugate, 2001). This relationship
remains significant when many variables, including the severity of the injury are
controlled. Research has also found that the association between employment and self-reported quality of life does not significantly decrease as time since injury increases (Steadman-Pare, Colantonio, Ratcliff, Chase, & Vernich, 2001). This demonstrates the importance of obtaining employment in the rehabilitation process, and suggests that it should be a priority of rehabilitation services to provide patients with the necessary skills to return to work.

However, before it is possible to focus on helping patients obtain employment, it is necessary to gain a more specific understanding of the barriers to employment. Currently the strongest predictor of employment obtainment is executive functioning. Research in rehabilitation populations has found that poor executive functioning is strongly associated with poor work adjustment (Altshuler et al., 2007). However, as will be described later in greater detail, executive functioning is a broad category that contains a variety of cognitive skills, and it is unclear which components are most critical for maintaining employment. In addition, a large amount of the variance seen in employment is not accounted for by executive functioning, and therefore further research is needed to examine alternative variables.

**Awareness.** The ability to monitor one’s own performance and observe the outcomes of that performance is critical for appropriately adapting behavior to a given environment. This skill is likely even more important in patients recovering from a traumatic brain injury, who often have to adjust to a decline in their social and cognitive skills. Unfortunately, individuals with a traumatic brain injury often exhibit impaired awareness of their errors during task performance (O'Keeffe, Dockree, Moloney, Carton, & Robertson, 2007), and as many as 45% of individuals with a traumatic brain injury
suffer from a decrease in their level of awareness (Flashman & McAllister, 2002). As would be expected, this deficit in awareness has also been found to be negatively correlated with everyday functioning and quality of life (O'Keeffe et al., 2007). Decreased awareness also appears to be associated with lower levels of motivation, and a lack of compliance with rehabilitation (Allen & Ruff, 1990). This lack of compliance makes it more difficult for these patients to achieve high levels of independence, and therefore they have difficult reintegrating with their communities.

Quality of Life After Traumatic Brain Injury

The common weaknesses and deficits just discussed are only a small sample of many of the difficulties that patients with traumatic brain injuries have to overcome. As noted, these problems can have a significant effect on the quality of life of patients. However, it remains unclear whether or not the quality of life of patients as a whole is significantly different from the general population, or if only small groups of these patients that experience this decline can attribute it to newly acquired deficits. A longitudinal study done by Johnston and Miklos (2002) reported that life satisfaction appears to steadily decline after an individual experiences a brain injury. Interestingly, injury severity has not been found to be significantly correlated with measures of life satisfaction (Dijkers, 2004; Johnston & Miklos, 2002).

However, other variables have been found to significantly predict levels of life satisfaction in patients with traumatic brain injuries. One variable that was found to be positively correlated with life satisfaction was marital status. Individuals who were married were more likely to report being satisfied with their life, but traumatic brain injury was also found to often be associated with marital conflict (Perlesz, Kinsella &
This suggests that a marital relationship serves as a social support, or as a protective variable in the lives of patients, but that the deficits associated with brain injury threaten that support.

In addition to social relationships, many personal characteristics have been found to be strongly correlated with life satisfaction in the traumatic brain injury population. For example, both self-reported personality traits and social-cognitive beliefs were found in the literature to be significantly correlated with life satisfaction (Rutterford & Wood, 2006; Cicerone & Azulay, 2007). With such comparatively low levels of life satisfaction, it is not surprising that patients who have suffer traumatic brain injuries are also likely to meet criteria for a variety of psychological disorders. Research has found that up to 77% of individuals with a traumatic brain injury meet criteria for major depressive disorder. In addition, up to 28% meet the criteria for substance abuse, 27% for PTSD, and 28% for an anxiety disorder (Moscato, Trevisian, & Willer, 1994). Such findings introduce the question of whether other cognitive characteristics could be significantly correlated with life satisfaction in this population, and how can rehabilitation address these characteristics.

Existing literature identifies two characteristics or broad categories that were repeatedly shown to influence the well-being of these patients: executive functioning and social problem solving (Kendall, Shum, Halson, Bunning, & Teh, 1997; Muscara, Catroppa, & Anderson, 2008; Rath, Simon, Langenbahn, Sherr, & Diller, 2003). Both executive functioning and social problem solving require the integration of a variety of cognitive skills, and directly relate to how people approach novel stimuli/obstacles in their environment.
Executive Functioning

Executive functioning refers to the integration of several cognitive skills people require to adapt to novel situations and pursue their life goals, which includes planning, initiation, and regulation (Lezak, 1982). It is a broad category that encompasses many of the specific skill deficits described earlier in this paper. It can be described as the integration of those skills for the purpose of generating goal directed behavior. Specifically, executive functioning connects directly to the frontal lobe/inhibition abilities described earlier, as well as to cognitive awareness and attention switching. In order to develop new behaviors, previous behaviors need to be inhibited, one needs to be able to attend to multiple alternative solutions, and one must be aware of one’s own performance to adequately adapt or generate behaviors. Executive dysfunction has been repeatedly seen and documented in traumatic brain injury, and is reported as one of the more common difficulties facing this population (Bamdad, Ryan, & Warden, 2003). Dysfunction in this area limits the ability of individuals to adapt and change their behavior to alter situations, and therefore becomes a major obstacle to the development of independent living skills and community re-entry.

Ylvisaker (1998) describes specific components of executive functioning. He identified self-awareness of strengths and needs, realistic goal-setting, planning necessary behaviors to complete that goal, self-initiation, self-monitoring, self-inhibition, flexibility and problem solving, and strategic behavior (the use of successful behaviors in other situations), as the critical components of executive functioning. Impairment in any of these components can have a significant impact on the executive functioning.
Executive functioning has been connected to a variety of challenges facing the traumatic brain injury population. For example, executive dysfunction has been implicated in poor social outcomes following a brain injury, which may explain some of the findings on executive functioning and employment that were described earlier (Tate, Fenelon, Manning, & Hunter, 1991). It has been hypothesized that cognitive inflexibility leads to problems in social communication. Other researchers have indicated other components of executive functioning as key to establishing appropriate social communication. Williams and Mateer (1991) hypothesized that problems with self-regulation (or inhibition) are linked to social skill deficits and explain many of the social difficulties seen in patients with traumatic brain injuries.

However, there have been inconsistent findings in the literature regarding the relationship between executive dysfunction and social skills deficits. Numerous studies have failed to find a relationship between executive functioning and social outcomes (Fordyce, Roueche, & Prigatano, 1983). Yeates and colleagues (2004) hypothesized that the reason for these inconsistent findings was the presence of a mediator between executive functioning and social skill deficits. Yeates believed that social problem solving is a mediator between executive functioning and social functioning. Effective social problem solving requires a number of abilities seen within executive functioning, such as the ability to generate alternative solutions (Warschausky, Giacoletti, Argento, Hurvitz, & Berg, 2003). In addition, research has shown that there is a correlation between social problem solving and social competence (Crick & Dodge, 1994).
Social Problem Solving (SPS)

Social Problem Solving (SPS) can be seen as the means people use to adapt to and cope with their environment, and the wide range of stressful problems they may face. It is how individuals try to alter the problems they face in their life, or how they change their reactions to those problems. Patients with traumatic brain injuries are faced with a variety of novel challenges and changes in their cognitive skill set, making their social problem solving process a critical component of their social interactions.

This ability to cope with daily problems plays a significant role in personal and social functioning (D’Zurilla & Nezu, 2007; Nezu, 2004). If coping is ineffective, an individual can engage in ineffective behaviors and damage their social relationships. These individuals are then more likely to perceive daily social problems as being stressful, which puts them at risk for developing a variety of psychological disorders and lowers their quality of life. Considering the research connecting traumatic brain injury with a decrease in quality of life, it is important to understand the factors that might help protect or increase the quality of life of those patients (Johnston and Miklos2002). The comorbidity of brain injury and psychological disorders lends further support to the hypothesis that social problem solving may be related to the quality of life of patients with traumatic brain injuries (Moscato, Trevisian, & Willer, 1994).

According to the theory of social problem solving, all life events are possible stressors or problems. How individuals respond to these events is important for determining the level of anxiety the person will experience, their success at integrating into their social environment, and eventually, their perceived quality of life. According to this theory, psychological stress is not simply the experience of facing stressors, but also
includes the individual’s reaction to those stressors. There are multiple factors that
determine how stressful a situation is perceived to be: the characteristics of the situation
itself, the individual’s appraisal of the situation, the individual’s appraisal of his or her
own abilities, and the success of attempted solutions (D’Zurilla & Nezu, 2007; Nezu,
2004). It is possible that individuals with strong social problem solving skills are at least
partially protected from the decrease in quality of life seen after a traumatic brain injury,
because they will better be able to manage these stressors. Likewise, patients with poor
social problem-solving skills might be more likely to show a decrease in their quality of
life, because the stress of the injury is more likely to lead to distress.

D’Zurilla, Nezu, and colleagues developed a model of social problem solving
consisting of two partially independent components: problem orientation and problem-
solving style (D’Zurilla & Nezu, 2007; D’Zurilla, Nezu, & Maydeu-Olivares, 2002;
to the set cognitive and emotional schemas people have about the problems they may face
in their lives, and how they will be able to cope with them. Research has identified two
orthogonal types of problem orientations: positive and negative (Nezu, 2004). Individuals
with a Positive Problem Orientation (PPO) usually view problems as challenges, and are
confident in their ability to overcome or face those challenges. They understand the
utility of negative emotions, and know that they are an integral part of the problem-
solving process. They are also aware of the time and effort that is needed for successful
problem solving. In contrast, individuals with a negative problem orientation (NPO) tend
to view problems as threats, expect problems to be unsolvable, and doubt their ability to
successfully cope with problems. They also find it more difficult to tolerate negative
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emotions they may experience in response to a problem, and may become frustrated or upset.

Perceiving everyday problems as insurmountable threats could lead individuals with a NPO to experience an increased stress response, be more easily overwhelmed by the problems they face, and have a decreased level of motivation for working to overcome those problems. Research has also identified individuals with a NPO as being at risk for having more chronic problems. Therefore, individuals with NPOs might experience a greater amount of stress due to having a larger number of unresolved problems. In contrast, PPO can often lead to an increase in positive emotion, and therefore an increase in motivation to attempt new problem-solving strategies, and fewer unresolved chronic problems (D’Zurilla & Nezu, 2007; D’Zurilla, Nezu, & Maydeu-Olivares, 2002; Nezu, 2004; Nezu, Nezu, Friedman, Faddis, & Houts, 1998).

The second major dimension of social problem solving, problem-solving style, refers to the cognitive and behavioral activities an individual engages in when they are faced with and attempting to solve problems in their life. Researchers have identified three different problem-solving styles: avoidant style, impulsive/carelessness style, and rational/planned style (D’Zurilla, Nezu, & Maydeu-Olivares, 2002). Individuals who use the avoidant style attempt to escape their problems, or look for others to solve the problems for them. Procrastination, passivity, and an overdependence on others are commonly seen as being a part of this style. The impulsive style is associated with hurried decisions, with the individual often using the first solution that comes to mind without examining other potential solutions to the problem. The rational problem-solving style entails the systematic use of skills to approach a problem and to carefully and
thoughtfully discover a solution. The following set of skills is implemented during planful problem solving: problem definition, generation of alternatives, decision making, and solution implementation and verification (D’Zurilla & Nezu, 2007; D’Zurilla, Nezu, & Maydeu-Olivares, 2002; Nezu, 2004). The avoidant and impulsive styles are commonly seen as maladaptive, whereas the planful problem-solving style is seen as adaptive.

The relationship between problem-solving ability and psychological well-being has been given considerable empirical attention. Many studies found a significant relationship between problem-solving ability and various forms of psychological well-being (Nezu, 2004; D’Zurilla, Maydeu-Olivares, & Kant 1997). The effectiveness of one’s problem-solving ability has been found to moderate the relationship between stress and distress (Nezu, 2004). These findings have led researchers to suggest that social problem-solving ability may have a significant impact on stress. Ineffective problem solving could increase the number of stressors an individual is exposed to, as well increase the duration of the distress caused by those stressors. Elevated levels of distress offer a possible explanation to the decline in quality of life seen in the traumatic brain injury population.

Problem orientation seems as though it may be an even more relevant factor in brain injury, when compared to problem-solving style, considering the deficits those patients often face. As described earlier, patients with traumatic brain injuries often suffer impairments in their executive functioning and attention. These deficits likely make the process of rational problem solving more arduous and time consuming. They are also often being confronted with the grief of realizing these difficulties are a new experience to them and a direct result of their brain injury. These hardships will make it important
for the patients to face social problems with a greater level of patience, realistic optimism, and with an understanding of how to utilize their emotional responses, both positive and negative.

**Problem Solving and Depression**

Given the nature of SPS, individuals with problem-solving deficits (defined as having a NPO or a maladaptive problem-solving style) would be expected to be at a greater risk of suffering from depression, and research has found that relationship (D’Zurilla, Chang, Nottingham, Faccini, & Titulo, 1998). Across age groups problem-solving deficits have been found to be significantly related to depression and anxiety. Specifically, researchers have found that deficits in problem solving are associated with an increase in depressive symptoms (Nezu, 2004).

It seems possible, given the strong relationship between problem-solving deficits and depression, that problem-solving deficits will be related to the increased levels of major depressive disorder seen in patients with traumatic brain injury. NPO and maladaptive problem-solving styles may be the mechanisms that cause those individuals to have difficulty adjusting to their environment and to their disability, which then makes them more likely to develop depression or other mood/anxiety disorders. This also relates to the concept of social involvement and community integration among patients with traumatic brain injuries. Depression is an illness commonly associated with social isolation, and therefore is a natural barrier to social inclusion. Social isolation and depression have been found to be correlated to one another, and to mortality within chronic health populations (Frasure-Smith et al., 2000). Strong social problem-solving
ability could help prevent the development of depression and social isolation, therefore increasing community inclusion, and increasing the quality of life of patients with a TBI.

**Gender Differences in Traumatic Brain Injury and Problem Solving**

Gender was discussed earlier in this study to illustrate some of the striking differences found in the traumatic brain injury population. Gender has been found to be significantly related to frequency of brain injury, as well as a variety of outcomes. Research has found that men are about twice as likely as women to suffer a traumatic brain injury; however, that difference does seem to decrease in older populations (Guerrero, Thurman, & Sniezek, 2000). Other research has also found that women show less of a decline in cognitive functioning following a traumatic brain injury, and are more likely to suffer from depression during rehabilitation, but also report lower levels of psychological stress (Schopp, Shigaki, Johnstone, & Kirkpatrick, 2004).

Gender has also been found to be significantly related to different aspects of problem solving. D’Zurilla, Maydeu-Olivares, & Kant (1997) conducted a study that used the Social Problem-Solving Inventory-Revised to examine gender differences in social problem-solving ability. Their study looked at a large group of undergraduate students between the ages of 17 and 20, a group of individuals between the ages of 40 and 55, and finally a large group of individuals between the ages of 60 and 80. The study found that on average, men scored higher on positive problem orientation and lower on negative problem orientation than did women. However, when the researchers controlled for age they found the gender difference only existed within the young adult group. This study illustrates the importance of controlling for age and gender when examining the effects of social problem solving.
Social Problem Solving and Traumatic Brain Injury

Much of the early research on problem solving in traumatic brain injury usually treated social problem solving as a cognitive skill. A prime example of this is research that was done by Ben-Yishay, Rattok, and Lakin (1985). They identified the steps involved in planful problem solving, including problem definition, generation of solutions, evaluation of solutions, and the implementation of solutions. The treatment they designed focused on helping patients to think more rationally. In fact, the steps they identified are nearly identical to the steps that are part of the previously mentioned rational/planful problem-solving style. These treatments were successful in reducing the pathological behavior of the patients, but this model appears to be somewhat incomplete. This early research on problem solving and traumatic brain injury fails to address the motivational, attitudinal, and affective aspects of problem solving. Although these studies address the concept of problem-solving style, they appear to be missing the other component of social problem solving, problem orientation. Two recent meta-analytic reviews of the Problem-Solving Therapy (PST) literature found that therapies that did not include a specific focus on the orientation component of SPS, generated less efficacious outcomes (Bell & D’Zurilla, 2009; Malouff, Thorsteinsson, & Schutte, 2007).

As described earlier, a negative problem orientation can lead to negative affect and avoidance. This increased avoidance may disrupt the use of the problem-solving skills an individual may possess. Research on non-injured individuals has demonstrated that problem-solving therapy that includes problem orientation training is superior to treatment that does not include such training (Nezu, Nezu, & Perri, 1989). Problem orientation appears to be especially relevant in traumatic brain injury,
considering affective reactions have been found to have a negative impact on the problem-solving ability of patients with traumatic brain injury (Tate, 1999). Fasotti, Kovacs, Eling, and Brower (2000) believed that patients may experience an information overload when confronted with complex social situations, and that this information overload leads to difficulty controlling their affect. They believed that the reason patients were more susceptible to this information overload was their slowed processing speed. A common side effect of brain injury is slowed processing speed, and this slowdown can make it difficult for the patient to analyze and understand all of the variables present in a complex social situation.

In addition, Rath, Simon, Landenbahn, Sherr, and Diller (2003) argued that it was not just the information overload that led to emotional overreactions, but also the distress caused from the subjective experience of information overload. They argued that patients with traumatic brain injury may experience distress due to an awareness of their impaired cognitive abilities, and this distress can lead to an exacerbation of their negative affect.

**Social problem-solving treatments for traumatic brain injury.** Although researchers and clinicians have addressed problem solving, the majority fail to address the problem orientation component. One exception is a study done by Rath, Simon, Landenbahn, Sherr, and Diller (2003). The purpose of their study was to examine the effectiveness on a rehabilitation program design to incorporate the concepts of social problem solving. They believed this would provide the patients with the emotional regulation they needed to implement the problem-solving skills they had.

Their study had sixty participants with traumatic brain injury, 27 of which who completed the treatment that included the components of problem solving, and 19 who
completed a conventional treatment program. Participants were selected who were at a higher-level, and could handle cognitively demanding tasks. Participants who had severe language deficits, psychoses, active substance abuse, or other neurological conditions were excluded from the study.

The group with the problem-solving components met once a week for a two-hour session, and the conventional group met for 2-3 hours per week, and included cognitive remediation and psychosocial training. In both groups participants were required to keep notes and provide a review of those notes at the next session. Both groups had two group leaders who were doctoral-level psychologists. In addition to the group meetings themselves, the participants in the social problem-solving group received 1-hour individual review sessions of the material presented during that week’s group session. Participants in the conventional group received 1-2 hours of individual cognitive remediation.

The social problem-solving group consisted of 12 sessions dedicated to problem orientation and emotional regulation, and 12 sessions dedicated to problem-solving style and clear thinking. The twelve sessions that focused on problem orientation were divided into four three-session modules. These sessions focused on removing individual obstacles to the use of effective problem-solving skills, and increasing the individual’s motivation to use those skills. During the first module group members were taught to identify “signals” that suggest there is a real problem present. During module 2, the group members were taught to accurately label problems to help the patients appropriately confront the problems they were faced with. The last module focused on helping the
patients to identify the characteristics of their brain injury that are likely to be “pitfalls” for them.

Throughout the different modules, the researchers emphasized helping the patients to inhibit their emotional reactions and helping them to be less impulsive. Group members were taught how to observe their physiological arousal and how to respond accordingly. They were also shown how to identify negative self-talk, and to replace that self-talk with positive internal statements. These and a variety of other techniques were taught to the participants for the purpose of addressing the motivational and attitudinal components of social problem solving.

During the second 12 sessions, participants were encouraged to continue the self-regulation exercises they previously learned, while being taught the necessary stages of rational problem solving. Participants were taught to “stop and think,” and then they were supposed to go through a sequence of problem-solving steps. The steps involved identifying the problem, generating multiple solutions, weighting the positives and negatives of those solutions, implementing a solution, and analyzing the effectiveness of the chosen solution. It was important that the participants learned to implement the steps to problem solving while maintaining the techniques they use to maintain a positive problem orientation.

The results of the study showed that the participants in the problem-solving treatment group showed significantly higher levels of improvement in executive functioning, problem-solving self-appraisal, emotional regulation, visual memory, immediate recall, and self-esteem. These results showed the importance of considering the components of social problem solving when developing rehabilitation treatments for
persons with a traumatic brain injury. It also showed that it was possible to design a treatment for traumatic brain injury patients that combined the concepts of problem orientation and problem-solving style.

There were several limitations to this study, however. First, the participants were all patients who were relatively high functioning, which limits the generalizability of these findings to the broader brain injury population. It is difficult to determine if social problem-solving deficits would exhibit the same characteristics in a lower functioning population, and if that population would respond to similar techniques. A second limitation of this study was the use of a social problem solving self-report measure that has not been validated for use within a traumatic brain injury population, and it is difficult to determine if its findings are valid within this study. This concern is somewhat minimized by the use of participants who maintain a high level of cognitive functioning, but the concern is still present.

**Assessing social problem solving in a traumatic brain injury population.** When working with patients who have suffered a brain injury, it is important to not assume the validity of self-report measures. Due to the cognitive deficits commonly seen in traumatic brain injury, patients’ responses to certain questions may no longer be valid. Kendall, Shum, Halson, Bunning, and Teh (1997) examined the validity of using self-report measures in a traumatic brain injury population to measure social problem-solving ability. In their study they used a video vignette to analyze the validity of the Social Problem-Solving Inventory, a self-report measure.

The study had a total of 30 participants, 15 participants who had suffered a traumatic brain injury and 15 who were part of an age matched control group. As with the
previous study, participants were chosen who had a relatively high level of functioning. Participants were excluded if they had severe memory deficits, other neurological problems, a chronic illness, or psychiatric conditions. They matched the education level of the control group with that of the traumatic brain injury group.

The self-report measure they used was designed to measure both the motivational and skill components of social problem solving. However, they chose only to use the items on the measure that assessed the skills component, because the focus of the study was on problem-solving skills. This potentially limits the validity of this study, because as described earlier it is important to consider the motivational component of problem solving.

The second method the study used to measure social problem-solving ability was a video vignette. Twelve different situations were selected for the video vignette, which were believed to present the participants with a variety of social problem situations. The situations involved refusing unreasonable requests, dealing with criticism, dealing with objectionable behavior, and understanding nonverbal cues. These categories were chosen because they were seen as being particularly relevant to patients with traumatic brain injury, who often have trouble in those selected areas. Each vignette on the video was a 30-second clip. The clip presented a social problem, but did not provide a solution. After viewing each clip, participants were asked how they thought the main characters should respond. They were asked to identify the problem for the main character, describe that problem, generate as many solutions as they could, and describe how they would implement one of the solutions. Two independent raters scored the responses of the participants.
The results of the study found that on the video vignette task, the patients with a traumatic brain injury showed a significant impairment in their problem-solving skills. Specifically, the patients showed impairments in their ability to identify social problems, and in their ability to generate multiple solutions. This is not a surprising result considering the deficits in executive functioning that are seen in this population. However, the answer participants gave on the self-report measure did not correlate with their performance on the video vignette. The answers the patients gave on the self-report measure did not significantly differ from those of the control group, despite the differences in performance between the two groups on the video vignette. This appears to suggest that self-report measures designed to measure the components of social problem solving are less valid within this population. However, there are several limitations to this study that should be addressed.

One limitation is that this study used an older version of the Social Problem-Solving Inventory. A newer revised version has been developed and has been found to be more valid for measuring the components of social problem solving. Also removing the questions in the measure designed to address the component of problem orientation, could be having a negative impact on the validity of the measure, and might explain the lack of correlation between the measure and the vignette. It is possible that certain characteristics of having a negative problem orientation are having a negative impact on the performance of the brain injury patients, and without measuring problem orientation this would not be noticed. In addition, the self-report measure looks more at the style individuals use to solve problems, and does not necessarily measure their ability as the
vignette does. An individual can have a tendency to use a rational problem-solving style, but still have deficits that make it difficult for them to implement.

**Social Problem Solving and Executive Functioning**

One previous study directly examined if social problem solving mediated the relationship between executive functioning and community integration (Muscara, Catroppa, & Anderson, 2008). The purpose of their study was to examine the hypothesis that social problem solving is a mediator between executive functioning and social outcomes. The authors proposed that identifying social problem solving as a mediator would explain the inconsistent findings regarding executive functioning and social outcomes in a traumatic brain injury population.

This study recruited 76 adolescents between the ages of 8 and 12. Participants were excluded if they had any other neurological disorder, a pre-injury developmental disorder, history of abuse, or a documented learning disability. Unlike the previously mentioned studies, this study allowed patients with more severe brain injuries, but classified them as mild, moderate, or severe. However, all participants were required to have experienced post-traumatic amnesia in order to participate in study.

Executive functioning was measured in the study using 6 different tests: Letter-Number Sequencing from the WAIS-III (Wechsler, 1997), Number Letter Trails from the Delis Kaplan Executive Functioning System (Delis, Kaplan, & Kramer, 2001), the Color-Word Interference Task (Delis, Kaplan, & Kramer, 2001), the Sorting Task, the Verbal Fluency Task (Delis, Kaplan, & Kramer, 2001), and the Behavior Rating Inventory of Executive Function (Gioia, Isquith, Guy, & Kenworthy, 2000). The Letter-Number Sequencing test is used to measure attention and working memory, the Number-Letter
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Trails measures cognitive flexibility, the Color-Word Interference Task is used to measure response inhibition, the Sorting Task examines the ability of participants to understand abstract concepts, and the Verbal Fluency Task evaluates verbal fluency and the generation alternative responses. The Behavior Rating Inventory of Executive Function is a measure provided to the parents of the participants, and the parents are asked to report their estimation of their child’s level of executive functioning. The participants’ current level of social functioning was measured using the Adaptive Behavior Assessment System (Harrison & Oakland, 2003). There are two parts to the Adaptive Behavior Assessment System, one part that is given to the participants themselves, and the other part that is given to the parents. Finally, the social problem-solving skills of the participants were analyzed using the Social Problem-Solving Inventory: Revised (D’Zurilla, Nezu, & Maydeu-Olivares, 1998).

The results of this study met one of the criterion for establishing a mediation relationship, and executive function was found to be significantly related to social problem solving. In addition, social problem solving was found to be significantly related to executive dysfunction, as measured by the Behavior Rating Inventory of Executive Function. Another of the criterion of mediation, that executive function be significantly correlated with social outcome, was partially supported by this study, as executive functioning was significantly related to the part of the Adaptive Behavior Assessment System that was given to the parents. It was also found that social problem-solving skills were significantly correlated with social outcome, and social problem-solving skills were found to significantly decrease the relationship between executive functioning and social outcome. These results meet the final criteria for mediation, and support the hypothesis
that social problem-solving skills mediate the relationship between executive functioning and social outcome.

One limitation to this study is that executive functioning was not significantly related to the self-report measure of social outcome, and was only significantly related to a caregiver report. In addition, the research only used participants who were children, and research in adults is necessary to examine the generalizability of these results. The study should also be replicated with other measures of social outcome and executive functioning, to measure the reliability of the results.

Outline of the Present Study

Study rationale. There is still a limited amount of research on social problem solving in the traumatic brain injury population, with most research focusing on social problem-solving skills and not on the motivational/attitudinal aspect of social problem solving. However, despite the small body of research, there is a significant amount of evidence linking social problem solving to social outcomes in the brain injury population. Rehabilitation programs based on the theory of social problem solving have successfully increased the quality of life of patients, and decreased many common symptoms of brain injury (Rath, Simon, Landenbahn, Sherr, & Diller 2003). There is also a growing amount of research that indicates social problem solving may mediate the relationship between executive functioning and social outcomes, but there is need for additional work in this area.

The purpose of the present study was to replicate the research that found social problem-solving skills mediate the relationship between executive functioning and social outcome, specifically community inclusion. In addition, the present study was designed
to replicate the findings using a sample from a population of patients who had suffered severe, rather than mild, traumatic brain injuries. In this way, the study was intended to extend the external validity of previous studies, and illustrate the importance of analyzing social problem-solving skills in more severely disabled populations.

Beyond the mediation analysis, an aim of the present study was to examine the relationship between social problem solving and quality of life in patients with traumatic brain injuries. Previous research had indicated that the quality of life of patients with brain injuries is often significantly affected by their injury, but there are a variety of variables that may protect or threaten the quality of life of these patients. The final aim of this study was to determine whether social problem solving might be another one of these variables.

**Hypotheses.** There were two hypotheses for the present study. These hypotheses examined the relationship between executive functioning, social problem solving, community integration, and quality of life.

**Hypothesis 1a.** As previously stated, research has identified a strong correlation between social problem solving and psychological wellbeing (Nezu, 2004; Kant, D’Zurilla, & Maydeu-Olivares, 1997). Therefore, it was predicted that total social problem solving score would explain a significant amount of the variance in quality of life.
Hypothesis 1b. It was also predicted that total social problem solving score would be positively associated with quality of life.

Hypothesis 1c. Negative problem orientation, avoidant style, and impulsive style were expected to negatively be correlated with quality of life.

Hypothesis 2. This study examined a population of patients not frequently studied by researchers, patients who had suffered a severe traumatic brain injury. Despite the difference in the population, the relationship between executive functioning and community integration was expected to be mediated by social problem solving, as was seen in previous research (Muscara, Catroppa, & Anderson 2008).

Method

Participants

All procedures were approved by the Drexel University Institutional Review Board (IRB). All participants for the study were recruited from Bancroft’s Brain Injury Program in New Jersey. Participants were approached while attending day treatment services and those who were interested began the consent process. In total, 35 participants were recruited for the study. The participants ranged in age from 25-66, with a mean age of 44 (SD=11.38). The majority of the participants in the study were Caucasian (83%), male (69%), and single (91%). Most participants had completed high school or had received a GED (86%). All of the participants were at least 1 year post-injury, and had suffered injuries that would qualify as severe.

Inclusion criteria. The following were inclusion criteria for the study: 1) have a confirmed diagnosis of a traumatic brain injury; 2) are at least 18 years of age; 3) are able to read English at the 5th grade level; 4) are oriented to time, place, and year.
Exclusion criteria. Individuals who had a current diagnosis of psychosis (previously diagnosed by a mental health provider).

Measures

Demographic and clinical variables. Demographic data were collected from all patients using a demographic questionnaire. The Demographic questionnaire included the following information: age, sex, race/ethnicity, sexual orientation, marital status, education level, socio-economic status, and current medical conditions. To determine the severity of the injury patients had suffered, data were collected from the records of all participants. The data collected included year of admittance to Bancroft, type of head injury (open or closed), date of injury, coma scale, and duration of loss of consciousness.

Social Problem-Solving Inventory-Revised, Short Form (SPSI-R:S). The model of social problem that was used in this study was originally developed by D’Zurilla and Goldfried (1971), and later expanded by D’Zurilla and Nezu (Maydeu-Olivares & D’Zurilla, 1996; D’Zurilla, 1986). D’Zurilla and Nezu (1990) constructed the Social Problem-Solving Inventory (SPSI) from their refined theory of social problem solving. A series of factor-analytic studies led to revisions in the SPSI, which triggered the creation of the Social Problem-Solving Inventory-Revised (SPSI-R). The SPSI-R is a 52 question self-report measure that measures five scales within the theory of social problem solving. Two of the scales focus on problem orientation and measure the positive and negative problem orientation of the participant. The other three scales focus on problem-solving style, and measure participants tendency to use rational problem solving, impulsive problem solving, or avoidant problem solving when faced with a stressor. A total measure of problem-solving ability is calculated by combining these five
scales. Higher scores on PPO and rational problem solving, and lower scores on NPO, impulsive problem solving, and avoidant problem solving generates a higher score for total problem-solving ability.

The present study used a short form of the revised measure, or the Social Problem-Solving Inventory-Revised: Short. This instrument consists of 25 items with five items in each scale. The Coefficient alpha for negative problem orientation was found to be 0.85 (Spence et al., 2002; Belzar, D’Zurilla, & Maydeu-Olivares, 2001). Test–retest reliability coefficients range from 0.72 (PPO, ICS) to 0.79 (NPO). Correlations between the SPSI-R and the short form range from 0.92 (RPS) to 1.00 (PPO); coefficient alphas range from 0.74 (ICS) to 0.85 (NPO, RPS, AS) (Belzar, D’Zurilla, & Maydeu-Olivares, 2001). There is evidence supporting convergent and discriminant validity of the SPSI-R and short form (D’Zurilla, Nezu, & Maydeu-Olivares 2001).

Wisconsin Card Sorting Test. The Wisconsin Card Sorting Test taps into a variety of components in executive functioning, including abstract reasoning and problem solving. Participants are given 4 cards of different shapes, colors, and numbers, which form 4 categories. They are then provided with new cards they have to match with one of the previous categories. However, the participants are provided with limited information and are not informed if they are supposed to sort the cards by color, form, or number. The only information they are provided with is if they are sorting the cards correctly or not. The Wisconsin Card Sorting Test is widely used by neuropsychologists to assess executive functioning, and the test is considered valid and reliable. This study primarily focused on the number of perseverative responses and categories completed on the
Wisconsin Card Sorting Test, which are identified by the manual as the scores most closely linked to executive functioning (Heaton, 1981).

**Community Integration Questionnaire (CIQ).** The CIQ is a self-report measure which was designed as a brief measure of the community integration of (community conclusion) traumatic brain injury patients (Willer, Ottenbacher, & Coad, 1994). The CIQ consists of 15 questions and scores can range from 0 to 29. Higher scores are indicative of higher levels of community integration, while lower scores are associated with lower levels of community integration. The CIQ can be further divided into three sub categories: home integration, social integration, and productivity. The CIQ has been found by researchers to have good internal consistency (alpha=.75) and excellent test-retest reliability (coefficient=.96) (Dalemans, de Witte, Beurskens, van den Heuvel, & Wade, 2010).

**WHO Quality of Life-BREF (WHOQOL-BREF).** The WHOQOL-BREF instrument comprises 26 self-reported items, which measure the following broad domains: physical health, psychological health, social relationships, and environment (Murphy, Herrman, Hawthorne, Pinzone, & Evert, 2000). Research has found that the WHOQOL-BREF has strong psychometric properties (Skevingtog, Lofty, & O’Connell, 2004). Research on the use of quality of life measures in the TBI population is limited; however, researchers have identified the WHOQOL-BREF as one of the preferred measures (Bullinger, 2002). Raw scores on the measure can range from 24 to 120, with higher scores being indicative of a higher quality of life. The WHOQOL-BREF can be broken down into four separate domains. The 1st domain assess how satisfied the participants are with their physical health, the second domain looks at their psychological
health, the 3\textsuperscript{rd} domain examines their social satisfaction, and finally the fourth domain is related to their satisfaction with their environment.

**Number-Letter Trails.** The Number-Letter Trails from the Delis Kaplan Executive Function System measures the ability to shift attention, which as described earlier is an important cognitive skill for effective problem solving (Delis, Kaplan, & Kramer, 2001). The measure requires participants to draw a line connecting consecutive numbers and letters, switching between the two categories. Completion time was recorded, and was used as an alternative measure of executive functioning for this study. The Letter-Number Trails task is a commonly accepted and used measure within the field of neuropsychology, and has been shown to be valid and reliable.

**Procedure**

Participants were approached at the recruiting sites while they were attending day treatment services. If they were interested in participating in the study, the investigator proceeded with obtaining informed consent. A detailed description of the consent process is provided due to the difficulty of obtaining informed consent with a cognitively impaired population. While an inclusion criterion for this study was the ability to read and understand the consent form, extra time was allotted during the consent process to accommodate individuals who had slowed processing speed, to ensure they had adequate time to process all information. The prospective participants were informed that participation was voluntary and that declining to participate would not negatively affect their rehabilitation program in any way.

Participants reviewed along with the investigator the consent form approved by Drexel University. The consent form described the purpose of the study, procedures, risks
and inconveniences, benefits, confidentiality, voluntary participation, injury clause, health information disclosure, and contact information of investigators. A personal copy of the consent form was provided to each participant. After the consent form was reviewed, the participants were allotted a 15-minute period to comprehend the material in the consent form. After the 15 minutes, the potential participant was asked if they had thought of any questions regarding the consent form. The researcher also asked the participants about the information contained in the consent form to ensure they were able to comprehend the material. After the participant was consented they were given a brief cognitive status exam to ensure they were oriented to time, place, and year. If they were oriented and able to comprehend the consent form, they were consented to participate in the study.

Once informed consent had been given through signature, the participant was then given the measures in the following order: demographic questionnaire, brief cognitive status exam, WCST, SPIS-R:S, CIQ, WHOQOL-BREF, and Number-Letter Trails. Due to concerns over cognitive fatigue, participants were reminded between measures that they could take short breaks before completing the other measures (only two participants asked for breaks). The whole procedure on average took close to 90 minutes, 30 minutes for consent and the brief cognitive status exam, 10 minutes for the demographic questionnaire, CIQ, SPIS-R:S, WHOQOL-BREF, and Number-Letter Trails, and 20 minutes for the WCST.
Data Analysis Plan

All data were analyzed using SPSS software (version 20.0). Descriptive statistics were run on all variables, checking for violation of statistical assumptions. A correlation matrix was used to examine the relationships between variables. All categorical variables were transformed and analyzed using dummy coding. Any demographic variables that were found to be significantly related to the IVs or DVs of the study were entered into the regressions as covariates. To examine the relationship between social problem solving and quality of life (Hypothesis 1), a hierarchical regression analysis was performed in which the quality of life variables were regressed on significant covariates and social problem solving (TSPS score).

To examine the second hypothesis that social problem solving mediates the relationship between executive functioning and community integration, a series of regression analyses were performed following the method outlined by Baron and Kenny (1986). To establish mediation, the independent variable (executive functioning), dependent variable (community integration), and potential mediator (social problem solving) must all be significantly associated with one another. Community integration was regressed on executive functioning alone and then social problem solving was regressed on executive functioning. Finally, community integration was regressed on both executive functioning and social problem solving. The effect of executive functioning on quality of life must be less in the later equation than in the first, if social problem solving was acting as a mediating variable.
Results

Out of the 35 participants who enrolled in the study, 34 completed the entire protocol. One participant was not able to complete the Wisconsin Card Sorting Task because he reported difficulty seeing the testing materials. No other participants were excluded due to missing data. Only one potential participant approached refused to participate in the study.

Descriptive information for all study variables can be found in Table 1. Independent variables include total social problem solving (TSPS), negative problem orientation (NPO), positive problem orientation (PPO), rational problem-solving style (RPS), avoidant style (AS), impulsive style (ICS), categories completed on the Wisconsin Card Sorting Task (Categories), perseverative responses on the Wisconsin Card Sorting Task (PR), time on Trails B, and quality of life (QTOTAL). Several of these variables (PPO, RPS, TSPS, and QTOTAL) appeared to be negatively skewed, and the Categories variable was positively skewed; all other variables were normally distributed. Logarithmic transformations were used to normalize skewed data. Following these transformations, the assumption of normality was once again assessed for each transformed variable. All transformed variables were normally distributed, with skewness and kurtosis falling within normal limits.
Bivariate Analysis of Variables

Correlation coefficients were obtained for independent and dependent variables. The results are displayed in Table 3.

Analysis for Potentially Confounding Variables

Descriptive statistics for all demographic variables can be seen in Table 2. As noted, previous research showed a significant gender difference in the components of social problem solving (D’Zurilla, Maydeu-Olivares, & Kant, 1997). Independent samples t-tests were conducted to compare social problem solving in male and female participants. There was a significant difference in the LOGTSPS scores for male (M=.94, SD=.16) and female (M=.77, SD=.15) participants ($t[33]=2.9$, $p=.007$, 95% CI [.05, .285], $d=1.01$). Several of the components of social problem solving also differed between male and female participants. There was a significant difference in the ICS scores for male (M=10.5, SD=5.3) and female (M=5.8, SD=3.6) participants ($t[33]=2.7$, $p=.012$, 95% CI [1.109, 8.255], $d=.94$). There was also a significant difference in the AS scores for male (M=9, SD=4.9) and female (M=4.9, SD=3.9) participants ($t[33]=2.4$, $p=.021$, 95% CI [.643, 7.539], $d=.836$). No significant differences were found between male and female participants for NPO, LOGPPO, or LOGRPS. Gender was also not significantly correlated with any other independent or dependent variables.

Pearson product-moment correlation coefficients were computed to quantify the relationship between other possible confounding variables and the independent and dependent variables of the study. Participant age was negatively associated with self-reported quality of life (LOGQTOTAL) ($r=.38$, $p=.025$). No other participant characteristics were significantly related to the independent or dependent variables.
Although severity of injury (i.e., coma score, loss of consciousness, alteration of consciousness, and post-traumatic amnesia) was originally expected to be a significant confounding variable, lack of variance in the severity of injury among this sample of participants eliminated this possibility.

Hypothesis Tests

Hierarchical regressions were used to analyze both of the hypotheses of this study. Before the analyses were completed, all relevant variables were examined to ensure they were congruent with the four assumptions of linear regression: linearity, independence, homoscedasticity, and normality of errors. To examine the assumptions, all experimental variables were graphed using a scatter plot, and the residuals of the regression analyses were also plotted (see Figures 1-6). The four assumptions appeared to be met by all experimental variables.

Hypothesis 1a: Total social problem solving score will explain a significant amount of the variance in quality life. The first set of hierarchical regressions were performed to determine the amount of variance in quality of life (LOGQTOTAL) that was explained by the participants’ total social problem solving scores (LOGTSPS). The gender and age of the participants was added into the regression as covariates because of their significant relationships with social problem solving or quality of life. The following equation was used as the regression model: \( \text{LOGQTOTAL} = b_0 + b_1 \text{(Gender)} + b_2 \text{(Age)} + b_3 \text{(LOGTSPS)} + E_i \).

A separate regression was run for each component of social problem solving, to determine if each separate component was predictive of quality of life in the sample. However, gender was not entered into the equations for NPO, LOGPPO, LOGRPS,
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because it was not found to be significantly related to those variables. The following equations were used:

\[
\text{LOGQTOTAL} = b_0 + b_1 \text{ (Age)} + b_2 \text{ (NPO)} + E_i; \text{ LOGQTOTAL} = b_0 + b_1 \text{ (Age)} + b_2 \text{ (LOGPO)} + E_i, \text{ LOGQTOTAL} = b_0 + b_1 \text{ (Age)} + b_2 \text{ (LOGRPS)} + E_i; \text{ LOGQTOTAL} = b_0 + b_1 \text{ (Gender)} + b_2 \text{ (Age)} + b_3 \text{ (ICS)} + E_i; \text{ LOGQTOTAL} = b_0 + b_1 \text{ (Gender)} + b_2 \text{ (Age)} + b_3 \text{ (AS)} + E_i.
\]

For each equation potentially confounding variables were entered into block one, while independent variables were entered into block two.

The first block of the regression that examined the relationship between LOGQTOTAL and LOGTSPS, was significant, suggesting that the gender and age of the participants were significant predictors of their self-reported quality of life. The gender and age of the participants were found to contribute 18.5% (medium effect size) of the variance in quality of life (\(F[2,33] = 3.52, p=.042\)). The model was also significant once LOGTSPS was added, and explained a higher percentage of the variance seen in the quality of life measure. The gender, age, and LOGTSPS score of the participants explained 43.4% (large effect size) of the variance observed in the quality of life measure (\(F[3,33] = 7.66, p=.001\)), which while significant, left 66.6% of the variance unexplained.

The regression showed that on average, the LOGQTOTAL score for women in the study was 0.03 points higher than that of the men (\(\beta = .03, t(33) = 0.40, p=.694\)), and an additional year of life was associated with a .01 increase in the LOGQTOTAL score (\(\beta = .01, t[33]=3.8, p<.001.\) A one point increase in LOGTSPS was associated with a 0.76 increase in LOGQTOTAL (\(\beta = 0.76, t[33]= 3.63, p=.001\)). The results of this analysis provide support for Hypothesis 1a.
Hypothesis 1b: Total social problem solving score will be positively associated with quality of life. The regression analysis described above was also used to test Hypothesis 1b. As hypothesized, participants who scored as having stronger social problem solving abilities reported higher levels in their quality of life.

Hypothesis 1c: Negative problem orientation, avoidant style, and impulsive style will be negatively correlated with quality of life. Although TSPS was significantly correlated with quality of life, separate regression analyses showed that specific components of social problem solving were not as strongly related to quality of life. Neither AS nor ICS were found to be significant predictors of quality of life. A regression model containing AS, gender, and age as predicting variables, explained 27% of the variance in LOGQTOTAL (large effect size) and was significant \( F[3,33]=3.64, p=.024 \). However, a change of 1 in AS was associated with a 0.02 change in LOGQTOTOTAL and was not itself a significant predictor \( \beta=0.02, t[33]=1.83, p=.077 \), although it appeared to be trending towards significance. The regression model with ICS, gender, and age was similar, and explained 26% of the variance in LOGQTOTAL \( F[3,33] = 3.54, p=.026 \). Once again ICS itself was not a significant predictor \( b = .01, t(33) = 1.76, p=.089 \).

Unlike AS and ICS, both orientation components of social problem solving (positive and negative) were significantly correlated with quality of life, as well as the rational problem solving component. The regression for NPO, once properly reflected, supported the first hypothesis of this study, and NPO was negatively correlated with LOGQTOTAL \( b = 0.02, t(33) = 2.26, p=.031 \). In further agreement with the first hypothesis, LOGPPO was positively correlated with LOGQTOTAL \( b = 0.23, t(33) = \)
Hypothesis 2: Social problem solving will mediate the relationship between executive functioning and community integration. Following the method outlined by Baron and Kenny (1986), the first step to determining whether social problem solving acts as a mediator is to establish a significant relationship between executive functioning and community integration. To analyze this first condition of mediation, CIQ was regressed on LOGCategories. The regression model was significant, and LOGCategories explained 12% of the variance in CIQ ($F[1,33]=4.33$, $p=.046$). The equation for the regression showed that in this present sample, number of categories completed on the WCST was positively associated with community integration, as measured by the community integration questionnaire ($\beta= 5.66$, $t[33]=2.08$, $p=.046$). No other measures of executive functioning used in this study (i.e., perseverative responses or completion time on trails B) were significantly correlated with CIQ.

The second step in determining the presence of a mediating variable in this case is establishing a significant relationship between social problem solving and executive functioning. To analyze the second condition of mediation, LOGTSPS was regressed on LOGCategories. LOGCategories explained 1% of the variance in LOGTSPS and was not a significant predictor ($F[1,33]= 0.35$, $p=.558$). As the second condition of mediation was not met, it was determined that social problem solving was not acting as a mediating variable between executive functioning and community integration, and there was no need for further analysis. The second hypothesis of this study was not supported by the data collected from this sample of participants.
**Exploratory analyses.** Although not directly related to any hypotheses of this study, Pearson product-moment correlation coefficients were calculated to further explore the relationship between social problem solving and quality of life. The previous analyses only examined the relationships between social problem solving (and the components of social problem solving) and total quality of life scores. However, responses to the WHOQOL-BREF can be broken down into four separate domains. Pearson correlations were used to examine the relationship between social problem solving and each of the specific domains. The correlation matrix can be found in Table 4. LOGTSPS was significantly related to domains 2 (psychological wellbeing), 3 (social), and 4 (environmental). Reflecting the direction of the correlation, due to the transformation of LOGTSPS, reveals that the social problem solving skills were positively correlated scores for domains 2, 3, and 4 on the quality of life measure.

**Discussion**

Millions of Americans has suffered traumatic brain injuries, and many of those injuries are severe and cause lasting impairments (Langlois, Rutland-Brown, & Thomas, 2004). Individuals who have suffered these severe injuries often experience a significant decrease in their quality of life, and find themselves isolated from their communities (Johnston & Miklos, 2002). Yet the challenges facing patients with more severe injuries have received little empirical attention, as researchers generally focus on developing rehabilitation programs for patients who have sustained mild injuries. The present study was designed to address this gap by exploring cognitive and psychosocial functioning among patients with more severe injuries and deficits. Specifically, the aim of this study was to replicate the mediating effect of social problem solving on the relationship
between executive functioning and community integration, within patients who have suffered severe injuries (Muscara, Catroppa, & Anderson, 2008). This study also extends previous work by examining the relationships between quality of life and social problem solving, in a sample of patients with severe injuries.

**Hypothesis 1**

The results of this study supported the hypothesis that social problem solving was positively correlated with self-reported quality of life in patients who have suffered a TBI. This was expected, because as previously stated, problem solving has been found to modulate the relationship between stress and distress. Patients who have suffered a TBI, especially patients who have suffered a severe TBI, are likely being exposed to numerous and significant stressors (many of which were described at the onset of this paper). Outside of the external stressors, patients who have suffered TBIs are also forced to adjust to a significant decrease in their own cognitive resources, likely the same resources they would have previously used to manage the external stressors they are facing. Therefore, it is not surprising that a skill set that allows these patients to modulate their reactions to stressors, might increase their perceived quality of life.

Social problem solving increasing quality of life through decreasing distress might also be seen in the specific domains of self-reported quality of life that were related to social problem solving. Problem solving was positively correlated with the participants’ perceived psychological, social, and environmental wellbeing, but not with their perceived physical health. Many of the questions that are part of the 1st domain on the quality of life measure are more objective measures of physical health, and less related to the amount of distress the participant is experiencing (e.g. how much medical
treatment do you need to function in your daily life, or how well are you able to get around). If social problem solving is primarily increasing quality of life by decreasing the distress participants are experiencing, and not by helping them resolve the stressors they are facing (where executive functioning may be significant), problem solving would be expected to more strongly correlated with domains 2, 3, and 4 on the measure.

The results of this study suggest that rehabilitation programs might benefit from considering the effect social problem solving orientation and style might be having on the quality of life their patients are experiencing. If nothing else, it may be warranted to consider the importance of incorporating some form of distress tolerance into rehabilitation programs, to help patients manage the stressors they are facing. As discussed previously in this paper, many of the stressors the patients are facing may be chronic in nature, and the patients may be forced to cope with a decreased repertoire of skills.

Hypothesis 2

This study was not able to replicate the work of others, such as Muscara, Catroppa, and Anderson, and did not find that social problem solving was a mediating variable between executive functioning and community integration (2008). Mediation was not possible, as a significant relationship between executive functioning and social problem solving was not found. This could be a result of the small number of participants that were recruited, as a power analysis indicated that the study would need at least 50 participants to achieve a power greater than .8, but the relationship did not appear to be trending towards significance. Another possible explanation is the severity of the deficits in executive functioning that were being seen in this sample (as made apparent by a
median of 1 for categories completed on the WCST). It seems plausible; the patients in this population were experiencing such extreme deficits in executive functioning, that their problem solving orientation and style were no longer a significant predictor of how they interacted with the world. An appropriate metaphor may be the importance of a proper eyeglasses prescription for someone who has lost his or her eyesight. In this example, social problem solving acts as the eyeglass prescription.

Despite the fact that social problem solving was not found to significantly correlate with executive functioning, this study did find that within this population of patients, executive functioning remained a significant predictor of community integration. Participants who were able to complete more categories on the WCST, were generally more integrated into their communities. Generally, this means they were more independently managing their activities of daily living, were able to identify significant social connections, and had more developed leisure activities. This is expected, as patients with more intact executive functioning are generally more capable of living independently. It is somewhat surprising that perseverative responses and performance on Trails B were not associated with community integration, as both variables are considered strong measures of executive functioning.

Most rehabilitation programs that focus on patients who have suffered TBIs already understand the importance of executive functioning, and would likely not be surprised by the results of this study. However, the results once again emphasize the importance of gaining a more complete understanding of the severity of the cognitive deficits a patient is faced with, when developing realistic treatment plans focusing on their community integration. The data suggest that increasing social problem solving in
patients who have suffered severe TBIs, may not significantly affect their community integration. This does not mean however, that social problem solving should not be considered, because as previously discussed it may have a significant impact on a patient’s ability to manage distress and quality of life.

**Limitations**

One limitation of this study was the study’s limited power, which was less than .8. Several of the analyses in particular appeared to have been limited by the power of the study (such as the relationship between perseverative responses and community integration). However, when examining the results of the study it did not appear that a greater number of participants would have a significant impact on the mediation analyses, and the first hypothesis of the study was already supported by the data.

A second limitation of the study was the limited diversity of the sample. The overwhelming majority of the participants in the study sample were single Caucasian males. This leads to questions regarding the external validity of the findings of this study. This is especially relevant considering the cultural sensitivity of many neuropsychological measures, including the measures of executive functioning. It is possible that with different populations of patients executive functioning might not be related in the same way or to the same degree to community integration.

Another limitation of the study that will be discussed, was the study only using self-report measures to assess social problem solving. There are some questions to the validity of using self-report measures to assess social problem solving with patients who have suffered TBIs. It is possible that patients who have sustained a TBI experience a decrease in their level of insight. Therefore, it may be necessary to develop an implicit
measure of social problem solving, in order to more accurately assess the style and
orientation of patients within this population. The study also failed to examine the effect
of testing on the participants’ responses on the self-report measures. Many of the
participants appeared to experience a stress response during testing, specifically during
the measures of executive functioning. The stress responses they experienced, may have
altered their responses to the self-report measures, and may have limited their own self-
awareness.

Future Directions

This study has only begun to examine the relationship between executive
functioning, social problem solving, community integration, and quality of life. For
example, this study was not designed to directly examine the relationship between
community integration and quality of life, which seems like a potentially robust
relationship at face value. Future research could more fully explore these variables, and
potentially provide rehabilitation programs with valuable information. Specifically,
studies with more power could re-examine if social problem solving mediates the
relationship between executive functioning and community integration, and determine
how severity of injury might moderate that mediation, if there is one.

Future research might expand upon the findings of this study by replicating the
study within more diverse populations. As stated, this study has limited external validity,
as it examined a sample of patients with limited diversity, from one rehabilitation site. In
order for the results to be generalized to larger populations of patients, the study will need
to be replicated with many samples. If the results are generalized, it would suggest that
social problem solving is an important factor to consider when attempting to improve the quality of life of patients within this population.

It may also be useful for future researchers to develop ways to assess social problem solving without the use of a self-report measure. This would allow the validity of using self-report measures to assess problem solving in this population to be assessed. Due to the nature of the cognitive deficits seen in this population, the development of new measures will require extensive research, as little research has been done previously. The development of the measure would improve the quality of future research, and allow researchers to be more confident in the construct validity of their studies. Similar measures have been developed by researchers to use in other populations of patients who suffer from cognitive impairment (Nezu, Nezu, & Arean, 1991). It may be possible to adapt these techniques for assessing social problem solving, to work with patients who have suffered TBIs.

Similarly, it may be useful to use a non-self-report measure of community integration. Research has shown that patients who have suffered TBIs may not be able to accurately report, or be aware of their own community integration/participation (Muscara, Catroppa, & Anderson, 2008). Whether or not the level of awareness patients have of their community integration (as well as their awareness of their social problem solving), is in itself a significant variable, may also be an important future research questions.

While not directly related to this research, some researchers have also begun to examine the effect the problem solving of caregivers has on patients, and have found that the wellbeing of the patients is significantly predicted by the problem solving of their
caregivers (Berry, Elliot, Grant, Edwards, & Fine, 2012). However, researchers have not yet looked for this result in patients who have suffered TBIs. Yet this information may be particularly relevant for patients with TBI, as the majority of patients who have suffered severe TBIs require long-term direct care. This care is also frequently provided by professionals and not family members, and little research has looked at the relationship between the problem solving of professional care providers, and the wellbeing of patients. Overall, any research done on this under studied population would likely be beneficial to rehabilitation programs, and to the patients themselves.
References


TRAUMATIC BRAIN INJURY, EXECUTIVE FUNCTIONING, AND SOCIAL PROBLEM SOLVING


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TRAUMATIC BRAIN INJURY, EXECUTIVE FUNCTIONING, AND SOCIAL PROBLEM SOLVING


Table 1. *Descriptive statistics for executive functioning and Social Problem Solving variables.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
<th>Skew</th>
<th>Kurtosis</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q Total</td>
<td>90.37 (14.13)</td>
<td>-.87</td>
<td>1.6</td>
<td>114</td>
<td>46</td>
</tr>
<tr>
<td>CIQ</td>
<td>17.34(4.24)</td>
<td>-.01</td>
<td>-.85</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>PR</td>
<td>31.53(11.21)</td>
<td>.34</td>
<td>-.04</td>
<td>62</td>
<td>14</td>
</tr>
<tr>
<td>Categories</td>
<td>1.44(1.44)</td>
<td>.9</td>
<td>-.23</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Trails B</td>
<td>206.31(108.68)</td>
<td>.64</td>
<td>-.72</td>
<td>420</td>
<td>45</td>
</tr>
<tr>
<td>TSPS</td>
<td>12.67(3.37)</td>
<td>-.91</td>
<td>.95</td>
<td>18</td>
<td>2.8</td>
</tr>
<tr>
<td>PPO</td>
<td>14.94(4.45)</td>
<td>-1.18</td>
<td>.95</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>NPO</td>
<td>7.63(5.02)</td>
<td>.52</td>
<td>-.7</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>RPS</td>
<td>12.77(4.83)</td>
<td>-.97</td>
<td>.68</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>AS</td>
<td>7.71(4.98)</td>
<td>.23</td>
<td>-1</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>ICS</td>
<td>9.03(5.24)</td>
<td>.27</td>
<td>-.67</td>
<td>20</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Q Total = QOL score; CIQ = Community integration score; PR = Perseverative responses; Categories = Categories completed on WCST; Trails B = Seconds to complete; TSPS = Total SPS; PPO = Positive problem orientation; NPO = negative problem orientation; RPS = rational problem solving; AS = avoidant problem solving; ICS = Impulsive problem solving
Table 2. Descriptive statistics for Demographic Data

<table>
<thead>
<tr>
<th></th>
<th>M (SD)</th>
<th>Min</th>
<th>Max</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>44.29 (11.38)</td>
<td>25</td>
<td>66</td>
<td>41</td>
</tr>
<tr>
<td><strong>Cognitive Status</strong></td>
<td>45.66 (9.10)</td>
<td>24</td>
<td>58</td>
<td>34</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td><strong>%</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24</td>
<td>68.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>31.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>32</td>
<td>91.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>3</td>
<td>8.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (Caucasian)</td>
<td>29</td>
<td>82.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black (African American)</td>
<td>6</td>
<td>17.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Psychotropic Medication</td>
<td>18</td>
<td>51.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychotropic Medication</td>
<td>17</td>
<td>48.6</td>
<td></td>
<td></td>
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Table 3. Correlation Coefficients for Experimental Variables

<table>
<thead>
<tr>
<th></th>
<th>CIQ</th>
<th>Trails B</th>
<th>PR</th>
<th>LOGCategories</th>
<th>LOGTSPS</th>
<th>LOGQTOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIQ</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trails B</td>
<td>-.217</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td></td>
<td>-.258</td>
<td>-.023</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOGCategories</td>
<td>.345*</td>
<td>-.241</td>
<td>-.494**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOGTSPS</td>
<td>-.070</td>
<td>-.290</td>
<td>.217</td>
<td>-.104</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LOGQTOTAL</td>
<td>.172</td>
<td>.117</td>
<td>.239</td>
<td>-.199</td>
<td>.405*</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: CIQ = Community integration score; Trails B = Seconds to complete; PR = Perseverative responses; LOGCategories = transformed Categories completed on WCST; LOGTSPS = Total transformed SPS; LOGQTOTAL = Total transformed quality of life

* Correlation is significant at the 0.05 level (2-tailed)
* Correlation is significant at the 0.01 level (2-tailed)
<table>
<thead>
<tr>
<th>Domain 1</th>
<th>Domain 2</th>
<th>Domain 3</th>
<th>Domain 4</th>
<th>LOGTSPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domain 2</td>
<td>.543**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domain 3</td>
<td>.601**</td>
<td>.526**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Domain 4</td>
<td>.542**</td>
<td>.527**</td>
<td>-.570**</td>
<td>1</td>
</tr>
<tr>
<td>LOGTSPS</td>
<td>-.125</td>
<td>-.392*</td>
<td>-.568**</td>
<td>-.449**</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)
* Correlation is significant at the 0.01 level (2-tailed)
Figure 1. Relationship between Quality of Life (WHOQOL-BREF) and Social Problem Solving (SPSI-R:S).
Figure 2. Relationship between Quality of Life (WHOQOL-BREF) and Negative Problem Orientation (SPSI-R-S).

R^2 Linear = 0.130
Figure 3. Relationship between Community Integration (Community Integration Questionnaire) and Executive Functioning (Categories Completed on the WCST).