Predictive Validity of Functional Assessment and Neuropsychological Test Scores in the Vocational Outcome of Persons with Traumatic Brain Injuries

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ABSTRACT

This study examines the validity of using a combination of two psychometric measures, an emotional adjustment measure, and functional assessment measures to predict vocational outcome in a traumatically brain injured population. Patients included 33 males and 11 females, with an average age of 32.3 years, and a stable work history over the past three years prior to injury. All had sustained a traumatic brain injury in the 12 months prior to initial testing, with a mean of 3.8 months since injury. Levels of severity of injury included 24 patients with severe injury, 12 patients with moderate injury, and 8 patients with mild injury. Patients completed the Logical Memory subtest (LM) of the Wechsler Memory Scale-Revised, Paced Auditory Serial Addition Test (PASAT), Beck Depression Inventory (BDI), and Personal Capacities Questionnaire (PCQ). A clinician working closely with the patient also completed the Functional Assessment Inventory (FAI) and the Behavior Checklist (BC) at the time of initial testing. Follow-up testing on available patients (n=16) was completed approximately six months after initial testing. Comparison of the functional assessment measures demonstrated that patients exhibited a decreased awareness of functional limitations relative to clinician's ratings, but identified an increased number of personal strengths. The present study demonstrates the first comparison of FAI and PCQ ratings in a TBI population, as well as the first available field research using the PCQ. Results also indicated that the only significant predictor on earned income after six months was the overall functional limitations score on the PCQ. The only significant difference in patients' test performance at six months with scores at initial testing was seen on the PASAT, which suggested that patients had a significant improvement in their speed of information processing after six months. In addition, comparison of patients from

Canadian and American rehabilitation agencies, respectively, revealed no significant differences between patients at either initial testing or at follow-up.

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To my husband, Brian

and my family

Thanks for all the support

CHAPTER ONE

Introduction

Traumatic brain injury (TBI) is responsible for a significant number of deaths regardless of age, race, or sex, and is one of the leading causes of death for people under the age of 45. In the U.S.A., TBI's are calculated to between 152 to 367 people per 100 000 each year, including many who suffer coma and extreme loss of bodily function (Sorenson & Kraus, 1991; Parker, 1990). The majority of persons who sustain TBI are between 10-30 years of age, with males outnumbering females almost three to one in this age range (Bond, 1986). In Canada, approximately 40 000 patients were discharged from hospitals annually with a diagnosis of skull fracture or intracranial injury (Statistics Canada, 1991). Dacey and Dikmen (1987) indicate that of the persons who sustain non-fatal head injuries, 50-70% receive medical care, 30-50% are hospitalized, while 20-40% receive no medical attention.

The result for those who survive their injuries is often suffering, extensive medical and rehabilitation care, disability and loss of income. Costs include not only the medical expense of the treatment, but also the cost of personal loss of independence. Thus, traumatic brain injury can have severe, lifelong effects that significantly impact the injured person's life in a multitude of ways.

Traumatic brain injury may be defined as " brain damage from a blow or other externally inflicted trauma to the head that results in significant impairment to the individual's physical, psychosocial and/or cognitive abilities" (Corthell & Tooman, 1985, p. 3). It is generally characterized by a change in consciousness, ranging from momentary dazing to prolonged coma during the acute phase after injury. The duration of this altered consciousness varies between individuals and with the severity of the injury.

Injuries may be classified more specifically according to the context in which they occur, and the physiological trauma that results. Direct causes of TBI include such things as closed head injuries, penetrating head injuries, neurotoxins, or birth damage (Parker, 1990). The resultant damage may include focal lesions, diffuse axonal damage, anoxia and/or hemorrhage. The behavioral effects of such injuries depend on various factors, including severity of injury, age, site of lesions, and premorbid personality (Lezak, 1983). TBI is often categorized into levels of severity based on the Glasgow Coma Scale (GCS) (Teasdale & Jennett, 1974)), length of post-traumatic amnesia (PTA), and/or length of loss of consciousness. Injuries are classified as "mild" when GCS is 13-15, PTA is less than an hour, and/or loss of consciousness is less than 20 minutes. Injuries are "moderate" when GCS is 9-12, PTA is greater than an hour but less than 24 hours, and loss of consciousness is greater than 20 minutes but less than an hour. Finally, injuries may be called "severe" when GCS is less than 8, PTA is greater than 24 hours, or loss of consciousness is greater than one hour.

The vast majority of TBI's may be classified as a "closed head injury." In such cases, there is no penetration of the skull, but injury results from sudden acceleration or deceleration of the head, and/or sharp rotational and shearing movements. Initial damage may be at the point of impact ("coup"), which may cause contusion, hemorrhage, or laceration. As the head decelerates, there is a second area of impact opposite to the first ("contrecoup"). Such damage is also possible without a direct blow to the head because of the rapid shifting of the brain within the skull.

A large literature on closed head injuries has identified the most common area of injury to be the anterior tips of the temporal regions and the inferior portions of the frontal lobes due to the close proximity of these areas to the bony projections of the inner table of the skull (Prigatano, 1991; Miller, 1993). Contusions and hematomas are more common in the frontal and temporal lobes than in any other region of the brain (Adams, Graham, Scott, Parker, & Doyle, 1980). Magnetic resonance imaging studies have confirmed that the frontal lobes are the most common location of focal lesions even after mild to moderate injury (Levin et al., 1987).

In addition, rotational acceleration and deceleration of the brain within the skull may result in "shear" injuries within the widespread area of tiny nerve fibers throughout the brain. This shearing effect is often referred to as "diffuse axonal injury," and is of significance since it may not be easily detectable on structural imaging scans (e.g., MRI, CT). This damage, may then be further exacerbated by hemorrhaging and/or edema leading to increased intracerebral pressure. Such injuries often produce a confusing picture of widespread diffuse lesions to both cortical and subcortical structures. Outcome following injury varies from death to prolonged coma to very minimal deficits. The unique nature of every injury complicates any early prediction of outcome, and may vary with such factors as age, location of damage, pre-injury level of functioning, and post-injury medical treatment and support systems (Stratton & Gregory, 1994). However, in some cases, the extent of the physical, cognitive and/or behavioral deficits may not be fully apparent, and the effects may be underestimated initially. In addition, the diffuse damage often associated with closed head injuries may not be accompanied by focal deficits; therefore, it may not always show up on a standard neurological examination. The frequency, nature and course of recovery of closed head injury have been targets for a great deal of investigation; however, despite the attention, the ability of the injured person to pursue a "normal life" remains in question.

Given that the knowledge of recovery following TBI remains uncertain, the question of how to better predict outcome becomes increasingly important. Within the general population, it has not been well-recognized that even mild to moderate injuries may lead to marked impairment with long lasting effects. Kraus and Arzemanian (1989) observe how little epidemiological information can be found in the scientific literature on mild to moderate head injuries, even though these injuries account for the majority of brain trauma in the industrialized world. Available research supports the observations that there may be permanent disabilities even after mild or moderate injuries (Leininger, Gramling, Farrel, Kreutzer & Peck, 1990), but note that victims' emotional and social distress is often ignored, especially if focal signs of neurological damage are minimal or missing.

One important direction for further research is toward the prediction of return to work (return to work). For practical purposes, return to work is a significant criterion of outcome because it requires effective integration of functioning in many areas. Furthermore, because of its clear link to financial status and self-esteem, post-injury vocational status has become a very important variable in head injury research.

Vocational Outcome

Perhaps one of the greatest challenges to persons following rehabilitation is to find and maintain some form of employment. Head injury can cause deficits in physical, cognitive and psychosocial functioning, each of which may make it difficult to return to work. The combination of such deficits, seen in many individuals following TBI, is thought to be largely responsible for the high rate of unemployment post-injury (Parker, 1990; Lyons & Morse, 1988). Reduced post-injury work status has been related to cognitive, psychosocial and physical difficulties (Crepeau & Scherzer, 1993; Stambrook, Moore, Peters, Deviaene & Hawryluk, 1990). More specifically, it has been suggested that the cognitive and behavioral deficits post-injury, more so than physical disabilities, may have the greatest impact on vocational outcome (Bruckner & Randle, 1972; Weddell, Oddy & Jenkins, 1980; Lezak, 1987; Parker, 1990).

The available research strongly suggests that a majority of persons with moderate to severe brain injury repeatedly fail in their efforts to return to competitive employment (Crepeau & Scherzer, 1993; Ezrachi, Ben-Yishay, Kay, Diller & Rattock, 1991; Wehman, Kreutzer, Sale, West, Morton & Diambra, 1989). In addition, this difficulty appears to persist long after the person has physically recovered. Weddell et al. (1980) found that even two years post-injury, 50% of patients studied were unable to return to work at all. Brooks, McKinlay, Symington, Beattie and Campsie (1987) examined post-injury employment status of severely injured patients two to seven years post-injury. They found that only 29% were working at the time of follow-up, compared to 86% who were employed prior to injury. Furthermore, this unemployment rate remained stable beyond two years. Other researchers have also found relatively high unemployment rates following TBI. For example (Peck et al., 1984; cited in Wehman et al., 1989) found an unemployment rate of 52% approximately 3.5 years after injury, while Jellinek, Torkelson and Harvey (1988) found 59% unemployment rate four years post-injury. Even with vocational rehabilitative efforts, Ben-Yishay, Silver, Piasetsky and Rattock (1987) reported that only 63% of their sample was employed after 12 months, 59% at 24 months, and 50% at thirty-six months. In a Canadian population, Klonoff and Snow (1991) found that nearly half of severely injured patients were unemployed two to four years post-injury, compared to 75% of persons with moderate injuries, and 94% of persons with mild injuries. Furthermore, many injured individuals who do return often take on less demanding positions for lesser compensation and may have difficulty maintaining employment (Lubusko, Moore, Stambrook & Gill, 1994; Brooks et al., 1987; McMordie, Barker & Paolo, 1990; Fraser, Dikmen, McLean, Miller & Temkin, 1988; Lacroix, 1992).

Further research also indicates that even those sustaining mild head injuries may experience significant problems in returning to their previous level of employment (Rimel, Giordani, Barth, Boll & Jane, 1981), although the extent and time course of such problems is controversial. In addition, the existence of long-term residual deficits and effects on employment remains in question. In a review of the literature, Fordyce (1991) states that it appears that the large majority of mild head-injured patients will not show significant impairments when tested at least two months from the time of the injury. On the other hand, in a sample containing 60% mild head injuries, Fraser et al. (1988) indicated that although 73% returned to work one year after injury, nearly half reported significant difficulties related to their injuries. Similarly, Klonoff & Snow

(1991) report that a substantial disruption in work may be experienced by less severely injured patients. In their sample containing 60% mild head injuries, and 78% employment two to four years post-injury, they indicate that many participants reported difficulty with interpersonal relationships on the job, and reduced productivity. Further research is clearly needed in order to delineate which, if any, aspects of mild head injury impact on later employment.

In addition to the direct effects of the head injury, other non-injury factors may play a role in vocational outcome. A negative correlation between age and employment has been shown (Wrightson & Gronwall, 1981; Brooks et al., 1987; McMordie et al., 1990), although Crepeau and Scherzer (1993) conclude that there is no association between age and employment outcome until age 60. Higher levels of education are associated with better vocational outcome (Rimel et al., 1981; Wehman, Kreutzer, Stonnington & Wood, 1988). Although Brooks et al. (1987) suggest that pre-injury employment level is not significantly related to return to work, Stambrook et al. (1990) indicate that lower post-injury occupational status is related to lower pre-injury vocational status. Other factors such as pre-existing personality, pre-injury IQ, alcohol/drug use, and social support systems could also affect return to work efforts. Although difficult to control, researchers need to be aware of the possible impact of such variables.

As noted above, follow-up several years post-injury suggests that a significant proportion of individuals are unable to return to previous levels of employment, while many may not be able to return to work at all. The existing research has identified a wide variety of possible factors which play a role in return to work. Gronwall (1977) points out the need to use both objective and subjective measures of work ability, and states that if the clinician bases the assessment of work ability on subjective reports only, it may be difficult to discriminate a genuinely disabled patient from one who is malingering. Given the possible combination of interacting factors, including cognitive abilities, emotional and social functioning, and functional limitations, it would be reasonable to examine a broad range of factors in any attempt to predict return to work following TBI.

Neuropsychological Deficits

The assessment of cognitive abilities following TBI is often considered a critical stage in the rehabilitation process, and difficulty in returning to work has often been associated with decreased cognitive abilities. Apart from possible focal damage, the damage often caused by TBI may consist of minute lesions and lacerations that affect a wide range of cognitive functions. The result may be a pattern of diffuse damage without clear evidence of focality regardless of the site of impact. This kind of damage may compromise general intellectual functions, mental speed, attention, memory, cognitive efficiency, praxis, sensory perceptual abilities, and/or higher level concept formation and complex reasoning abilities (Parker, 1990; Lezak, 1983; Squire, 1986). Ben-Yishay and Diller (1983) state that because cognitive deficits affect the way a person perceives and responds to the environment, they "unequivocally outstrip the physical deficits as the primary cause of difficulty in independent living, social re-adaptation, family life, vocational and educational pursuits" (p. 17).

Research has also begun to recognize that even mild head injuries may result in significant cognitive impairments. For example, a blow that fails to produce any loss of consciousness can cause a pronounced temporary impairment of recent memory (Binder, 1986). However, there remains great controversy about the chronicity of symptoms following mild injury, and the relative impact of physical versus psychological factors in their continuation. Several studies suggest that mild brain injury may well have longer lasting, possibly permanent, effects than is often thought. Rimel et al. (1981) found that only 2% of patients with minor head injury had positive neurological findings three months later, despite the fact that 78% complained of headaches, 59% of memory deficits and 15% of difficulties with activities of daily living or transportation. Dacey and Dikman (1987) point out that despite an initially normal neurological examination or mild alteration in the level of consciousness, 1-3% of patients sustaining a mild injury will require a neurosurgical operative procedure. Many symptoms of mild and severe head injuries are reported to be similar, especially in such areas as memory and attention, headaches, dizziness and irritability (Uzell, Langfitt & Dolinkas, 1987), suggesting that there may well be some common areas of damage. Miller (1986) suggests that subtle neurobehavioural consequences of seemingly "mild" head injuries have been grossly underestimated. These deficits, although often unrecognized, may seriously interfere with personal, social and vocational adjustment. Parker (1990) states "their relatively less disabling symptoms may significantly affect their ability to resume normal lives" (p. 281).

In order to aid rehabilitation planning, standardized neuropsychological testing is frequently used to try to identify cognitive strengths and weaknesses following TBI. In addition, the results have be used to try to predict the future likelihood of return to independent living and/or work. As noted earlier, various types of cognitive deficits may be seen following injury. Perhaps the most common deficits experienced are difficulties in attention, speed of information processing, and memory (Bond, 1986). Given the large number of persons who experience these types of deficits, and their apparent importance in everyday functioning, the present study will focus primarily on these areas of neuropsychological dysfunction as possible predictors of vocational outcome.

Memory

Difficulty with memory is also an extremely common deficit, and is the complaint most often reported both by the injured individual and by the family (Baddeley, Harris, Sunderland, Watts & Wilson, 1987). Hart (1994) points out that among the wide variety of neuropsychological impairment following TBI, memory impairment may be the most prominent and persistent deficit. Memory function is extremely complex, due to a variety of symptoms that occur, changes over time, and possibly some dependence on the location of damage. Structures that have been implicated in memory function include the temporal lobe (cortex, hippocampus, amygdala), the diencephalon (mediodorsal thalamus, mammillary bodies), and the frontal lobes, all of which may be affected significantly by a closed head injury.

Memory problems are often apparent immediately following coma, in the form of post-traumatic amnesia (PTA). PTA may be defined as the state of confusion and disorientation following trauma during which the patient seems unable to acquire and retrieve new information (Russel, 1971). Various studies suggest that patients with a PTA of more than a week may suffer permanent disorders of memory, especially in the encoding of new information (Bennett-Levy, 1984). However, the presence of an extended PTA is not necessarily a prerequisite for memory impairment.

Even after resolution of PTA, a large number of injured persons continue to experience marked memory impairment. In fact, the diffuse damage caused by closed head injury may often cause more severe memory deficits than does focal damage (Bond, 1986). Brooks (1983) points out that final levels of recovery of memory vary considerably, as does the time for best recovery. Interestingly, the severity of the injury appears to be related to the final level of deficit, but not to the rate of recovery (Bond, 1986).

Memory has traditionally been tested with the Wechsler Memory Scale (WMS) (Wechsler, 1945), and the more recent Wechsler Memory Scale-Revised (WMS-R) (Wechsler, 1987). Although various types of memory are tested by the WMS and WMS-R the focus of the present review will be on verbal memory. Given the emphasis on language and communication across many aspects of society, including the work place, the assessment of verbal memory is critical in TBI evaluation (Guilmette & Rasille, 1995). Early studies evaluating the Wechsler Memory Scale (WMS) performance after closed head injury suggest that scores on the Logical Memory subtest

(LM) and paired-associate learning decreased as a function of PTA (Brooks, 1976). Kear-Colwell and Heller (1980) administered the WMS to a group of closed head-injured patients and normals. They concluded that although head injury was associated with decreases in all aspects of memory function, it had a particularly marked effect on tasks that required the new learning of verbal material and its immediate recall. Similar detrimental effects on verbal learning have also been found with symptomatic mild head injured persons (Leininger et al., 1990).

The assessment of verbal memory has relied heavily on three basic measures: paragraph recall (e.g., LM), list learning (e.g., Rey Auditory Verbal Learning Test, California Verbal Learning Test), and paired-associate learning (Verbal Paired Associates on WMS-R). Given that prose recall presents information within a meaningful context, it is suggested that the use of a paragraph learning paradigm would be the closest emulation of a real life situation, such as a job. Kischka, Ettlin, Heim & Schmidt (1991) found that LM was more sensitive than paired-associates learning in confirming the memory complaints of patients following whiplash injuries. Similar conclusions were reached by Baddeley et al. (1987), who found that prose recall was significantly correlated with patient ($r=.50$) and relative ($r=.58$) subjective reports of memory problems, but that other memory tests (e.g., recognition of abstract figures, face memory) were not. In addition, although well-learned information (e.g., vocabulary) was often retained, the speed of access to that information was impaired. It has been demonstrated that severely injured patients perform worse on the LM subtest relative to both normative data and normal controls (Reid & Kelly, 1993; Crossen & Wiens, 1988). Other researchers have suggested that LM performance may also be impaired following mild brain injury (Krischka et al., 1991), although this finding is not universal. Guilmette and Rasile (1995) found that scores on the LM subtest did not reliably discriminate mild brain injuries based on comparison to normative data.

Several studies suggest that memory decline has a significant impact on return to work. Early work by Ben-Yishay et al. (cited in Hart & Hayden, 1986) suggested that measures of immediate memory were more effective than VIQ for predicting vocational competence. Lam, Priddy and Johnson (1991) found that a competitively employed group differed significantly from a marginally employed and from an unemployed group on a measure of visual spatial memory (Benton Visual Retention Test). Brooks et al. (1987) found that within a battery of tests, the only measure of memory that was a reliable predictor of return to work was the Logical Memory subtest of the WMS. Like Baddeley et al. (1987), they suggest that while some measures of memory and attention may be useful predictors, other measures are of questionable value. Ben-Yishay et al. (1987) support these conclusions, suggesting that within the cognitive realm, deficits in memory, learning and attention are the primary reasons for employment failure.

Attention and Information Processing

A common complaint by patients and relatives following head injury is difficulty with attention and/or concentration (Oddy, Coughlan, Tyerman & Jenkins, 1985; Van Zomeren & Van den Burg, 1985). Several studies have identified deficits on measures of sustained attention and concentration, speed of thinking and new learning during the more acute stages of recovery (Gronwall, 1977; McMillan & Glucksman, 1987; McLean, Temkin, Dikmen & Wyler, 1983), and research suggests that longer term attentional deficits may result directly from closed head injury (Gronwall & Sampson, 1974; Stuss et al., 1985; Parasuraman, Mutter & Molloy, 1991; Ponsford & Kinsella, 1992). Such deficits may be difficult to characterize due to the variety of definitions of attention and its components. Ponsford and Kinsella (1992) addressed this difficulty, and examined the nature of the attention deficit in a group of severely head injured subjects. They found no evidence for the presence of deficits in focused attention, sustained attention, or supervisory attentional control, but found significant evidence for a reduction in the speed of information processing. Other research has also characterized this deficit in information processing as one of the most pronounced and persistent cognitive deficits associated with closed head injury (Van Zomeren, Brouwer & Deelman, 1984; Schmitter-Edgecombe, Marks, Fahy & Long, 1992).

Although the subject remains controversial, other researchers have also noted alterations in information processing following mild head injuries. Leininger et al. (1990) concluded that deficits can be found in some individuals three months to three years post-injury. Compared to normals, symptomatic mild head-injured subjects scored significantly worse on tests of reasoning and speed of information processing. The severity of the deficits was not correlated with neurological status (e.g., conscious or unconscious) immediately following injury. Katz and DeLuca (1992) also report significant attention and information processing deficits in the absence of apparent neurologic problems, and suggest that both anatomic factors and neurotransmitter changes may contribute to the pathologic sequelae. Most symptoms abate within the first few months, but a sizable subgroup remain symptomatic up to one year or more.

Schneider and Schiffrin (1977) proposed that there are two forms of information processing. "Automatic processing" occurs without conscious control, has no capacity limitations, and does not demand conscious attention. On the other hand, "controlled processing" requires conscious attention and has a limited capacity and rate. They further suggest that there are two measures of efficiency of controlled processing: speed of performance and accuracy. They conclude that attention deficits result when the demands of a task exceed the person's conscious processing capacity or speed. Given that there seems to be this limited capacity, it would be controlled processing that would be most affected following closed head injury.

This reduced rate of controlled, or effortful, processing may be directly attributed to deficits in cognitive abilities post-injury. Although there is some evidence that peripheral sensory and motor processes may be slowed following severe head injury

(Hannay, Levin & Kay, 1982), research strongly suggests that deficits in central cognitive processes are primarily responsible for the slowed speed of information processing after head injury. Schmitter-Edgecombe et al. (1992) suggest that severe closed head injury patients exhibit a deficit in the efficiency of the encoding stage of information processing, in addition to impairments in the decision making/response selection process. Similar findings have been reported in various other studies of speed of information processing (Gronwall & Sampson, 1974; Van Zomeren, 1981; Shum, McFarland, Bain & Humphrey, 1990). Slowed encoding and response times may result in significantly lowered scores on timed cognitive tests despite the capacity to perform the required test accurately (Lezak, 1983). In general, a deficit in speed of information processing may result in relatively poor performance on tasks demanding concentration and continuous mental tracking, such as oral arithmetic, or sequential arithmetic and reasoning problems that must be performed mentally (Gronwall & Wrightson, 1981). In everyday life, such a reduction in the efficiency of information processing may have deleterious effects on a person's capacity for competitive employment.

A variety of measures have been used in order to try to evaluate the effects and extent of reduced speed of information processing. Several of the commonly used measures include the Paced Auditory Serial Addition Test (PASAT) (Gronwall, 1977), the Symbol Digit Modalities Test (Smith, 1973), simple and/or choice reaction times, and cancellation tests. However, there is some difficulty in determining the pure cognitive slowing when there is a motor component involved in the response, as in the case of reaction times and cancellation tests. Ponsford & Kinsella (1992) indicate that the best single measure of the deficit in speed of information processing was the oral version of the Symbol Digit Modalities Test. Their results suggested that, where possible, head-injured subjects tended to sacrifice speed to maintain accuracy.

However, when this adjustment is not possible, as on speeded tests such as the PASAT, head-injured subjects made significantly more errors than did controls.

Gronwall and her colleagues (Gronwall & Sampson, 1974; Gronwall & Wrightson, 1974, 1975, 1981; Gronwall, 1977) have examined PASAT results in a number of studies. Gronwall and Wrightson (1981) indicated that significant effects on information processing may be seen after mild to moderate head injury, and that the degree of the information processing deficit was predicted by performance on the PASAT. Gronwall (1977) demonstrated that the PASAT may be used to estimate individual performance and progression during recovery, and suggested that "there is ample evidence that patients with normal scores can function adequately in their normal occupations" (p. 372). She concludes that the difficulties experienced by some patients when they return to work appear to be related to an inability to process information as rapidly as normal controls, and that the PASAT is a useful and objective measure which may be used as a guideline for rehabilitation and return to work planning. In more recent work, Brooks et al. (1987) found that the longest string at the fastest speed from the PASAT was one of the most reliable predictors of ability to return to work. Given these results, and the fact that we are not always given the luxury of slowing our work performance to maintain accuracy, the PASAT may be the most accurate reflection of real world demands on information processing. Therefore, it would be reasonable to include the PASAT as a possible predictor of vocational outcome.

Predictive Validity of Neuropsychological Testing

Despite recognition that TBI may result in poor performance on formal psychometric tests, the predictive validity of such testing for return to work has not yet been fully documented. Deficits in the neuropsychological domain are unable to account for all the difficulties experienced after brain injury, and in many cases, do not always correlate well with abilities to perform real world activities (Baddeley et al., 1987; Hart & Hayden, 1986; Wehman et al., 1989). For example, Baddeley et al.

(1987) demonstrate that tests that are sensitive indicators of the presence of brain damage do not necessarily predict the frequency of reported memory problems in everyday life.

Many neuropsychological tests presently used have been validated against criterion variables such as "presence of brain damage" or "locus of lesion", and may not be sensitive enough to detect the full effects of diffuse damage. It is important to recognize that even the most sensitive neuropsychological measures may not tap all possible deficits, and that results "within normal limits" do not necessarily consider more subtle losses. Even if the person appears unimpaired, it is very possible that overall efficiency is reduced, and the person less able to generate strategies to cope well with all the details of everyday life. Therefore, at the present time, it may be that comprehensive neuropsychological testing to determine work readiness after brain injury does not fully identify the impact on real-world activities.

With regard to closed head injuries, predictions of performance of real world activities may be especially tenuous. In many such cases, outcome can be attributed to a basic deficit in information processing which may overlie specific deficits due to focal lesions. Individuals with information processing deficits may be expected to show disproportionate decrease in performance when faced with increased complexity, distraction or stress. Therefore, ability to perform in highly structured test situations may not accurately reflect abilities in a more natural environment. Similarly, the practical significance of a measured memory deficit may depend largely on the demands on the individual for memory in his/her everyday functions. As such, scores on a standard neuropsychological test battery may overestimate ability to function in everyday life. Many clinicians are aware that persons with closed head injuries may function within normal limits in a testing situation, but report significant difficulties at work and/or in social situations (Hart & Hayden, 1986).

This criticism is not to suggest that neuropsychological test scores have no relevance in predicting future performance. Clearly, some researchers have demonstrated that some specific measures may have some predictive power. Rather, the purpose is to point out that the predictive validity of such tests is not as high as might be desired. As Acker (1986) points out, the validity and reliability of neuropsychological tests have been well established, but their ability to predict future functioning levels has not been documented sufficiently. It is reasonable that the study of brain-behavior relationships began with identification and location of damage, since it would be impossible to speculate on real world function without some idea of the type and location of damage reflected by each test. At the present time, however, it is reasonable to expand the investigation of just how such test results relate to real world settings, and to examine how cognitive impairments interact with other types of deficits. Long term outcome is likely due to a combination of cognitive, psychosocial and personality changes that follow injury, all of which may not be adequately reflected in a neuropsychological examination alone.

Psychosocial/Emotional Deficits

Emotional and social disturbances after head injury can be dramatic, especially because many survivors appear to be physically well. Parker (1990) feels that emotional distress and dysfunction are so common that it is unlikely that TBI may occur without damage to the "emotional apparatus" of the brain directly, and/or some form of post-traumatic stress. Lezak (1987) suggests that persons with TBI are much more handicapped by emotional and personality deficits than by cognitive and/or physical limitations. In a four-year study, she concluded that the areas most impaired were those related to social adjustment (e.g., social contact, return to work or school, and leisure activities). Stratton and Gregory (1994) point out that there are neural pathways which connect cortical regions in the frontal and temporal lobes to the limbic region. While the cortical regions have traditionally been associated with cognitive functioning, the limbic system has been thought to play a role in emotional control. Therefore, changes in emotional function could be a direct result of TBI. The most difficult sequelae of head injury to treat may be these psychosocial and emotional difficulties; thus, recognition of such changes should be considered crucial in any attempt to predict outcome.

"Executive Function" Impairment

Psychosocial functioning in the brain-injured individual reflects a complex interaction of factors. Personality changes have been reported by up to 75% of families as long as five years post-injury (Brooks, Campsie & Symington, 1986). Studies after intervals of up to 15 years have shown that one half to two thirds of severely brain injured patients show personality disturbances (Prigatano, 1991). Families and friends may find it very difficult to relate these changes to a head injury that occurred months or years earlier, and often may feel that these changes are in some sense deliberate and could be controlled with effort from the injured person (Lezak, 1988; Miller, 1993).

In many cases, the personality changes seen have been associated with dysfunction in the frontal lobes. Behavioral changes following frontal lobe damage has stimulated a great deal of interest for many years. As far back as 1848, in the case of Phineas Gage, it was noted that frontal lobe damage appeared to produce drastic changes in "personality" with relatively little impact on cognitive functions (Prigatano, 1989). Research from World War I describes similar effects, with various patients described as euphoric, irritable, tactless, or inappropriate (Stratton & Gregory, 1994). It has been suggested that brain injury to the frontal lobes may alter personality by disrupting neuronal connections responsible for its integration (Prigatano, 1991).

Damage to the frontal and prefrontal areas often results in deficits in "executive functions". Executive abilities may be defined as the ability to engage in independent, purposive, goal-directed behavior (Lezak 1983). Impaired executive functions may lead to difficulty with attention, anticipation, goal selection, planning, organization, initiation, execution, and self-regulation (Lezak, 1983; Stuss & Benson, 1986). Many researchers agree that impairments following TBI that involve the executive control system have a deleterious effect on community reintegration (Sohlberg, Mateer & Stuss, 1993; Cicerone & Giacina, 1992).

However, given that there are various possible combinations of deficits, it is difficult to clearly define, and much less measure, a "frontal lobe syndrome." Frontal lobe damage may be undetected by classical neurological and psychodiagnostic testing (Parker, 1990). Multiple deficits may occur, many of which are subtle alterations in functioning rather than a clear loss of ability. Several measures have been used to attempt to identify different aspects of frontal lobe damage. For example, the Wisconsin Card Sort Test (Heaton,1981) provides information on mental flexibility and perseverative tendencies.

Research suggests that such psychosocial changes may significantly affect ability to return to work. Miller (1993) suggests that the single most significant factor in post-injury job adjustment is the psychosocial or behavioral status of the person, rather than the level of physical or cognitive disability. In many cases, despite residual abilities that may be considerable, frontal signs such as impaired initiative and apathy, lack of critical capacity, defective social judgement and egocentricity, inability to plan or sustain activity, impulsivity, irritability, and low frustration tolerance is likely to render injured persons unemployable or only marginally employable. Lyons and Morse (1988) also found that problems with behavior and social skills frequently have a detrimental effect on employment. Kaplan (1988) indicated that subjects' major adjustment problems at 13 months post-injury were psychosocial and family oriented, and that employment post-injury was heavily dependent on the ability to engage in socially appropriate interactions. Klonoff and Snow (1991) found that even though the large majority of those with mild (93.6%) and moderate (75%) injuries eventually returned to work, most experienced some disruption in work activity. Despite returning to work, a significant proportion of the overall sample reported enduring changes in the qualitative aspect of job functioning (e.g., difficulty with interpersonal relationships, increased irritability with co-workers, reduced productivity). These findings suggest that a substantial disruption in work may exist even when the physical and intellectual capacity to work is present, and that difficulties returning to work can be experienced across a range of severity of injury.

Depression

In addition to impairments in executive functions, many researchers have identified depression as a common occurrence following TBI. However, despite the substantial literature on outcome following brain injury, there are relatively few studies aimed at the specific impact of depression following TBI. Although it has been suggested that depression is a relatively common occurrence at some point during recovery, especially when the patient is trying to adjust to new physical and/or cognitive limitations, conclusions about the frequency and duration of depressive symptoms after TBI vary.

The frequency of depression after TBI remains a point of debate among researchers. Emotional dysfunction, including depression, anxiety, and low self-esteem, is commonly reported (Fordyce, Roueche & Prigatano, 1983). The prevalence of depressive disorders in a TBI population has been estimated at anywhere from 20-60%. Fedoroff et al. (1992) found that major depression occurred in 26% of patients while hospitalized. McKinlay, Brooks and Bond, Martinage and Marshal (1981) suggested that approximately half of their patients with severe head injury reported symptoms of depressed mood at three, six, or twelve months post-injury. Tyerman and Humphrey (1984) reported that 60% of severely injured patients exhibited marked depressive symptoms within the first 15 months following injury. Jorge, Robinson, Arndt, Starkstein, Forrester and Geisler (1993a) evaluated patients at admission, and three, six and twelve months post-injury, and found that the frequency of depression remained at approximately 25% during the first 12 months. Burns, Kappenberg, McKenna and Wood (1994) found depression to be substantially involved in the sequelae of brain injury in the first year. They found that TBI patients reported greater feelings of inferiority and reduced feelings of competence than did persons with other types of brain injury (e.g., strokes, tumors). TBI patients also reported an increasing emphasis on depressive symptoms relative to normal controls. Finally, Kinsella, Moran, Ford and Ponsford (1988) found that 33% of TBI patients could be classified as depressed within the first two years post-injury.

Other researchers have examined the duration of depressive symptoms following brain injury. It has been suggested that affective disturbances may be transient, lasting for several weeks post-injury, or may be more persistent over several months (Grant and Alwes, 1987). Jorge et al. (1993a) found that 41% of patients who met DSM-III-R criteria for depression while in hospital did not meet criteria after three months. In addition, there was no significant relationship between depression and measures of either physical or cognitive deficits. Jorge, Robinson, Starkstein and Arndt (1993c) further suggest that not all post-TBI depression is similar. They found that 78% of patients with non-anxious depression had transient symptoms (e.g., during acute hospital stay only). In addition, all transiently depressed patients had diffuse brain injury with a significantly greater frequency of left anterior lesions. In contrast, depressive symptoms that were also associated with several weeks of anxiety lasted for an average of 7.5 months, and were more strongly associated with greater right hemisphere damage. One explanation for the varying reports on depression following TBI which has been put forth is that there may be two underlying causes of depression following brain injury. Transient depressive disturbances during the acute phase may be attributable to neurochemical and physical changes in the brain, while longer term depressive symptoms may be due to the reaction to the loss of cognitive and/or physical competence ((Aloia, Long, & Allen, 1995; Van Zomeren & Saan, 1990; Prigatano, 1987).

Other studies have also suggested that depression may result from damage to different parts of the brain involved in the experience and expression of emotional behavior. Depression may occur more frequently with lesions of the left frontal and temporal lobes, with lesions closer to the frontal lobe more likely to be associated with more severe depressive episodes (Miller, 1993). For example, agitated depression, often accompanied by language disturbances, may occur following left frontal lobe damage (Robinson, 1986), while more apathetic or "flat" depressions may be seen following damage to the right frontal damage (Ross & Stewart, 1987). Jorge at al. (1993a) found that patients with transient depressive symptoms were associated with left dorsolateral frontal and/or left basal ganglia lesions. The symptoms may appear less pronounced in brain injured individuals due to the emotional flattening sometimes seen following TBI. In these cases, erratic or poor recovery, or worsening of deficits after initial recovery, may be some indications of the presence of depression.

Given the diffuse damage characteristic of TBI, it is not unusual that some individuals develop depressive symptoms post-injury. The behavioral changes associated with depression may well impact any effort to return to work, and should therefore be considered in any assessment of work readiness.

Awareness of Deficit

In other cases, the injured individual may not recognize that there is anything wrong at all, and may be confused by the reactions of others. This inability to recognize or acknowledge the extent of deficits that exist post-injury can also be extremely detrimental to outcome, since little effort will be expended to compensate for unacknowledged or unrecognized deficits. Prigatano, 1989 & 1991) proposed that TBI frequently alters a person's capacity for self- and social awareness. People with this kind of deficit have the "curious mixture of perceiving themselves as normal on the one hand, and yet at the very same time recognizing an altered capacity in themselves" (Prigatano, 1989, p. 415). For example, they may identify physical deficits as a result of their injury, or even cognitive deficits such as memory, but they very rarely identify deficits in interpersonal functioning. In addition, although severe anosognosia may diminish in the weeks or months after TBI, a lesser degree of impaired awareness may remain for months or years after injury.

This disorder of awareness has several major implications for long term outcome. First of all, unawareness or only partial awareness of deficits often results in patients choosing work activities that are not within their realm of competence. Second, difficulty integrating both cognitive and affective components of behavior will necessarily affect new learning, as well as attempts at "relearning" old behaviors. This difficulty is often manifested in perseverative attempts at ineffective problem-solving and interactions. Finally, injured persons may not recognize how impulsive, irritable and demanding that they can be, and therefore do not make a concerted effort to alter inappropriate behaviors. Unfortunately, good measures of the level of self-awareness and effective rehabilitation strategies have not yet been developed for widespread use.

The literature is rather sparse as it relates to the effects of impaired awareness on later outcome, especially vocational outcome. Several studies have attempted to measure awareness deficits by comparing patients' ratings of deficits with ratings made by others close to them. Oddy et al. (1985) demonstrated the importance of decreased awareness after TBI by asking patients and their families to describe problems that remained seven years after injury. Overall, they found that patients tended to underestimate the frequency of problems compared to relatives' reports. Families also noted two problems that the patients never reported. The first problem was that many patients tended to behave in a much more childish manner than normal, while the second was that some patients refused to admit to the presence of any difficulties at all.

Prigatano et al. (1986) did an analysis of initial outcome data after rehabilitation. The criteria for "success" depended on the patients' ability to be productive in their lives, to maintain adequate personal relationships, and to show some degree of active involvement in rehabilitation activities. Patients and staff at the rehabilitation hospital were asked to rate the impact of the injury on daily behavior in these areas. Results showed that every one of the "failures" insisted that they were totally aware of their deficits, whereas staff felt that there were areas in which these patients' awareness was limited. On the other hand, "successful" patients produced ratings similar to those of the staff, and acknowledged that there were some deficits present. Prigatano, Pepping and Klonoff (1986) found that patients also tended to underestimate the severity of their deficits compared to relatives' reports. Similar results were reported by Fordyce and Roueche (1986) in a comparison of behavior ratings by patients, relatives and staff. They found that patients rated themselves as more competent than did their relatives, while relatives rated patients as more competent than did the staff.

Prigatano, Altman and O'Brien (1990) found that the deficits generally underestimated by TBI patients are in the social and emotional arena. On the other hand, patient ratings of their abilities to carry out general self-care activities generally agreed with judgements made by relatives. Therefore, it was suggested that it is in the area of judging more complex interpersonal skills that the effects of impaired awareness can be most clearly demonstrated. They also pointed out that results of neuropsychological batteries may fail to capture the more complex impairments underlying the disturbance in self-awareness.

Clearly, a variety of changes in psychosocial and emotional functioning may occur post-injury, depending on the areas damaged and upon the premorbid personality characteristics of the person. Personality changes are not uncommon, particularly following damage to the frontal lobes. Depression may also be present as individuals try to deal with deficits. On the other end of the continuum of psychosocial functioning, impaired awareness of deficits and of appropriate behavior will also deter successful outcome. In fact, even with full awareness, people may find it very difficulty to accept and adjust to their sudden limitations. Thus, the psychosocial impact of TBI may be as long lasting and as detrimental as many cognitive deficits, and should receive at least as much attention in any attempt to predict vocational outcome.

Functional Deficits

One of the remaining problems in attempting to predict outcome has been the emphasis put on specific areas of cognitive deficit rather than on overall functional ability. The point is not that overall functional status is more important than identification of specific deficits, but rather that an integration of both approaches might be more useful than either one alone. Halpern and Fuhrer (1984) state that "functional assessment is the measurement of purposeful behavior in interaction with the environment, which is interpreted according to the assessment's intended uses" (p. 3). In terms of return to work, functional assessment may be defined as a "systematic enumeration of vocationally relevant strengths and weaknesses" (Crewe & Athelstan, 1984, p. 1).

One instrument that proposes to assess a person's capacity for work or other productive activity is the Functional Assessment Inventory (FAI) (Crewe & Athelstan, 1984). The FAI was developed in a counseling center that served persons with severe physical or psychiatric difficulties. The purpose of the inventory was to assess vocationally relevant strengths and limitations in an efficient and comprehensive fashion. The FAI consists of 30 items which emphasize abilities thought to influence future employability, and also includes measures of social and environmental variables that may also impact outcome. Although these additional variables are not actually measures of functional capacities or limitations, the authors felt that they may contribute significantly to the prediction of vocational outcome and should therefore be included. The resultant measure provides an evaluation of the patients' behavioral capacities and identification of key social and environmental factors.

Based on the results of principal components analyses on results from a general vocational rehabilitation population, the FAI may be further broken down into specific areas of functional limitations. Crewe and Athelstan (1984) suggest that the most complete and satisfactory breakdown of the FAI consists of the following seven factors: Adaptive Behavior (7 items), Motor Functioning (4 items), Cognition (4 items), Physical Condition (5 items), Communication (3 items), Vocational Qualifications (6 items), and Vision (1 item). Scores on each factor may be obtained by adding the ratings on each items included in the given factor. Frequency distributions, mean scores, and range of scores are available for each factor in the FAI manual (Crewe & Athelstan, 1984). Turner (1982) also confirmed that the essential factor structure remained the same across hearing impaired, orthopedic, and combined mentally ill, developmentally disabled and chemically dependent disability types. Thus, in addition to a composite score for functional limitations, factor scores may be derived for each client with indicate the relative severity of problems in these specific areas.

Work on the FAI has also led to the development of several companion instruments, one of which is the Personal Capacities Questionnaire (PCQ) (Crewe & Athelstan, 1984). The PCQ is an item-by-item translation of the FAI into first person terms and simpler language so that it may be completed by the patient. This instrument is meant to identify how the patient views his/her capacities, as well as to provide a "basis for discussing the differences in client and counselor perceptions" (Crewe & Athelstan, 1984, p. 1). No research has yet been conducted on the accuracy of client self-ratings based on the PCQ, or on comparing ratings on the FAI to the PCQ (Thomas, 1991; Crewe, 1993). Such information would give some sense of what the client perceives as functional strengths and limitations. In addition, if PCQ ratings differ significantly from the professional's ratings on the FAI, reasons for the discrepancies could be explored. This issue is particularly important in situations where there is a lack of awareness or of acceptance of disabilities.

The FAI is intended to serve several purposes (Crewe & Athelstan, 1984). First, it is intended to provide a comprehensive evaluation of strengths and weaknesses of the person as a whole, regardless of medical diagnosis. Such an evaluation allows the development of a rehabilitation plan that makes use for the strengths while trying to work around the shortcomings. Second, it is suggested that the FAI may provide useful information for decisions regarding eligibility for rehabilitation services. Third, the FAI may provide a more reliable and accurate basis for identifying an individual's abilities than will a diagnostic label. Of greatest relevance to the present study, it is also proposed that the FAI may identify functional limitations that are related to and predictive of rehabilitation outcome. Furthermore, when used in combination with the PCQ, it purports to allow comparison of professional and patient perceptions, which may reflect the patient's level of awareness of deficits.

Although the FAI was initially designed for a physically injured rehabilitation population, it has been used to evaluate vocational outcome in a traumatically brain injured population. In a study with 76 TBI individuals, Mysiw, Corrigan, Hunt, Cavin & Fish (1989) indicated that the FAI composite score had the greatest discriminating power for predicting vocational readiness when compared to the Mini-Mental Status Exam, the Glasgow Outcome Scale, and the Rancho Los Amigos Hospital Levels of Cognitive Functioning Exam. Results suggested that patients with composite scores of 0-10 were most likely to return to competitive employment, 11-20 to vocational training, 20-40 to supported employment, and 41-80 to continue remedial therapy. The Overall FAI score did not reliably discriminate competitive return to work (0-10) from vocational training (11-20); however, there was a possible confound in these results because the researchers did not control for previous employment. As a result, more individuals in the 0-10 range had a previous job to which to return, while more individuals in the 11-20 range were looking for new employment.

Purpose of Study

Unfortunately, there are very few devices, if any, that incorporate some measure of all types of deficits and that reasonably predict the readiness of the brain-injured person to return to work. It may be that the most useful approach would combine measures of cognitive, psychosocial, and functional deficits. To this end, the purpose of the present study is to examine the predictive validity of a combination of measures of psychometric variables, psychosocial/emotional disturbances, and functional impairments. For the purpose of the present study, "return to work" will be defined as any form of employment for which monetary compensation is received. This definition would include full-time work (greater than 20 hours per week), part-time work (less than 20 hours per week), or participation in a sheltered workshop. The use of earned income as an outcome measure does not imply that earning potential should be the only measure of recovery, but it allows differentiation of patients who are actively participating in the job market with those who are inactive and currently dependent on others for financial support. Based on the literature, the following hypotheses were made:

1. TBI patients will demonstrate impaired performance on the delayed component of the Logical Memory subtest (LM), as demonstrated by decreased scores on the LM relative to normative data.

2. Patients will demonstrate an impaired speed of information processing, as demonstrated by increased time per response on the PASAT relative to normative data.

3. Patients will identify at least a mild to moderate level of depression of the BDI at the time of initial testing, and BDI scores will increase after six months to reflect an increase in the overall degree of depression.

4. There will be a significant difference between FAI and PCQ ratings, with clinicians identifying a greater number of functional limitations and fewer personal strengths than will patients.

5. Principal components analyses of the FAI and PCQ factor structure will reveal a factor structure for TBI patients compatible for that described in Crewe and Athelstan (1984) for a general rehabilitation population.

6. The combination of LM, PASAT, BDI, FAI-FL, BC, and DIFF scores at initial testing will predict earned income over the six months since initial testing, as demonstrated in a stepwise regression analysis.

7. There will be a significant difference in test scores at initial testing between patients who have returned to work and patients who have been unable to return to work. Patients who have been unable to return to work will demonstrate lower LM scores, higher time per response on the PASAT, higher BDI scores, higher FAI-FL scores, higher PCQ-FL scores, and higher BC scores than employed patients.

8. There will be a significant difference in test scores at follow-up testing between patients who have returned to work and patients who have been unable to return to work. Patients who have been unable to return to work will demonstrate lower LM scores, higher time per response on the PASAT, higher BDI scores, and lower PCQ-FL scores.

9. There will be an overall improvement in psychometric test performance at six month follow-up, including increased LM scores and decreased time per response on the PASAT.

10. Patients will exhibit improved awareness of deficits after six months, as demonstrated by higher scores on the PCQ-FL at six month follow-up.

11. Performance on the measures will be consistent for all patients regardless of which rehabilitation center referred them, including test scores at the time of initial testing, income levels at the time of initial testing, and income levels at six months follow-up.

A secondary purpose of this study was to collect normative data on the FAI and PCQ for a TBI population, which will provide a basis of comparison between FAI and PCQ. At the present time, there is no available field research on the PCQ (Crewe, 1993), and knowledge of how this instrument relates to the FAI may be a valuable contribution in prediction of post-injury employment. In addition, there are no normative standards for the use of the FAI with a TBI population. It was hypothesized that:

12. Overall functional limitations scores on the FAI would discriminate between mild, moderate and severe levels of TBI.

13. Overall functional limitations scores on the PCQ would discriminate between mild, moderate and severe levels of TBI.

CHAPTER TWO

Method

Subjects

Patients were recruited from four agencies that provide psychological and/or vocational assessment, intervention and/or training for persons with TBI's. Agencies included G.F. Strong Rehabilitation Center in Vancouver, B.C., HealthSouth Rehabilitation Institute of Tucson in Tucson, AZ, Barrow Neurological Institute Adult Day Hospital and outpatient clinic, and the Bridges Head Injury Program at St. Joseph's Hospital in Tucson, AZ. Each agency identified possible participants, and determined how they wished to contact potential participants.

All participants were volunteers who agreed to participate in an initial evaluation and follow-up study of recovery of function and return to work. All patients had a medical diagnosis of brain injury due to an environmental trauma. Severity of injury was rated by the Glasgow Coma Scale at the time of admission to acute care (GCS) (Teasdale & Jennett, 1974). When GCS was unavailable, either the length of post-traumatic amnesia (PTA) (Russell, 1971) or length of unconsciousness was used to estimate severity. Injuries were classified as "mild" when GCS was 13-15, PTA was less than an hour, or loss of consciousness was less than 20 minutes. Injuries were "moderate" when GCS was 9-12, PTA was greater than an hour but less than 24 hours, or loss of consciousness was greater than 20 minutes but less than an hour. Finally, injuries were "severe" when GCS was less than 8, PTA was greater than 24 hours, or loss of consciousness is greater than one hour. Measures based on GCS scores (Godfrey, Partridge, Knight & Bishara, 1993; Leach, Frank, Bouman & Farmer, 1994; Jorge, Robinson, Starkstein & Arndt, 1993c;Ponsford & Kinsella, 1992), length of PTA (Parasuraman, Mutter & Molloy, 1991; Aloia, Long & Allen, 1995; Gronwall & Wrightson, 1975;McMillan & Glucksman, 1987), and length of unconsciousness (Boake, Freeland, Righolz, Nance & Edwards, 1995; Jellinek, Torkelson & Harvey,

1982) are commonly accepted parameters of injury severity. Patients included 33 males and 11 females, with an average age of 32.3 years and mean education level of 13.7 years. All patients had a stable work history over the past three years prior to injury, with minimal requirements of regular part-time employment at least 50% of the time. All had sustained a traumatic brain injury in the 12 months prior to initial testing, with a mean of 3.8 months since injury. Levels of severity of injury included 24 patients with severe injury, 12 patients with moderate injury, and 8 patients with mild injury. Any individual with a documented medical history of previous head injury (e.g., prior to the present injury) involving a loss of consciousness of greater than 30 minutes was excluded. All patients had adequate reading and language abilities, vision sufficient enough to read text, hearing sufficient enough to understand a voice from a tape recorder, and at least one functional hand (as determined by the referring clinician). Levels of pre-injury and post-injury occupation were classified based on job descriptions and evaluations documented in the Dictionary of Occupational Titles (1991). In accordance with the University of Victoria Human Subjects Committee procedure, each patient received information describing the purpose of the research and what participation would require (Appendix 1), and a copy of the consent form to act as a research subject (Appendix 2), and a consent form for the release of relevant medical records (Appendix 3). Original copies of the consent forms were kept by the researcher, with additional copies provided to the referring rehabilitation agency.

Materials

A questionnaire of demographics, education, medical, and work history was completed for each patient (Appendix 5). This questionnaire was based on a similar questionnaire outlined in Lacroix (1992). Pre- and post-injury employment status was determined by classifications based on the Dictionary of Occupational Titles (1991). The Dictionary of Occupational Titles (DOT) is a reference text compiled by the U.S. Department of Labor which provided job titles and their requirements in such areas of physical demands, environmental conditions, general educational development, aptitudes, interests, and temperament. The D.O.T. provides a nine digit occupational code in which each set of three digits has a specific meaning. Together, they provide a unique identification code for a particular occupation which distinguishes it from all the others. The first three digits identify an occupational group. The first digit identifies one of nine broad categories, followed by the second digit which identifies one of 83 occupationally specific divisions. The divisions are then divided into homogenous groups, as identified by the third digit. The middle three digits of the code are the "Worker Functions" ratings of the tasks performed in the occupation. These three digits identify the worker's relationship to one of three groups: data (fourth digit), people (fifth digit), and things (6th digit). Generally speaking, worker functions which involve greater degrees of responsibility and judgement are assigned lower numbers in these three groups. It is assumed that the worker can then perform any higher numbered function listed in each of the three groups. The last set of three digits distinguish a particular occupation from all others. If a six-digit code is unique to one occupational title, the last three digits are always "010.) If there is more than one occupation identified by the first six digits, the last three digits are usually assigned in alphabetical order of titles in multiples of four (e.g., 010.104,018, etc.). Since new occupations have been added since the original edition, have been added sequentially following the previous last entry for each of the six digit codes.

Memory

The measure of memory consisted of the Logical Memory II (delayed) subtest of the Wechsler Memory Scale-Revised (WMS-R). This subtest is intended to assist in the clinical evaluation of verbal memory function. Normative data is based on a stratified sample based on the normal population of the U.S.A. (n=316). Extensive scoring rules have been developed to minimize scoring complexity and to maximize scoring accuracy. Interscorer reliability coefficients based on these criteria have been estimated at the .99 level (Wechsler, 1987).

Information Processing

Information processing was measured by performance on the Paced Serial Auditory Addition Test (PASAT) (Gronwall, 1977; Gronwall & Sampson, 1974; Gronwall & Wrightson, 1974). The test is a serial addition task designed to estimate speed of information processing and sustained attention. The patient is required to encode the auditory input, respond verbally, and inhibit encoding of his own response while listening for the next number in the series. The series of numbers was recorded on tape. The PASAT has been shown to be sensitive to mild concussion (Gronwall & Sampson, 1974; Gronwall & Wrightson, 1975), and to indicate readiness to return to work (Gronwall, 1977).

Executive Functions

The measure of executive functioning consisted of a behavior checklist derived from common behavior and personality changes reported following damage to the frontal lobes (Lezak; 1983; Cummings, 1985; Stuss & Benson, 1986). The checklist was made up of 12 descriptive statements of changes in behavior and personality that may occur following TBI (Appendix 6), and was completed by the clinician. As the checklist was developed specifically for the present study, no established information on validity and/or reliability is available.

Depression

Screening for the presence of depression was completed with the Beck Depression Inventory (BDI) (Beck, Rush, Shaw & Emery, 1979). The BDI is widely accepted as an instrument with which to evaluate the intensity of depression in psychiatric populations, as well as to assess the possible presence of depression in a normal population. Although the BDI has not been specifically normed for a TBI population, it was chosen because of its widespread use, ease of administration, brevity, and high face validity. The BDI is a self-report rating scale which consists of 21 four-choice items rated by the subject. The items cover a range of possible depressive symptoms which the subject may have been experiencing in the past week, including the day on which the ratings were completed. Each item may be scored between 0 (symptom not present) to 3 (severe). The total score is obtained by summing the highest scores endorsed for each of the 21 items. The maximum score is 63. Although there is no arbitrary score that can be used to classify different degrees of depression exactly, Beck (1987) suggests guidelines for interpretation of the scores in a normal population as follows: 0-9 = normal range; 10-15 = minimal; 16-19 = mild-moderate; 20-29 = moderate-to-severe; 30-63 = severe. It was understood that this classification is based on the severity of self-reported emotional distress and is not equivalent to a formal diagnosis of clinical depression.

It has been further suggested that different sets of BDI items may be used to differentiate between psychiatric, medical, and normal samples (Plumb & Holland, 1977; Cavanaugh, Clark, & Gibbons, 1983). A "cognitive-affective" subscale score may be computed from the scores on the first 13 items, while a "somatic-performance" subscale score may be calculated for the last eight items. These subscales may be used to assess the level of depression in patients whose vegetative and somatic symptoms due to medical concerns may over-estimate the severity of their depressions.

Test-retest reliability was above .90 and tended to follow the trend for each patient on depth of depression (Beck, 1970). Concurrent validity coefficients with the Zung Depression Scale reached .79 in psychiatric patients and .54 in college students (Kerner & Jacobs, 1983). Beck (1970) reported correlations of .66 between the BDI and psychiatric ratings of university students.

Functional Assessment

Functional assessment was completed using the Functional Assessment Inventory (FAI) and Personal Capacities Questionnaire (PCQ). The FAI is a rating scale designed to assess vocational capacities. It consists of 30 items, each of which describe four possible levels of functional limitation. The four levels include "no significant impairment" (score = 0), "mild impairment" (score = 1), "moderate impairment" (score = 2), and "severe impairment" (score =3). The inventory also includes 10 "special strength" items, which are checked to identify exceptional assets that may act to offset and/or neutralize other limitations. After each item is rated, the scores are summed to produce an overall composite score which provides an estimate of functional limitations (FL score). In addition, the FAI can be broken down into seven factor scales of adaptive behavior, motor functioning, cognition, physical condition, communication, vocational qualifications, and vision.

Interrater agreement and internal consistency reliability of the FAI items, subscales, and total FL score are generally high. Reliability testing of the FAI began in 1978 at the University of Minnesota Hospital (n=64), and revealed that 75% of the ratings made by pairs of observers were identical, while an additional 22% differed by only one point on the four point scale. Further field testing of the FAI took place in Minnesota (n=351), Wisconsin (n=1716), Minneapolis Society for the Blind (n=60), and in a Management Information System (MIS) in Wisconsin and California (n=1318). Reliability was again evaluated as part of the MIS pretest study. Their report (Turner, 1982) found that the reliability coefficient alpha was .79 - .80, while the standardized item alpha was .81 - .81. Turner (1982) states that "It can concluded with some certainty that, taken as a whole, the FAI is reliable, and that individual items were scored reliably as well" (p. 55).

Studies also suggest that the FAI is a valid measure of vocational strengths and limitations. Two approaches were taken to document concurrent validity. Turner (1982) evaluated the relationship between the 30 functional limitation (FL) items and the subject's primary medical diagnosis. Results showed that 29% of the variance was accounted for by the association between the functionally assessed disability and the general medical diagnosis. Data from the Wisconsin and Minnesota studies based on expert judgement also supported the validity of the FAI. Experienced counselors were asked to rate the severity of the client's disability and to predict prospects for employment. Results supported the hypothesis that persons rated as highly disabled had high scores on the FL items and low scores on the strength items. In the Wisconsin sample, every FL score was significantly correlated with counselor ratings of severity of disability, as was the overall FL score (r=-.567). Strength items showed weaker relationships, bur were all still significantly correlated with predictions of employability. However, with the exceptions of two of ten of the strength items, there was no significant correlation with the severity of disability. Correlations between the FAI items and the counselor predictions were slightly higher in the Minnesota sample.

The patient's perceptions of functional limitations were assessed with the Personal Capacities Questionnaire (PCQ). The PCQ is the patient's self-report inventory that corresponds with the FAI. Patients were instructed to read each statement and then rate themselves according the same type of rating scale and scoring system described previously for the FAI. No field research on the reliability and validity of the PCQ has been conducted up to the present time.

Procedure

A primary interest in the present study was to evaluate the predictive validity of a combination of the following measures: PASAT, Logical Memory II, BDI, FAI, PCQ, and Behavior Checklist. The PASAT and Logical Memory subtest were included as measures of information processing and memory, respectively. In addition to providing measures of neuropsychological function, these measures provided an objective measure of disability that may not be achieved by the other more subjective measures. The BDI provided information about the possible presence and degree of depressive symptoms, while the Behavior Checklist provided information regarding behavior and personality changes since injury. The FAI and PCQ provided measures of perceived vocational strengths and weaknesses, and may be further broken down into related areas of deficit. The difference between the FAI and PCQ scores was then used as a measure of the subjects' level of awareness of deficits.

Recruitment of patients began with a brief presentation of the study to the appropriate agencies. Those agencies which agreed to cooperate with the study determined how they would contact possible patients. All patients identified as possible participants were given a verbal request to participate, a written information form, and both consent forms.

Participation began with a brief explanation of the study. Informed consent forms were verified and completed, and copies of the consent forms were given to each patient. Patients were also informed that the information obtained from them or from their files would be identified only by an assigned number.

The initial testing session consisted of a brief interview and completion of the data collection form, the Logical Memory subtest, the PASAT, the BDI and the PCQ. Following the interview, testing began with the immediate recall trial of Logical Memory. The patient was given the standardized instructions based on the WMS-R (1987) manual. The examiner then read the first story, and asked for recall. The same process was then repeated for the second story. After completion of the immediate recall phase, patients were asked to try to remember the stories. After a delay of 30 minutes, the patient was asked to recall as much as they could of the stories. If the patient did not recall one or both of the stories, he/she was cued according to the standardized instructions. Responses were recorded verbatim. Results were scored according to the detailed criteria provided in the WMS-R manual. Raw scores were converted to percentile equivalents based age-based normative data provided in the WMS-R manual (Wechsler, 1987). The delayed memory score will be identified in the statistical analysis as "LM Score."

During the 30 minute delay period for the Logical Memory subtest, the first two trials of the PASAT were administered. The patient was required to listen to a series of single digit numbers, and instructed to add aloud each number to the number immediately preceding it. Performance is based on an externally determined pace across four different trials. Each trial involves the presentation of the same series of numbers, each at an increasingly faster pace (every 2.4 or 2.0 seconds). Specific instructions were given according to instructions described in Spreen & Strauss (1991, p. 143-144). Sixty-one numbers were then presented in random sequence. The same numbers were presented in the same order on both trials. Number of correct and incorrect responses were recorded, with a maximum score of 60. The average time per response is referred to as the "PASAT score" in the statistical analysis. Average time per correct response for adults under the age of 40 years is about 3.2 seconds (SD .25) (Gronwall, 1977).

After completion of the PASAT, the patient completed the BDI. The patient was asked to read each set of four statements, and select the one that best described how he/she has been feeling in the last week. Finally, the patient was asked to complete the PCQ. The 30 functional limitation items of the PCQ was rated by the patient in the same fashion as the FAI (see below). The score for each item of the PCQ was based on the patient's perception of his/her functional strengths and weaknesses. One score was assigned to each item. Scores were then summed to generate an overall functional limitations (FL) composite score ranging from 0-90. An overall strength score, based on the 10 strength items at the end of the questionnaire, was also computed. After completion of the PCQ, the delay component of Logical Memory was completed.

A health care professional who had been directly involved with the injured individual within the rehabilitation setting completed the FAI and the Behavior Checklist based on his/her knowledge of the patient. For the present study, this professional was either a neuropsychologist or a speech therapist. On the Behavior

Checklist, the health professional was asked to check off any of the twelve statements that he/she felt applied to the patient in question. For the FAI, each health care professional was provided with the standard set of instructions for completing the FAI (Crewe & Athelstan, 1984). Unless otherwise specified, ratings reflected the patient's level of functioning at the time of the assessment. The 30 functional limitation items of the FAI were each be rated according to the following scales: 0 (no limitation), 1 (mild impairment), 2 (moderate impairment), or 3 (severe impairment). Specific descriptive statements were available for each of the 30 items in order to aid in accurate ratings. The score for each item of the FAI was based on available information, including direct observations, clinical interviews, test results, and/or information from previous records. One score was assigned to each item. Scores were then summed to generate an overall functional limitations (FL) composite score ranging from 0-90. This score will be referred to as the "FAI score" in the statistical analysis.

In addition, 10 "special strength" items were included at the end of the questionnaire in order to identify assets that are felt to have some significant neutralizing effect on the vocational impact of the disabilities e.g., "has an exceptionally pleasing personality"; "possesses a vocational skill that is in great demand.") These items are not composed of behavioral rating scales, but provide basic descriptions which will be rated as either present or absent. The rater read each statement, and marked any of the descriptions that applied to the specific patient.

After completion of the FAI and PCQ, the difference between the two was determined by subtracting the PCQ score from the FAI score. This result reflected the difference in the perceptions of abilities of the rehabilitation professional and of the patient. This score represented a quantitative measure of the patient's level of awareness of deficits. This score is referred to as the "Difference score" in the statistical analysis.

Patients were contacted again approximately six months after the initial testing. Available patients were asked to return for follow-up testing, which consisted of Logical Memory, PASAT, PCQ, and BDI. This testing provided some indication of changes in abilities, perception of abilities, and/or emotional status since the time of initial testing. For all patients who participated in initial testing, a post-injury work history was completed (see Appendix 5), and current occupational levels were evaluated according to the D.O.T. After completion of the study, all subjects were offered a written summary of the overall group results of the study, as well as a follow-up phone call to allow for any further questions.

CHAPTER THREE

Results

SPSS for Windows 6.0 was used to calculate the statistics and an alpha level of .05, unless otherwise stated, was the test for significance. Significance levels of post-hoc tests using Bonferroni corrections have been corrected in the analysis, and therefore may be interpreted as significant at the .05 level. Dependent variables evaluated in the present study included the Logical Memory II (LM), the Paced Auditory Serial Addition Test (PASAT), the Beck Depression Inventory (BDI), the Personal Capacities Questionnaire functional limitations score (PCQ-FL), the Personal Capacities strength score (PCQ-S), the Functional Assessment Inventory functional limitations score (FAI-FL), the Functional Assessment Inventory strength score (FAI-S), the Behavior Checklist (BC), and the difference score (DIFF) which consisted of the difference between FAI-FL and PCQ-FL.

Sociodemographic characteristics noted at the time of initial assessment included age, education level, occupational status, and gender. Gender was coded as 1 (male) and 2 (female). Occupational status was determined according to the Dictionary of Occupational Titles. All occupational codes for patients both pre- and post-injury may be seen in Table 1. Severity of injury at the time of admission to an acute care hospital and/or rehabilitation agency were also recorded. Severity of injury levels were

Table 1

Occupational Codes for Each Patient Based on Dictionary of Occupational Titles Classifications

Patient#	Pre-Injury Job Title	D.O.T.#	Post-Injury Job Title	D.O.T.#
1	Apartment Manager	186.167-018	-	-
2	Cashier-Retail	211.462-014	Cashier-Retail	211.462-014
	Truck Loader	914.667-010	Truck Loader	914.667-010
3	Vocational Counselor	045.107-042	-	-
4	Postal Clerk	243.367.014	Postal Clerk	243.367-014
5	Restaurant Cook	313.361-014	-	-
6	Bricklayer-Construction	869.687-026	-	-
7	Tax Form Preparer	219.362-070	-	-
8	Payroll Clerk-Clerical	215.382-014	Payroll Clerk-Clerical	215.382-014
9	Automotive Mechanic	620.261-018	Automotive Mechanic	620.261-018
10	Maintenance Repair	899.381-010	Maintenance Repair	899.381-010
11	Heavy Truck Driver	905.663.014	-	-
12	Police Officer	375.264-010	Police Officer	375.264-010
13	Translator	137.267-018	-	-
14	Ironworker	615.482-018	Ironworker	615.482-018
15	Bricklayer	861.318-014	Bricklayer	861.318-014
16	Buyer-Professional	162.157-038	-	-
17	President (any industry)	189.117-026	President	189.117-026
18	Attorney	110.107-010	Attorney	110.107-010
19	Air Conditioner Installer	637.261-010	Air Conditioner Installer	637.261-010
20	Bartender/	312.474-010	-	-
	Warehouse Manager	184.167-114	-	-
21	Janitor	382.664-010	-	-
22	Auto Parts Delivery	722.687-058	Auto Parts Delivery	722.687-058
23	Assembly Line Worker	525.684-042	-	-
24	Bartender	312.474-010	-	-
25	Furniture Assembler	763.684-038	-	-
26	Furniture Assembler	763.684-038	-	-
27	Teacher's Assistant	099.327-010	-	-
28	Bartender	312.474-010	-	-
29	Elem. School Teacher	092.227-010	Lighting Salesperson	290.477-014
30	Manager	183.167-018	-	-
31	Asbestos Removal Worker	869.684-082	-	-
32	Computer Operator	213.362-010	Computer Operator	213.362-010
33	Asbestos Removal Worker	869.684-082	-	-
34	Carpet Salesman	270.357-026	-	-

Table 1 continued

Patient#	Pre-Injury Job Title	D.O.T.#	Post-Injury Job Title	D.O.T.#
35	Merchandise Manager	185.167-034	Merchandise Manager	185.167-034
36	Real Estate Agent	186.177-058	Real Estate Agent	186.177-058
37	Secretary	201.362-030	-	-
38	Carpenter-Construction	860.381-022	Graphic Design Artist	141.061-018
39	Meat Cutter	316.684-018	-	-
40	Occupational Therapist	076.121-010	-	-
41	Financial Planner	250.257-014	Financial Planner	250.257-014
42	Chef (Hotel/Restaurant)	313.131-014	-	-
43	Recreation Supervisor	187.167-238	Recreation Supervisor	187.167-238
44	Prison Classification Interviewer	166.267-022	-	-

categorized as severe, moderate or mild, and were coded as 1, 2 and 3, respectively. Rehabilitation referral agencies were categorized as American and Canadian, and were coded as 1 and 2, respectively. Employment at the time of follow-up was initially categorized as full-time employment (greater than 20 hours/week), part-time employment (10-20 hours/week), and unemployed. However, examination of the data revealed that only four patients had returned to work on a part-time basis; therefore, employment categories were re-coded as 1 (employed) and 2 (unemployed) in order to improve the equality of the groups. Descriptive statistics were calculated for each dependent variable for the sample as a whole, as well as by severity of injury. Overall means and standard deviations for each measure at initial testing may be seen in Table 2. Means and standard deviations for each variable according to severity of injury may be seen in Table 3. One-way ANOVA's performed on each of the dependent variables with an independent variable of level of severity (3 levels) revealed no significant effect of severity of injury on any of the initial assessment measures. Post-hoc independent t-tests with Bonferroni correction also revealed no significant differences between levels of severity on any of the measures. However, the large difference in sample size between the mild, moderate and severe injuries make these analyses difficult to interpret. Summary of the ANOVA's and post-hoc comparisons may be seen in Appendix 7.

Initial Testing

Psychometric Variables

Given the unequal number of mild, moderate and severe injuries, all variables were evaluated for the sample as a whole. Performance on the psychometric variables of Logical Memory (30 minute delay score) and the PASAT revealed a wide range of scores, which is consistent with the heterogeneous abilities of a TBI population. Mean performance on the delayed component of the Logical Memory subtest fell at the 27th percentile (compared to normative data for ages 25-34), which is at the low end of the average range compared to a normal population. Comparison of the mean score on the

Table 2

Overall Group Means and Standard Deviations for LM, PASAT, BDI, PCQ-FL, PCQ-S, FAI-FL, FAI-S, BC, and DIFF at Initial Testing

	LM	PASAT	BDI	PCQ-FL	PCQ-S	FAI-FL	FAI-S	BC
Mean	17.41	6.18	9.18	12.09	5.84	17.32	2.66	2.66
S.D.	10.01	3.84	7.38	7.83	2.53	11.12	2.03	2.44

Table 3

Means and Standard Deviations for LM, PASAT, BDI, PCQ-FL, PCQ-S, FAI-FL, FAI-S, BC and DIFF for Mild, Moderate and Severe TBI Patients at Initial Testing

MILD	LM	PASAT	BDI	PCQ-FL	PCQ-S	FAI-FL	FAI-S	BC	DIFF
Mean	20.75	4.98	7.25	10.00	6.25	11.63	2.75	1.50	1.63
S.D.	9.66	1.89	4.01	4.72	2.60	6.72	1.98	1.31	8.14
MOD	LM	PASAT	BDI	PCQ-FL	PCQ-S	FAI-FL	FAI-S	BC	DIFF
Mean	19.00	5.60	10.33	14.75	5.42	17.33	2.67	2.17	2.58
S.D.	9.75	2.87	9.29	6.82	2.43	7.44	2.50	2.41	10.93
SEVERE	LM	PASAT	BDI	PCQ-FL	PCQ-S	FAI-FL	FAI-S	BC	DIFF
Mean	15.50	6.88	9.25	11.46	5.92	19.21	2.63	3.29	7.75
S.D.	10.21	4.62	7.33	8.93	2.64	13.26	1.88	2.61	12.20

LM with the raw score at the 50th percentile for ages 25-34 of the Wechsler Memory Scale-Revised revealed no significant difference (t(4)=-.64, p=.56). Comparison to normative data provided for TBI patients and normal controls (Guilmette & Rasile, 1995) also revealed no significant difference between the TBI samples (t(4)=-.17, p=.88) or between the TBI sample in the present study and the normal controls (t(4)=-1.74), p=.16).

Mean performance on the PASAT, however, revealed significant impairment relative to age norms, with response times of patients at 1.93 times that of age peers (<1st percentile). Gronwall (1977) and Weber (cited in Spreen & Strauss, 1991) report that the average time per correct response is about 3.2 seconds (S.D. = .25) for adults below 40 years of age.

<u>Executive Functions</u>

Clinicians' ratings of patients executive functions on the Behavior Checklist suggested that the majority of patients did not exhibit a large number of the behavioral deficits identified on the BC, as the total possible score was 12. Means and standard deviations for each item on the Behavior Checklist are presented in Appendix 8. Examination of the frequency distributions indicate that items most frequently endorsed by clinicians (greater than 30% of the time) were items 1 (difficulty attending to relevant information) and 3 (decreased spontaneity and production of behavior). The remainder of the items were endorsed less than 30% of the time. Frequency distributions for all items may be seen in Appendix 9.

<u>Depression</u>

Mean scores on the BDI indicated that the majority of the patients fell within normal limits relative to suggested cut-off scores (0-9= normal range, 1-15= minimal depression) (Beck, 1987). However, a small subgroup of patients (n=6) endorsed depressive symptoms beyond the mild to moderate level (scores greater than 15). Two of the six patient ratings fell in the mild-moderate range of depressive symptoms (16-19), two in the moderate to severe range (20-29), and two in the severe range (>30). Comparison of the cognitive-affective subscale (Items 1-13) and the somatic-performance subscale (Item 14-21), as suggested by Plumb and Holland (1977) and Cavenaugh, Clark and Gibbons (1983), revealed no significant difference between the two measures ($t(43)=1.19$, $p=.24$). Means and standard deviations for each BDI subscale may be seen in Table 4. Means and standard deviations for each item on the BDI are presented in Appendix 10.

Examination of the frequency distribution, seen in Appendix 11, revealed that items 15 (work difficulty) and 17 (fatiguability) were the most frequently endorsed by patients (greater than 50% of the time). Of the 44 patients, 52.3% reported that work difficulty was a problem area, while 79.5% reported that they got tired more easily than before. The items least frequently endorsed (less than 25% of the time) included items 3 (sense of failure), 5 (guilt), 6 (punishment), 7 (self-dislike), 9 (suicidal ideas), 12 (social withdrawal), 14 (body image change), 18 (loss of appetite), and 21 (loss of libido).

Relationships Between Variables at Initial Testing

The Pearson correlation matrix for all variables at initial testing may be seen in Table 5. Examination of the correlations for all measures revealed a number of significant relationships between dependent variables.

Of particular interest to the present study was the associations between well established measures and the functional assessment variables, including the functional limitations scores of the FAI and PCQ, respectively. Of additional interest was the relationship(s) of the BC with other variables. Given that the functional assessment measures have not generally been used with a TBI population, and the BC has never been used except for in the current study, it is of interest to examine their relationships with more commonly used measures.

With reference to the FAI, significant correlations existed between the FAI functional limitations score (FAI-FL) and the PASAT ($r=.47$, $p=.001$), the FAI-FL and the PCQ functional limitations score (PCQ-FL) ($r=.32$, $p=.03$), the FAI-FL and the FAI strength

Table 4

Means and Standard Deviations for the Cognitive-Affective Subscale and the Somatic-Performance Subscale of the Beck Depression Inventory

	Cognitive-Affective (#1-13)	Somatic-Performance (#14-21)
Mean	4.89	4.23
S.D.	4.92	3.21

Table 5

Pearson Correlation Matrix of Variables at Initial Testing

	BC	BDI	DIFF	FAIFL	FAIS	LM
BC	1.0000 P= .	.0358 P= .818	.4346 P= .003	.4338 P= .003	-.0708 P= .648	-.3534 P= .019
BDI	.0358 P= .818	1.0000 P= .	-.2788 P= .067	.1061 P= .493	-.1847 P= .230	-.0508 P= .743
DIFF	.4346 P= .003	-.2788 P= .067	1.0000 P= .	.7575 P= .000	-.2494 P= .103	-.2554 P= .094
FAIFL	.4338 P= .003	.1061 P= .493	.7575 P= .000	1.0000 P= .	-.3623 P= .016	-.2452 P= .109
FAIS	-.0708 P= .648	-.1847 P= .230	-.2494 P= .103	-.3623 P= .016	1.0000 P= .	-.0158 P= .919
LM	-.3534 P= .019	-.0508 P= .743	-.2554 P= .094	-.2452 P= .109	-.0158 P= .919	1.0000 P=
PASAT	.3178 P= .036	-.1866 P= .225	.6302 P= .000	.4704 P= .001	-.2506 P= .101	-.3446 P= .022
PCQFL	-.0142 P= .927	.5551 P= .000	-.3744 P= .012	.3218 P= .033	-.1529 P= .322	.0221 P= .887
PCQS	-.1821 P= .237	-.0220 P= .887	-.0060 P= .969	-.1452 P= .347	.0840 P= .588	-.1112 P= .473

Table 5 continued

	PASAT	PCQFL	PCQS
BC	.3178 P= .036	-.0142 P= .927	-.1821 P= .237
BDI	-.1866 P= .225	.5551 P= .000	-.0220 P= .887
DIFF	.6302 P= .000	-.3744 P= .012	-.0060 P= .969
FAIFL	.4704 P= .001	.3218 P= .033	-.1452 P= .347
FAIS	-.2506 P= .101	-.1529 P= .322	.0840 P= .588
LM	-.3446 P= .022	.0221 P= .887	-.1112 P= .473
PASAT	1.0000 P= .	-.2457 P= .108	.0624 P= .687
PCQFL	-.2457 P= .108	1.0000 P= .	-.1975 P= .199
PCQS	.0624 P= .687	-.1975 P= .199	1.0000 P= .

score (FAI-S) (r=-.36, p=.02), the FAI-FL and the BC (r=.43, p=.003), and the FAI-FL and the DIFF (r=.7575, p=.001). The first correlation suggests that the greater the overall FAI-FL score, the slower the patient's speed of information processing. Given that speed of information processing is a common deficit post-injury, the fact that a correlation exists between this previously established measure of brain injury and the FAI suggests that increasing scores on the FAI reflect limitations in cognitive processing. The correlation between the FAI-FL and PCQ-FL suggests that increasing scores on both measures reflect increasing levels of functional impairment. The significant negative correlation between the FAI-FL and FAI-S indicates that higher scores on the FAI-FL, which reflect greater impairment in functioning, are associated with a reduced number of personal strengths identified by the clinician. The correlation between the BC and the FAI-FL suggests that greater deficits in executive functions are associated with increasing functional limitations as measured by the FAI. Finally, the correlation between the FAI-FL and the DIFF scores indicate that increasing FAI-FL scores are associated with greater differences between FAI-FL scores and PCQ-FL scores.

In addition to the significant correlation of the PCQ-FL with FAI-FL, a significant correlations was seen between the PCQ-FL and the DIFF score (r= -.37, p=.03), and the PCQ-FL and BDI (r= .56, p<.001). The first suggests that as PCQ-FL scores decrease, there is a greater difference between the FAI-FL and PCQ-FL scores. The correlation between the BDI and PCQ-FL suggests that as patients' self-reports of depressive symptoms increased, their estimate of functional limitations also increased. Examination of the means of the functional limitations (FL) score on the PCQ and FAI of the six patients with a mild or greater degree of depression (16 or greater on the BDI) indicate that depressed patients in fact rated their overall functional deficits as more severe than did the health care professional who completed the corresponding FAI. As shown in Table 6, this difference is in contrast to ratings made for non-depressed patients, in which relatively greater functional limitations are reported by the clinician. Statistical comparison of the

Table 6

Means and Standard Deviations for FAI-Fl and PCQ-FL Scores for Depressed (BDI≥15) and Non-Depressed Patients at the Time of Initial Testing

	FAI-FL		PCQ-FL	
	Depressed	Non-Depressed	Depressed	Non-Depressed
Mean	16.17	17.50	19.00	11.00
S.D.	4.79	11.84	10.83	6.81

difference in means was not performed due to the large discrepancy between the number of depressed patients (n=6) and the number of non-depressed patients (n=38).

Analysis further revealed a significant correlation between the BC and LM scores ($r = -.33$, $p = .035$), BC and the PASAT scores ($r = .3178$, $p = .04$), and the BC and the DIFF scores ($r = .43$, $p = .003$). The first association indicates that as verbal memory scores increase, indicating better retention and/or retrieval, there is a corresponding decrease in BC scores. This decrease in BC scores indicate fewer executive function impairments noted by the health care professional. The correlation between the BC and the PASAT indicates that greater executive function impairment is associated with slower speed of information processing. Lastly, the correlation between the BC and the DIFF score demonstrates that greater levels of executive dysfunction are associated with larger discrepancies between the FAI-FL score and the PCQ-FL score.

Finally, significant correlations were seen between the PASAT and the DIFF scores ($r = .63$, $p < .001$) and the PASAT and LM scores ($r = -.34$, $p = .02$). The association between the PASAT and DIFF scores suggests that as speed of information processing slows, the difference between the FAI-FL and PCQ-FL score increases. The negative correlation between the PASAT and the LM indicates that slower speeds of information processing are associated with greater impairment in delayed prose recall.

Functional Assessment Measures

Summary of overall scores as well as individual item analyses were completed for the FAI and PCQ. Means and standard deviations for functional limitation item scores on the FAI and PCQ may be seen in Appendix 12 and 13. Within the individual item ratings obtained on the FAI, items with severity ratings of greater than one (1=mild impairment) were items 1 (learning), 3 (memory), 12 (mobility), 13 (capacity for exertion), 14 (endurance), and 15 (loss of time from work). In contrast, the only items with severity ratings of greater than one on the PCQ were items 13 (capacity for exertion) and 14 (endurance).

Examination of the frequency distributions for functional limitations items on the FAI indicate the items most often endorsed by clinicians (greater than 50% of the time) were items 1 (learning), 2 (memory), 11 (motor speed), 12 (mobility), 13 (capacity for exertion), 14 (endurance) 15 (loss of time from work), 22 (access to job opportunities), 23 (requirements for special working conditions), 26 (accurate perception), and 30 (problems-solving). Items that were the least likely to be endorsed (less than 25% of the time) includes items 2 (reading/writing in English), 5 (vision), 6 (hearing), 7 (speech), 16 (stability of condition), 17 (work record), 19 (personal attractiveness), 21 (finances), 25 (social support), and 29 (desire to work). Frequency distributions for each item may be seen in Appendix 14.

Examination of the frequency distributions for functional limitations items on the PCQ indicate that the items most frequently endorsed by patients (greater than 50% of the time) were items 11 (motor speed), 13 (capacity for exertion), and 14 (endurance). The frequency with which these items are endorsed by patients is consistent with the frequency of endorsement by clinicians on the FAI. Items least likely to be endorsed on the PCQ were items 2 (reading/writing in English), 6 (hearing), 8 (language), 15 (absence from work), 16 (stability of condition), 17 (work record), 18 (acceptability to employers), 19 (personal attractiveness), 20 (work skills), 21 (finances), 24 (work habits), 25 (social support), 27 (interaction with others), and 29 (desire to work). Items which are consistent with ratings on the FAI include items 2 (reading/writing in English), 6 (hearing), 16 stability of condition), 17 (work record), 19 (personal attractiveness), 21 (finances), 25 (social support), and 29 (desire to work). Frequency distributions for each item on the PCQ may be seen in Appendix 15.

Examination of the frequency distributions for the strength items of the FAI and PCQ may be seen in Appendix 16 and 17, respectively. Strength items most frequently endorsed on the FAI were items 38 ("is extremely motivated to succeed vocationally") and 39 ("job available for client with previous or current employer), both of which were identified for 50% of the patients. Strength items endorsed more than 50% of the time on the PCQ were items 32 (I have a very pleasing personality), 35 (I am very well-trained or educated), 36 (my family is extremely understanding and eager to help me get back to work), 38 (I am absolutely determined to get a job), 39 (an employer I know is already holding a job open for me), and 40 (I have unusually good common sense).

Comparison of FAI and PCQ

Direct comparison of the FAI and PCQ scores was completed using a repeated measures MANOVA with dependent variables of overall functional limitations score (FL) and overall strength scores (S). FL scores provide an estimate of perceived strengths and weaknesses, while S scores provide an estimate of "exceptional assets that may be so significant as to neutralize the impact of the disabilities" (Crewe & Athelstan, 1984, p. 29). Results demonstrated a overall difference between the two measures ($F(2,42) = 24.43$, $p<.001$). Pairwise comparisons were performed using dependent one-tailed t-tests with a Bonferroni correction. As seen in Figure 1, results showed that health care professionals rated patients' vocational abilities as significantly more impaired than did patients themselves ($t(43)= -3.05$, $p=.004$). In addition, patients identified a significantly greater number of strength items than did the health care professionals ($t(43)=6.78$ $p<.001$) (see Figure 1). Summary of the MANOVA and post-hoc comparisons may be seen in Table 7.

Factor Analyses of the FAI and PCQ

Functional Assessment Inventory

Individual item scores on the functional limitations questions from the FAI were subjected to a principal components analysis with a varimax rotation in an effort to provide a comparison of factor scores with results from other populations. Because they are not scaled in the same way, the strength items were not included in this analysis. The sample size was very limited; therefore, the results of principal components analysis should be interpreted with caution (Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .55127). However, the purpose of the analysis was to determine if the factor scores

Figure 1. Mean Scores for FAI-FL, PCQ-FL, FAI-S and PCQ-S at Initial Testing. Analysis revealed a significant difference between FAI-FL and PCQ-FL, and between FAI-S and PCQ-S.

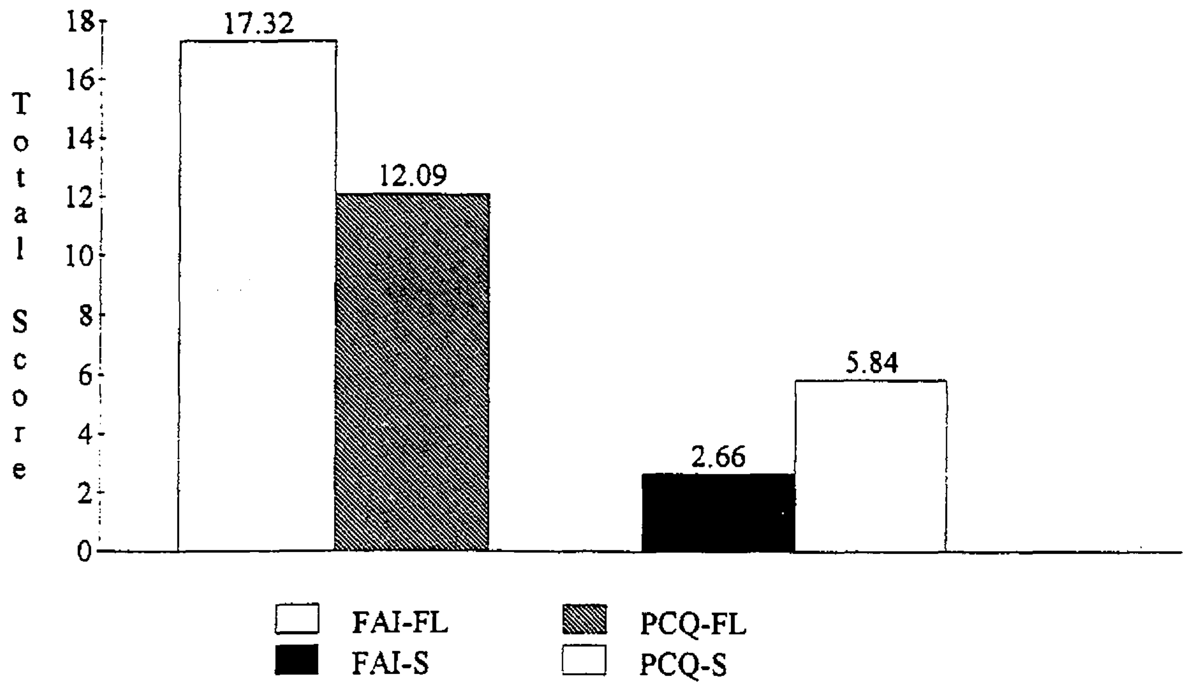

T o t a l S c o r e
18
16
14
12
10
8
6
4
2
0
17.32
12.09
2.66
5.84
FAI-FL
PCQ-FL
FAI-S
PCQ-S

Table 7

Summary of Repeated Measures MANOVA and Post-Hoc Paired T-Tests with Bonferroni Correction for Comparison of Functional Limitations Scores (FAI-FL and PCQ-FL) and Strength Scores (FAI-S and PCQ-S)

MANOVA	Exact F	df	p
	24.42646	2, 42	<.001*
Post-Hoc t-Tests	t	df	p
Functional Limitations Scores	-3.05486	43	.004*
Strength Scores	6.78117	43	<.001*

* Significant at $p<0.05$

reported by Crewe and Athelstan (1984) for other disability subgroups (e.g., physical disability, behavioral disability) were comparable for those found with a TBI population.

The initial analysis identified eight factors with eigenvalues greater than one, accounting for 72.3% of the variance. The complete rotated factor matrix may be seen in Appendix 18. To address the impact of the very limited sample size, this analysis was repeated three times with a subject removed. This procedure allowed comparison of the overall factor structure ($n=44$) with each analysis completed for "n-1" patients included. Comparison of the factor structure identified with $n=44$ with the factor structures of several analyses with $n=43$ revealed that the factors identified in the initial analysis were relatively stable (93% of the same item loadings at $r>.72$; 86% of the same item loadings at $r>.60$). Therefore, the findings from the original principal components analysis were selected as the most representative.

The limited sample size allows considerable opportunity for capitalization on chance, so it was also felt that the standard error of correlation might underestimate that actual amount of error in the factor loadings. To address this problem, the statistical significance of a factor loading was determined by doubling the critical values for a simple correlation at $p=.01$ (Stevens, 1986). The suggested value for a sample size of 50 is .36 (Stevens, 1986, p.344); therefore, only loadings greater than 2(.36) = .72 would be declared statistically significant, and interpreted in the analysis. Based on this criteria, three major factors and four single item factors, or singlets, were identified from the initial analysis. These factors accounted for 67.7 % of the variance, and are shown in Table 8. However, given the exploratory nature of the analysis, and the stringent probability level for inclusion ($p<.01$) items with factors loadings greater than .60 are also indicated in brackets. Allowing for this extra latitude in interpretation permits the inclusion of the eighth factor with an eigenvalue greater than one, accounting for the remaining 4.6% of the variance. This factor structure may be compared with the suggested factor structure

Table 8

FAI Factors and Significant Item Loadings

Factor Name	Item	Factor Loading	Item Descriptor	Variance
1. Adaptive Behavior	24	.776	Work Habits	.295
	27	.777	Effective Interaction	
	28	.856	Judgement	
	29	.796	Congruence of Behavior	
	30	.792	Problem Solving	
	(1)	(.623)	(Learning)	
	(18)	(.619)	(Acceptability to Employers)	
	(26)	(.660)	(Accurate Perception)	
2. Physical Function	12	.841	Mobility	.110
	(13)	(.681)	(Capacity for Exertion)	
3. Communication	2	.729	Speech	.074
	7	.769	Language	
	8	.745	Ability to Read and Write	
4. Upper Body Functioning	9	.869	Upper Extremity Functioning	.063
	10	.871	Hand Function	
5. Perceptual Organization	4	.742	Perceptual Organization	.053
6. Social Support	25	.853	Social Support System	.043
7. Hearing	8	.753	Hearing	.039
8. Disincentives for Employment	(16)	(.606)	(Stability of Condition)	(.046)
	(21)	(.682)	(Economic Disincentives)	

*Items in ( ) represent factor loadings less than .72 but greater than .60

identified for a general rehabilitation population (Crewe & Athelstan, 1984), seen in Appendix 18.

Personal Capacities Questionnaire

Individual item scores on the functional limitations questions from the PCQ were also subjected to a principal components analysis with a varimax rotation. A great deal of caution is needed in the interpretation of these factor loadings, since the Keyer-Olkin Measure of Sampling Adequacy was very poor (KMO= .36887). However, the purpose of the analysis was exploratory, and may provide a basis for comparison to the FAI factor structure found in the present study, as well as the FAI factor structure suggested by Crewe and Athelstan (1984).

The analysis identified eleven factors with eigenvalues greater than one, accounting for 78.4% of the variance. The complete rotated factor matrix may be seen in Appendix 19. Based on the same criteria for statistical significance of factor loadings as was described for the FAI (see above), five major factors and six single item factors, or singlets, were identified in the analysis. These factors are shown in Table 9, and may be compared with the suggested factor structure identified for the FAI functional limitations scores.

Prediction of Return to Work

All patients but one were successfully contacted following by phone after six months. For the one patient who was not available, return to work status was obtained from the facility which had provided outpatient services. Initially, return to work status was identified as full-time (greater than 20 hours/week), part-time (1-20 hours/ week) or unemployed. However, only four patients returned to work at a part-time level, so these patients were combined with the full-time group in order to simplify further analyses. Results indicate that 43.2% of the patients had returned to work after six months, while 56.8% failed to return. The mean age of subjects who returned to work was 35.3 years, with a average education level of 13.47 years. Analysis revealed that age ($r=-.30$,

Table 9

PCQ Factors and Significant Item Loadings

Factor Name	Item	Factor Loading	Item Descriptor	Variance
1. Vocational Qualifications	19	.870	Personal Attractiveness	.189
	20	.838	Work Skills	
	26	.745	Accurate Perception	
	(22)	(.681)	(Access to Job Opportunities)	
	(23)	(.626)	(Special Job Requirements)	
	(30)	(.682)	(Problem Solving)	
2. Motor Function	11	.843	Motor Speed	.101
	12	.839	Mobility	
3. Cognition	1	.733	Learning	.094
	4	.726	Perceptual Organization	
4. Social Skills	8	.822	Language	.075
	27	.774	Interaction with Others	
5. External Support	21	.754	Finances	.064
	25	.806	Social Support System	
6. Upper Body Functioning	9	.818	Use of Arms	.059
7. Decision Making	29	.787	Desire To Work	.046
	(28)	(.705)	Judgement	
8. Absence from Work	15	.774	Absence from Work	.044
9. Speech	7	.895	Speech	.042
10. Work History	17	.870	Work Record	.037
11. Hearing	6	.873	Hearing	.034

*Items in ( ) represent factor loadings less than .72 but greater than .60

p=.046) was significantly associated with return to work, while education, gender and severity of injury had no significant correlation with return to work status. Although education was not directly related to return to work status, an age by education confound was seen (r=.353, p=.019), which suggests that the older subjects tended to have higher levels of education. In the 19-29 year age group (n=17), 35.3% had returned to work, while 33.3% of the 30-39 years old age group (n=18) and 77.7% of the 40-50 year old age group (n=9) had returned. Summary of the comparisons may be seen in Table 10.

Examination of occupational status, based on the nine overall job categories identified by the D.O.T. (See Appendix 1), indicated that the largest proportion of patients who returned to work (31.5%) were in the "Professional, Technical and Managerial Occupations." A breakdown of the number of patients employed in each job category at six months follow-up may be seen in Table 11.

However, the greatest rate of return to work, based on the pre-injury proportion of patients in each job category, was seen in the "Machine Trades" (100%) and in the "Clerical and Sales Occupations" (71.4%). Summary of pre-injury employment status and post-injury employment status for each D.O.T. job category can be seen in Table 12.

A between groups MANOVA with an independent variable of employment after six months (2 levels) and dependent variables of LM, PASAT, BDI, PCQ-FL, FAI-FL, and BC was performed to determine if there were differences in the original test scores between patients who returned to work after six months and those who did not. Logarithmic transformation was performed on the PASAT variable to achieve normality of distribution, and a square root transformation was required to achieve homogeneity of variance for the FAI-FL variable. The overall results revealed no significant difference between the groups (Hotelling's T (6,37) =.113, p=.654). Planned post-hoc comparisons independent t-tests with Bonferroni correction revealed no significant differences between variables. Summary of the MANOVA and post-hoc comparisons may be seen in Table 13. Means and standard deviations for each measure at the time of initial testing may be

Table 10

Summary of Correlations Between Return to Work Status (Employed or Unemployed) After Six Months, Age, Gender, Education Level and Injury Severity

	AGE	EDUC	GENDER	RTW	SEVERITY
AGE	1.0000 P= .	.3530 P= .019*	.1359 P= .379	-.3027 P= .046*	.1178 P= .446
EDUC	.3530 P= .019*	1.0000 P= .	.1446 P= .349	-.0785 P= .613	-.0070 P= .964
GENDER	.1359 P= .379	.1446 P= .349	1.0000 P= .	.0269 P= .862	.1284 P= .406
RTW	-.3027 P= .046*	-.0785 P= .613	.0269 P= .862	1.0000 P= .	-.2856 P= .060
SEVERITY**	.1178 P= .446	-.0070 P= .964	.1284 P= .406	-.2856 P= .060	1.0000 P= .

*Significant at p<.05

**Spearman Rho statistic used for all correlations with Severity measure

Table 11

Summary of Patients Employed in Each D.O.T. Job Category at Six Months Follow-Up (n=19)

Occupational Category		% Patients
0/1	Professional, Technical, and Managerial Occupations	31.5%
2	Clerical and Sales Occupations	26.3%
3	Service Occupations	5.3%
4	Agricultural, Fishery, Forestry, and Related Occupations	0%
5	Processing Occupations	0%
6	Machine Trades Occupations	15.8%
7	Benchwork Occupations	5.3%
8	Structural Work Occupations	10.5%
9	Miscellaneous Occupations	5.3%

Table 12

Summary of Pre-Injury Employment Status and Post-Injury Employment Status for Each D.O.T. Job Category

Occupational Category	Number of Patients (Pre-Injury Status)	% of Patients Employed After Six Months
0/1	15	40.0%
2	7	15.9%
3	7	15.9%
4	0	0%
5	1	0%
6	3	100.0%
7	3	33.3%
8	6	33.3%
9	2	50.0%

Table 13

Summary of MANOVA and Post-Hoc T-Tests with Bonferroni Correction for Comparison of Employed and Unemployed Patients on the LM, PASAT, BDI, PCQ-FL, FAI-FL, and BC at Initial Testing

MANOVA	Value	Exact F	df	p
Hotelling's T	.11295	.69654	6, 37	.654
Post-Hoc t-Tests		t	df	p
LM		.06256	42	.950
PASAT		.32319	42	.748
BDI		-.88206	42	.383
PCQ-FL		-1.80821	42	.078
FAI-FL		-1.45910	42	.152
BC		.09979	42	.921

* Significant at $p<0.05$

Table 14

Means and Standard Deviations for LM, PASAT, BDI, PCQ-FL, FAI-FL, BC and DIFF at Initial Testing Based on Return to Work Status (Employed/Unemployed) After Six Months

EMPLOYED	LM	PASAT	BDI	PCQ-FL	FAI-FL	BC	DIFF
Mean	17.53	6.01	7.94	9.47	14.12	2.71	4.64
S.D.	9.96	2.22	5.32	5.93	6.51	2.20	7.78
UNEMPLOYED	LM	PASAT	BDI	PCQ-FL	FAI-FL	BC	DIFF
Mean	17.33	6.29	9.96	13.74	19.33	2.63	5.59
S.D.	10.22	4.62	8.43	8.51	12.94	2.62	13.24

seen in Table 14.

The Pearson correlation matrix for all variables at the time of initial testing and return to work after six months may be seen in Table 15. Examination of the relationships indicate that none of the variables at initial testing were significantly correlated with return to work status, although there is a trend toward significance for the PCQ-FL.

Based on variables chosen on an a priori basis, predictor variables of LM, PASAT, BDI, FAI-FL, DIFF and BC were entered in a stepwise multivariate regression analysis. All variables were transformed to standardized scores (Z-scores) prior to the analysis to correct for the different range of scores for each variable. Results revealed that none of the predictors met criterion for inclusion in the equation. In addition, the DIFF score was highly correlated with both the FAI-FL and PASAT scores, which resulted in difficulty with multicollinearity between predictor variables. Multicollinearity presents a problem because it severely limits the size of the multiple correlation (R), and because it makes determining the importance of a given predictor difficult because the effects of the predictors are confounded. To address this difficulty, the PCQ-FL score was substituted for the DIFF score because of its lower correlation with other variables. The dependent variable consisted of cumulative earned income from employment during six months between initial testing and follow-up. A predictor variable was included in the equation only if it was significant at $p=.05$ level. Results revealed that only the PCQ-FL score reached significance, and accounted for 10% of the total variance in the equation ($F(1,41)=4.54$, $p=.039$). A summary of multiple regression results and associated R^2 values for variables may be seen in Table 16. As seen in Figure 2, income levels after six months were generally seen with lower PCQ-FL scores.

In addition, a post-hoc regression analysis was performed using the sociodemographic and test variables which were most highly correlated with return to work status. All variables with correlations of greater than .20 were included. These variables were the FAI-FL, PCQ-FL, PCQ-S, age, and severity of injury. Results revealed that only the

Table 15

Pearson Correlation Matrix for the LM, PASAT, BDI, PCQ-FL, PCQ-S, FAI-FL, FAI-S, DIFF, BC and Return to Work Status

	BC	BDI	DIFF	FAIFL	FAIS
RTW	-.0154 P= .921	.1349 P= .383	.0410 P= .791	.2311 P= .131	-.0881 P= .570

	LM	PASAT	PCQFL	PCQS
RTW	-.0097 P=.950	.0354 P= .820	.2687 P= .078	-.2182 P= .155

*Significant for two-tailed test of probability

Table 16

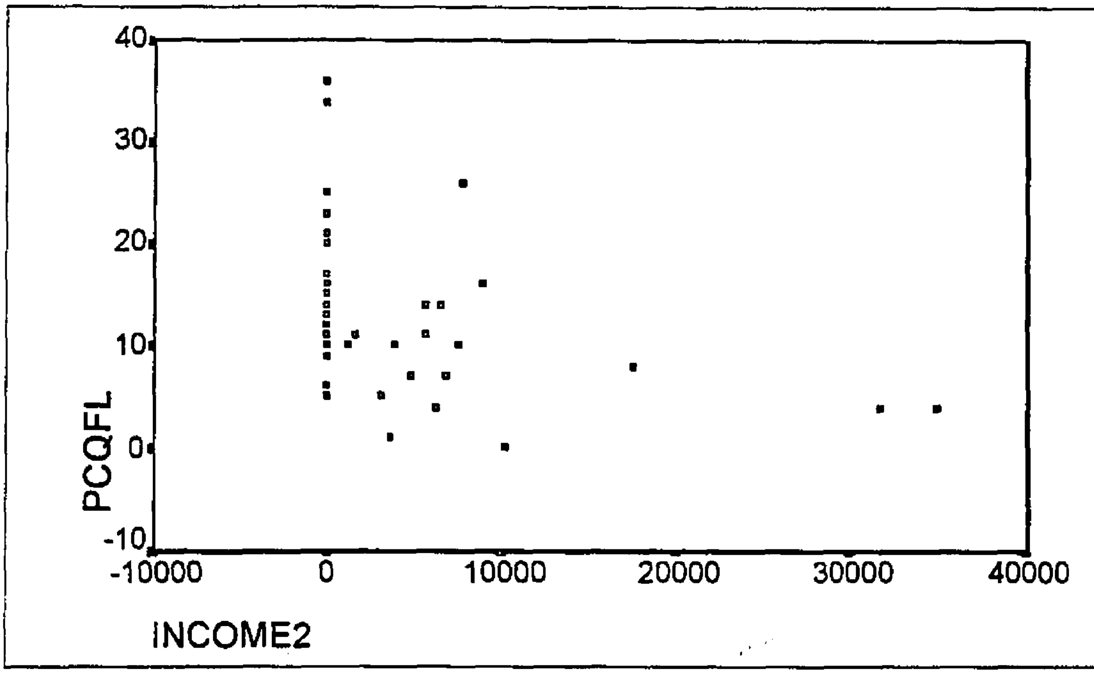
Multiple Regression Coefficients and Associated R^2 Values for Predictor Variables of LM, PASAT, BDI, FAI-FL, PCQ-FL and BC, and Dependent Variable of Earned Income After Six Months

	Multiple R	R^2	Adjusted R^2	df	F	p	BetaIn
Step 1	.31588	.09978	.07782	1, 41	4.54	.039*	-.3159

Variables in Equation	B	Beta	t	p
PCQ-FL	-2391.12	-.3159	-2.132	.039*

* Significant at $p<0.05$

Figure 2. Distribution of PCQ-FL Scores at Initial Testing Across Income Levels at Six Months Follow-Up. Analysis revealed that PCQ-FL scores were a significant predictor of earnings post-injury.


40
30
20
10
0
-10
PCQFL
-10000
0
10000
20000
30000
40000
INCOME2

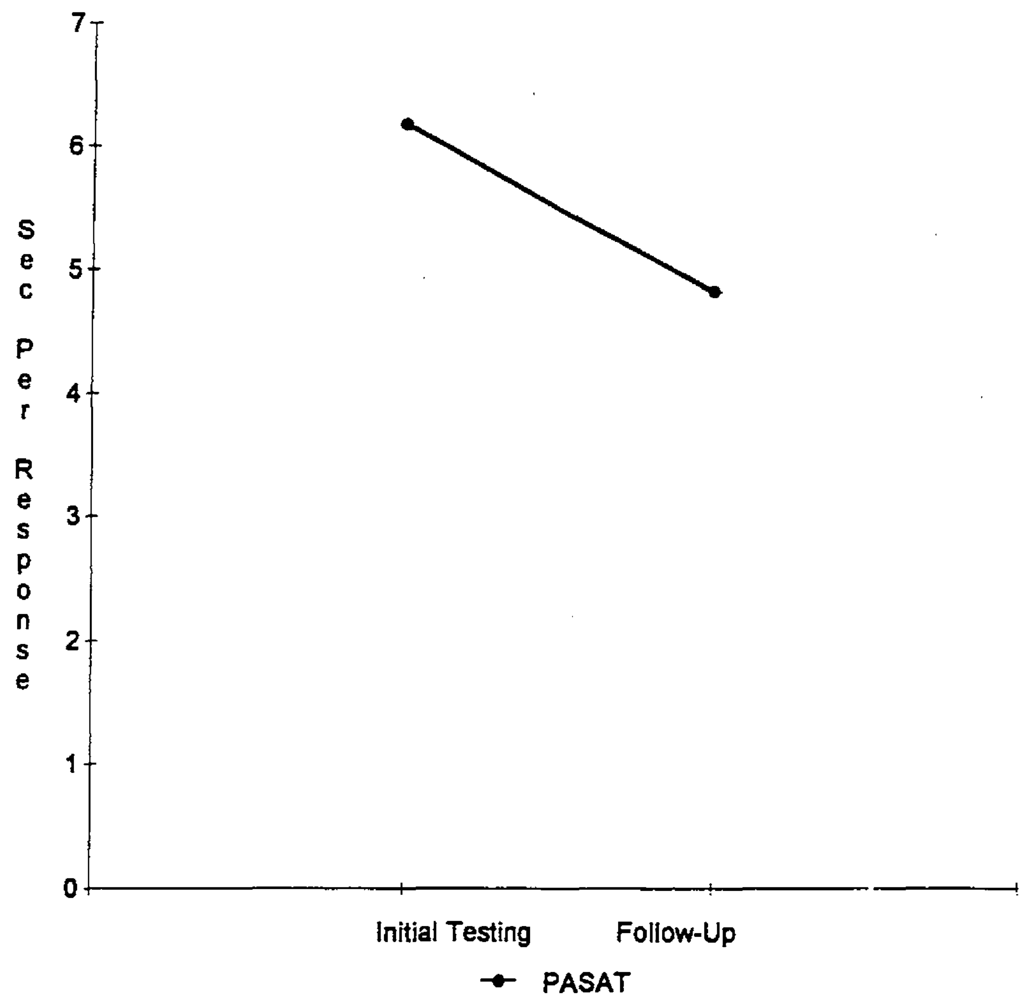
PCQ-FL score reached significance, accounting for 10% of the total variance in the equation (F(1,41)=4.54, p=.039).

Follow-Up Testing

The LM, PASAT, BDI and PCQ were re-administered to a sub-group of patients (n= 16) six months after initial testing. All patients available for re-testing were included. The Pearson correlation matrix for all variables administered at follow-up testing may be seen in Appendix 21. Examination of the correlation matrix for all measures revealed that only the PCQ-FL and the BDI scores were significantly correlated (r=.77, p=.001). This relationship, also present at the time of initial testing, suggests that patients who identify a greater number of functional limitations also report a higher number of depressive symptoms. Comparison of results at the time of initial testing with the results at re-testing was performed using a repeated measures MANOVA with dependent variables of LM, PASAT, PCQ-FL, and BDI. Overall comparison of results at initial testing with results at follow-up demonstrated no significant difference (F(4,12)=.1.84, p=.191). Planned post-hoc comparisons were performed using multiple paired t-tests with a Bonferroni correction. Comparisons revealed a significant improvement in the average time/response on the PASAT (t(15)=-2.61, p=.014). This result, seen in Figure 3, suggests an increase in the speed of information processing during the six months since initial testing. The remainder of the post-hoc comparisons were not significant. A summary of the MANOVA results and post-hoc comparisons may be seen in Table 17. Means and standard deviations for variables included at follow-up may be seen in Table 18.

Closer examination of the PASAT scores at the time of follow-up revealed that all patients tested had faster time per response scores than they did at the initial assessment. Despite this improvement in scores, there was no significant difference in the PASAT score based on return to work status (t(14)=-.58, p=.572). Thus, it appears that while speed of processing improved over time, it could not be used to distinguish those patients who returned to work from those patients who did not.

Figure 3. Mean Response Time (Seconds/Response) for the PASAT at the Time of Initial Testing and at Six-Month Follow-Up. Analysis revealed a significant decrease in response times at the time of follow-up.



7
6
5
4
3
2
1
0
Sec Per Response
Initial Testing
Follow-Up
PASAT

Table 17

Summary of Repeated Measures MANOVA and Post-Hoc T-tests with Bonferroni Corrections for LM, PASAT, BDI and PCQ-FL Scores at Initial Testing and Follow-Up Testing

MANOVA	Exact F	df	p
	1.8353	4, 12	.191
Post-Hoc t-Tests	t	df	p
LM	.61632	15	.547
PASAT	-2.75408	15	.014*
BDI	.21160	15	.835
PCQ-FL	1.05131	15	.310

* Significant at $p<0.05$

Table 18

Means and Standard Deviations for Variables at Follow-Up Testing

	LM	PASAT	BDI	PCQ-FL	PCQ-S
Mean	17.06	4.82	12.06	15.13	4.06
S.D.	8.64	1.73	10.23	13.24	1.61

While the BDI total score did not change significantly from the time of initial testing, it is possible that the two subscales may have changed. Repeated measures MANOVA comparing the cognitive-affective subscale and somatic-performance subscale at initial testing and at follow-up testing revealed no significant difference between the subscales at each time, and post-hoc t-tests revealed no differences between each subscale at initial testing and follow-up. Summary of the MANOVA and post-hoc analyses may be seen in Table 19. Comparison of these subscale means revealed no significant difference ($t(15)=1.16$, $p=.265$). Means and standard deviations for each of the BDI subscales at the time of follow-up may be seen in Table 20. Means and standard deviations for each item on the BDI at six months follow-up may be seen in Appendix 23.

Although there was not a significant change in the PCQ-FL ratings over six months, comparison of the PCQ-FL scores at six months follow-up with the original FAI-FL scores was no longer significant ($t(15)=.96$, $p=.35$). The overall mean of the PCQ-FL at six months was still less that the mean for the FAI-FL, but it appears that patients' self-ratings were now closer to the clinicians' ratings made at the time of initial evaluation. Examination of the items rated as most severely impaired on the PCQ-FL at follow-up revealed some changes since the time of initial testing. At follow-up, items rated as most severely impaired (scores greater than one) consisted of items 3 (memory) and 14 (endurance). Means and standard deviations for each item on the PCQ-FL at follow-up may be seen in Appendix 24.

Examination of the frequency distributions for the items on the PCQ-FL at follow-up also revealed some differences from initial testing. Items endorsed most frequently at follow-up included items 1 (learning), 3 (memory), 4 (visual perception), 17 (work history), 23 (requirements for special working conditions), and 30 (problem-solving). Frequency distributions for all functional limitations items on the PCQ at follow-up may be seen in Appendix 25.

Examination of the frequency distributions of strength items on the PCQ at follow-up

Table 19

Summary of Repeated Measures MANOVA and Post-Hoc Paired T-Tests with Bonferroni Correction for Comparison of BDI Subscales at Initial Testing and Follow-Up Testing

MANOVA	Exact F	df	p
	.32322	2, 14	.729
Post-Hoc t-Tests	t	df	p
Cognitive-Affective Subscale	-.83110	15	.419
Somatic-Performance Subscale	-.30888	15	.762

* Significant at $p<0.05$

Table 20

Means and Standard Deviations for the Cognitive-Affective Subscale and the Somatic-Performance Subscale of the Beck Depression Inventory at Six Months Follow-Up

	Cognitive-Affective (#1-13)	Somatic-Performance (#14-21)
Mean	6.25	5.39
S.D.	5.06	4.19

indicated that items 32 (pleasing personality), 36 (supportive family), and 40 (unusually good common sense) were endorsed more than 50% of the time. Frequency distributions for all strength items on the PCQ may be seen in Appendix 26.

Canadian Versus American Agencies

Comparison of the Canadian patients (n=16) and American patients (n=28) at the time of initial testing was completed using a between groups MANOVA with dependent variables of LM, PASAT, BDI, PCQ-FL, FAI-FL, and BC. A natural log transformation was performed to normalize the distribution of the PASAT variable. Overall comparison of the two groups indicated no significant differences in test scores at the time of initial testing (Hotelling's T (6,37)=.114, p=.651). Pairwise comparisons using independent two-tailed t-tests with a Bonferroni correction revealed no significant difference between individual variables. Summary of the MANOVA and post-hoc comparisons between variables may be seen in Table 21. Comparison of the average pre-injury income using an independent two-tailed t-test for unequal groups (after controlling for exchange on the dollar) was not significantly different (t(41.68)=-.03, p=.973). Comparison of post-injury earned income using an independent two-tailed t-test for unequal groups was also not significant (t(40.53)=1.38, p=.174).

Table 21

Summary of Between Groups MANOVA and Post-Hoc T-tests with Bonferroni Corrections Comparing Canadian and American Agencies on LM, PASAT, BDI, PCQ-FL, FAI-FL and BC Scores at the Time of Initial Testing

MANOVA	Value	Exact F	df	p
Hotelling's T	.11357	.70034	6, 37	.651
Post-Hoc t-Tests (USA & Canada)		t	df	p
LM		.17172	42	.864
PASAT		1.53547	42	.132
BDI		-.55108	42	.585
PCQ-FL		-1.31424	42	.196
FAI-FL		-.16470	42	.870
BC		.45124	42	.654

* Significant at $p<0.05$

CHAPTER FOUR

Discussion

Accurate evaluation of vocationally relevant abilities following a TBI is a difficult, and sometimes controversial, process. The present study attempted to demonstrate the usefulness of combining measures of cognitive skills, emotional status, and functional abilities in order to provide a brief but useful assessment of functioning, as well as to predict vocational outcome after six months.

Initial Testing

Memory

At the time of initial testing, patients did not show marked deficits in the area of verbal memory, although performance varied widely. Comparison to WMS-R normative data available on the delayed component of the Logical Memory subtest revealed that TBI patients performed at the 27th percentile relative to age norms (Wechsler, 1987). Given the preponderance of literature suggesting that verbal memory is significantly impaired following TBI (Hart, 1994; Baddeley et al. 1987; Bond, 1986), this finding was somewhat surprising. In fact, several studies have found that performance on the LM was significantly impaired following TBI (Dikmen, Machamer, Winn & Temkin, 1995; Reid & Kelly, 1993; Crosser & Wiens, 1988).

Several explanations for the relative lack of impairment on the LM might be put forth. First, all patients were involved in a structured rehabilitation program at the time of testing, and may have benefited from those services. However, given the recency of their injuries, and the fact that memory is often reported as a long-lasting and often permanent deficit post-injury, it seems unlikely that rehabilitation services aided memory skills a great deal. Another possibility is that the average education of the present sample (13.7 years), was above that of the normative sample. Unfortunately, no educational level is reported for the LM normative sample, but it is possible that the level of education may have resulted from somewhat better premorbid memory skills. Alternatively, it may be that comparison to age norms may not reflect the full severity of verbal memory impairment. Guilmette and Rasile (1995) report that in a sample of mild head-injured patients with comparable educational levels, mean performance on the delayed component of LM fell only one third of a standard deviation below the mean relative to WMS-R normative data. In contrast, a control group matched for age, education, race and gender performed nearly on full standard deviation above the mean. They determined that this difference between TBI patients and a matched control group was more robust that the difference seen for either a list-learning task or a paired-associate learning task. However, patients who returned to either work or school reported continuing difficulty with work demands and cognitive processing. In the present study, performance on the LM was nearly two thirds of a standard deviation below the mean based on Wechsler (1987). However, compared to reported mean performance of a control sample of similar age and education level who performed nearly one full standard deviation above WMS-R age norms, the performance of patients in the present study would be at the 3rd percentile, which would be in the impaired range.

Attention and Information Processing

In contrast to their memory performance, patients exhibited significant impairments in speed of information processing relative to age norms, as the mean time per response on the PASAT is almost twice that expected for persons 40 years and younger. This latter finding is consistent with the vast majority of the literature which suggests that speed of information processing is significantly impaired subsequent to TBI (Ponsford & Kinsella, 1991; Gronwall & Wrightson, 1975, 1981; Gronwall, 1977). Based on average time per response of persons with mild (4.05 ± 1.42 seconds/response), moderate (5.27 ± 2.05 seconds/response) and severe injuries (8.28 ± 3.81 seconds/response) provided by Gronwall and Wrightson (1981), the performance of the patients in the present study is very consistent for a group made up of mostly moderate and severe injuries. Ponsford and Kinsella (1991) noted slightly better speed of processing scores for persons with severe injuries within the first year post-injury (4.6 ± 1.6 seconds/response), but these scores are still at least two standard deviations below the expected age norms provided by Gronwall (1977) of $3.2 \pm .25$ seconds/response. In addition, Ponsford and Kinsella (1991) noted that head-injured patients made significantly more errors on the PASAT than did a matched control group. Thus, the present results support previous findings that the PASAT may be used to demonstrate speed of information processing deficits in a TBI population.

A correlation was seen between the PASAT and the LM, which is not surprising since it could be assumed that the rate of encoding of new information would be affected by the person's speed of information processing. As suggested by Sohlberg and Mateer (1989), "attentional capacity is a logical component of any memory model since it is this capacity that allows information to have access to the system to begin with" (p. 139).

Finally, the correlation between the FAI and the PASAT demonstrates a possible relationship between speed of information processing and vocational strengths and weaknesses. Gronwall (1977) has suggested that the PASAT may be used to monitor work readiness, and that normal performance on the PASAT is associated with ability to return to normal employment. Given that the FAI was developed to assess work related skills, it would not be considered unexpected to find a relationship with speed of information processing.

Executive Functions

A new measure, the Behavior Checklist, was used in the present study in an effort to address the wide variety of possible executive function deficits that are often seen after TBI. The BC was designed to identify the presence or the absence of specific behavioral problems identified in previous literature (Lezak, 1983; Stuss & Benson, 1986; Prigatano, 1991). Although overall scores were low compared to the total possible scores, it is felt that the BC may have some utility in TBI assessment. Several factors may have played a role in reducing the scores on the BC. First, all patients were involved in a structured rehabilitation program at the time of testing, which may have put fewer demands on their executive abilities than might be present in less structured day-to-day living. As such, some of the behavioral deficits that may have been present were alleviated by the presence of a strong external structure. Secondly, although clinicians familiar with the patient were making the behavioral ratings, they were not able to observe the patients in all settings throughout the day, and therefore, may not have been able to rate behaviors in less structured settings. Finally, the structure of the rating scale itself may have been problematic. Since clinicians were only identifying the presence or absence of symptoms, rather than levels of severity, it may be that clinicians only endorsed items that were severe behavioral problems. Further modification of the BC for future studies may be able to address these problems areas.

Within the present study, the most commonly endorsed items on the BC were those describing difficulty attending to relevant information, and decreased spontaneity and production of behavior. The former is a deficit that is often reported in the literature following damage to the frontal lobes. Fuster (1989) reported that in frontal lobe damaged monkeys, there was an inability to maintain consistent, directed attention over time, and that vulnerability to interference appeared to be the basic deficit. Similar results are reported for persons with frontal lobe injuries (Woods & Knight, 1986; Stuss et al., 1985), and is thought to be due to difficulty inhibiting attention and responses to irrelevant events. Stuss (1991) suggests that the primary problem with attention following frontal lobe injury may be an increased vulnerability to the effects of interference. Stuss (1985) used the Brown-Peterson triads to demonstrate that interference impaired head-injured performance relative to normal controls. These deficits in attentional control have also been associated with damage to the dorsolateral prefrontal cortex (Knight, 1991; Cummings, 1985), in which other behaviors such as planning, goal-directed behavior, sequencing, organization, judgement and insight may also be impaired.

The decreased spontaneity and production of behavior is also a deficit commonly reported in the literature describing frontal lobe damage. Janowsky, Shimamura and

Squire (1989) found that patients with left or bilateral frontal lobe lesions produced fewer words on a word fluency test than did control subjects. Similar results were reported by Levin, Goldstein, Williams and Eisenberg (1991), who suggested that the impairment in initiation may be related to difficulties organizing and searching for information in semantic memory. In addition, this decreased spontaneity of behavior is consistent with behaviors reported following bilateral mesial prefrontal damage involving the supplementary motor and cingulate cortex (Knight, 1991; Cummings, 1985). Damage to these areas may produce slowness or akinesia, diminished initiative, indifference, and apathy, and may often be mistaken for depression.

Examination of the relationship of the BC with other variables also suggests that the BC may be a valid reflection of deficits following TBI. The association between LM scores and the BC suggest a relationship between verbal memory skills and frontal lobe function. Given that the frontal lobes are thought to be involved in attention and organization skills, both of which would be required for accurate recall of information after a delay, it is reasonable that increasing scores on a measure thought to identify frontal dysfunction are related to increasing degrees of memory impairment. Vanderploeg, Schinka and Retzlaff (1994) provide further support for this hypothesis, concluding that attentional aspects of executive abilities appear to play a role in learning and working memory. They suggest that attention and mental tracking are essential aspects of working memory, and that these variables are essential in long-term memory acquisition. In addition, it has been suggested that both memory and executive functions rely on similar brain structures. The prefrontal cortex has long been associated with executive functions (Lezak, 1983 & 1987; Stuss & Benson, 1986). Other researchers have also suggested that the frontal lobes play a role in associative learning (Drewe, 1975; Petrides, 1982), recency memory (Milner; cited in Vanderploeg et al., 1994) and delayed recall (Freedman & Oscar-Berman, 1986). The frontal lobes are thought to play a role in organization and attentional abilities, both of which should impact the learning and recall of contextual-verbal information such as that used in LM.

The BC also had a significant correlation with the PASAT scores, which suggested that greater impairments in executive functioning are associated with a slower speed of information processing. Ponsford and Kinsella (1991) suggest that poorer PASAT performance is seen following TBI because patients cannot "sustain accurate detection performance under capacity-demanding conditions unless adequate motivation is provided" (p. 807). The role of interference, as discussed by Stuss (1985,1991) may also play a role in PASAT performance, as normal performance on the PASAT demands intact ability to perform rapid mental operations while simultaneously attending to external stimuli. TBI patients with greater vulnerability to interference may be distracted by the external stimuli of the voice on the tape and be less able to perform the task. As discussed above, the frontal lobes appear to play a primary role in the regulation of attentional processes; therefore, it is not surprising that a measure of executive functions would be positively correlated with PASAT performance.

Finally, the BC was also correlated with the difference between FAI-FL scores and PCQ-FL scores (DIFF). This association makes inherent sense since the difference score is a reflection of the discrepancy between clinicians' ratings on the FAI-FL and patients' ratings on the PCQ-FL, and was proposed to represent a measure of awareness of deficit. According to the original hypothesis, the greater the discrepancy, the less awareness exhibited by the patient. Since awareness of deficit is generally associated with dysfunction of the frontal lobes (Prigatano, 1989, 1991), greater deficits in awareness should also be related to greater impairments in executive functioning.

Depression

The finding that only 13.6% of patients reported a significant number of depressive symptoms on the BDI is somewhat lower that estimates from previous research of the incidence of depression following TBI (Burns et al., 1994; Jorge et al., 1993a, 1993b;

Tyerman & Humphrey, 1984). For the majority of patients in the present study, the mean score on the BDI was within normal limits relative to the cut-off score of 10.9 suggested by Beck (1987). Several explanations for this reduced incidence might be suggested. First, it may be that the BDI does not identify the types of depressive symptoms that may be present in a TBI population. This explanation seems unlikely, since the BDI was constructed to cover a wide range of depressive symptoms, and is commonly used with a variety of different populations. However, it should be recognized that a number of the items on the BDI , such as weight loss, sleep disturbances, and energy level, may reflect deficits directly attributable to the TBI rather than actual depressive symptoms. Alternatively, it may be that the vast majority of TBI patients in this study were simply not experiencing a significant number of depressive symptoms. Such a conclusion would be inconsistent with much of the previous literature which suggests at least some degree of depression is prevalent in a TBI population.

However, there are two possibilities which may help explain the relative absence of depressive symptoms at the time of initial testing. One possibility is that at least several patients had experienced a transient depression which had resolved by the time they reached outpatient services. This possibility is supported by the findings of Jorge et al. (1993a), who found that within a group of TBI patients hospitalized following TBI, 41% were depressed while in acute care, but no longer depressed at three months follow-up. In addition, Jorge et al. (1993c) suggest that transient depression is more strongly associated with diffuse damage and/or a greater degree of damage in the left anterior portions of the brain, and the present sample all had diagnoses of diffuse injury. A second possibility is that patients were not yet fully aware of their deficits, and as such, were not experiencing any significant degree of distress over their loss. Since the frontal structures are the most common area of damage after TBI, and impairments in awareness of deficit are often associated with frontal injuries (Prigatano, 1989, 1991), it may be that this unawareness also extends into awareness of emotional dysfunction. Jorge et al. (1993c) also found that the presence of frontal lesions was associated with a decreased probability of longer lasting anxious depressions. Given the association between anxiety and arousal/attentional mechanisms, and between those attentional mechanisms and frontal lobe functions (Fuster 1989), it might be suggested that prolonged depression requires relatively intact frontal lobe structures.

This possibility that lack of awareness plays a role in the reporting of depressive symptoms was further supported by examination of the cognitive-affective and somatic-performance subscales. Breakdown of the BDI scores into the cognitive-affective subscale and somatic-performance subscale may provide some insight into the reasons for the relatively lower scores reported by TBI patients. Comparison to six other populations used by Beck (1987) in the normative sample (mixed diagnostic, single episode major depression, recurrent major depression, dysthymic disorder, alcoholic, and heroin addicts) revealed that the normative sample groups scored anywhere from 1.54 to 3.24 times greater on the cognitive-affective subscale than did the TBI sample in the present study. In comparison, the six normative groups' scores on the somatic-performance subscale only ranged from 1.11 to 1.84 times as great as the TBI population. These results suggest that although patients in this study endorsed a relatively similar number of somatic complaints on the BDI as do other clinical samples, they reported fewer cognitive and/or affective symptoms. As seen in Table 4, there was no significant difference in TBI patients ratings on the cognitive-affective subscale and the somatic-performance subscale, despite the fact that there are five more items included in the cognitive-affective scale. Such a breakdown suggests that the largest difference between the TBI patients in the present sample, and the above mentioned groups was accounted for by scores on the cognitive-affective subscale. Therefore, it may be suggested that TBI patients are less aware of potential cognitive-affective symptoms, especially in the early stages after injury. Thus, the patients more easily identified physical sequelae of their injuries, but were less aware of deficits in the cognitive and emotional realm.

Given that lack of awareness of deficits is generally associated with more severe injuries, it seems plausible that persons with milder injuries may exhibit greater awareness, and therefore, greater degrees of depression. The results of the present study do not support such an assumption, as two of the six depressed patients had moderate injuries, while four of six sustained severe injuries. However, the number of patients with significant levels of depression was very small (n=6), and may not provide adequate representation of depression following TBI. Jorge et al. (1993a) were also unable to identify a consistent relationship between depression and measures of either physical deficits (Johns Hopkins Functional Inventory) or cognitive impairment (Mini-Mental Status Exam). In addition, Godfrey, Partridge, Knight & Bishara (1993) compared injury severity and patients' reported level of behavioral impairment, and found no significant correlation. An alternative explanation may be that the extent of damage to the frontal regions is the key to lack of awareness, and perhaps decreased depression, rather than the overall severity of injury.

Of further interest is the relationship between the PCQ and the BDI, where it was seen that depressed patients (BDI>15) estimated their functional limitations at a higher level than did clinicians. Non-depressed patients, however, showed the opposite tendency (see Table 3). This association between depression and over-estimation of deficits may be described as an example of one end of a "continuum of awareness", which may range from total lack of awareness to partial awareness to over-awareness of deficit. There is much literature available which strongly suggests that persons with traumatic brain injury may be partially to wholly unaware of deficits (Prigatano, 1991). It might reasonably be suggested that the patients who are less aware of the extent of their deficits may also exhibit less depression related to those deficits. Based on the present results, it may also be suggested that those patients who report significant depressive symptoms may actually overestimate their functional limitations.

Somewhat similar results were seen in a study of severely injured patients who were asked to complete a memory self-rating questionnaire three years post-injury (Boake, Freeland, Ringholz, Nance and Edwards,1995). Interestingly, they found for valid responders who were classified as depressed, the correlations between memory self-ratings and performance on formal memory tests were not consistently in the same direction. In contrast, non-depressed patients did show a significant positive correlation between the two. These results suggest that the presence of depression may impact a patient's perception of memory abilities. Taken together with the results of the present study, it might be suggested that an assessment of possible depressive symptoms may be useful in the evaluation of TBI in order to aid the patient in gaining accurate insight into his deficits.

Functional Assessment

Previous normative studies of the FAI (Crewe & Athelstan, 1984) report that the mean score for the FAI-FL in a general rehabilitation population (12.26 ± 8.10) is somewhat lower than that found in the present study (Table 2). Ratings for a physical disability group made up of orthopedic injuries, amputees, cardiac illness, diabetes, and other illnesses (14.63 ± 9.37) were more similar. However, the most similar results were those reported for a behavioral disability group made up of persons with mental illness, developmental disability, or chemical dependency (18.36 ± 9.42). Mean scores for the PCQ-FL at initial testing were generally less than all of the normative groups used for the FAI-FL studies, although these scores increased by the time of follow-up. These results suggest that the functional limitations seen in a TBI population may be slightly greater than those of a general rehabilitation group, and may be more comparable to the level of deficit seen in the behavioral disability group.

Interestingly, strength scores for the FAI in the present study are above means reported for the normative groups. Compared to the TBI group used in the present study, the general rehabilitation group (1.13 ± 1.73), physical disability group (1.47, no standard deviation reported), and behavioral disability group (.82, no standard deviation reported) were rated as having fewer overall strengths by clinicians. Although no clear explanation for this discrepancy can be given, it may be that the relatively sudden onset of TBI allows for greater strengths to be seen at the acute stage of injury (e.g., employers holding jobs, etc.). Finally, it can be seen that TBI patients rate their strengths well above those reported by clinicians for other disability subgroups. Unfortunately, there are no directly comparable statistics available.

Factor Analyses of the FAI and PCQ

Various principal components analyses have been performed on previous data sets (Crewe & Athelstan, 1984). Based on this previous work, Crewe and Athelstan (1984) report that the results from the Wisconsin DVR sample (n=1716) are "the most complete and satisfactory view of the dimensions of the FAI" (p. 48). These factors can be seen in Appendix 19, and will subsequently be referred to as the "general" factor structure.

Overall, the FAI factor structure for TBI patients derived in the present study (Table 8) is not inconsistent with results of the general factor structure. Comparison of the FAI factor structure for TBI patients, and the general factor structure is as follows:

1) Factor 1, "Adaptive Behavior," is essentially identical to the general factor structure's "Adaptive Behavior" factor except that Item 26, "Accurate Perception" did not meet criteria for inclusion. Also, Factor 1 included Items 1 (Learning) and 18 (Acceptability to employers). This factor accounted for the largest proportion of the variance in both the general factor structure and in the FAI factor structure for TBI patients.

2) Factor 2, "Physical Function", is compatible with the general factor structure's "Physical Condition", although only two of the five items identified in the Wisconsin sample met criteria for inclusion on this factor in the present study.

3) Factor 3, "Communication", shares two of the three items included in the general factor structure's "Communication" factor. In the present study, Item 2 (Ability to Read and Write) was included in the "Communication" factor, whereas in Crewe and Athelstan (1984), Item 2 loaded on the "Cognition" factor.

4) Factor 4, "Upper Body Functioning", is consistent with the general factor structure's "Motor Functioning" factor, although only two of the four items met criteria for inclusion on this factor in the present study.

5) Factor 5, "Perceptual Organization", is a singlet that was not previously identified. In the general factor structure, Item 4 (Perceptual Organization) is part of a larger "Cognition" factor. Interestingly, there was no similar "Cognition" factor seen in the present study. Review of the factor loadings for TBI patients (Appendix 19), and of the items included in the "Cognition" factor in the general factor structure, reveals that both learning and memory items have loadings of greater than r=.30 on Factor 1 ("Adaptive Behavior"), Factor 3 ("Communication"), and Factor 5 ("Perceptual Organization"). Keeping in mind the degree of caution needed to interpret this analysis, one possible interpretation of the original "Cognition" items may be that deficits in these areas are more pervasive in a TBI population than in a general rehabilitation population, and therefore, load across a number of factors.

6) Factor 6, "Social Support", is also a singlet that was not identified in the general factor structure. Rather, Item 25 (Social Support System) loaded as part of the "Adaptive Behavior" factor.

7) Factor 7, "Hearing", is also a singlet not identified in the general factor structure. Rather, item 6 (Hearing) loaded on the "Communication" factor.

8) Factor 8, "Disincentives for Employment," was also not seen on the general factor structure. Rather, Item 16 (Stability of Condition) loaded on the "Physical Condition" factor, while Item 21 (Economic Disincentives) loaded on the "Vocational Qualifications" factor.

The PCQ factor structure for TBI patients derived in the present study (Table 9) is less consistent than the general factor structure. Comparison of the PCQ factor structure for TBI patients, the general factor structure, and the FAI factor structure for TBI patients (referred to as "TBI factor structure") is as follows:

1) Factor 1, "Vocational Qualifications", is a combination of "Adaptive Behavior" and "Vocational Qualifications" from the general factor structure. It included two items from the "Adaptive Behavior" factor from the TBI factor structure, but was otherwise not comparable.

2) Factor 2, " is made of one item from "Motor Functioning" and one item from "Physical Condition" on the general factor structure. It is most consistent with the "Physical Function" factor of the TBI factor structure.

3) Factor 3, "Cognition" is consistent with the "Cognition" factor on the general factor structure, although two of the original four items did not meet criteria for inclusion. There was no comparable factor on the TBI factor structure.

4) Factor 4, "Social Skills," was not identified in the general factor structure. Rather, Item 8 (Language) loaded on the "Communication" factor, while Item 27 (Interaction with Others) loaded as part of "Adaptive Behavior." It was also not seen on the TBI factor structure.

5) Factor 5, "External Support," was not identified in the general factor structure, although it is consistent with the "Social Support" singlet identified on the TBI factor structure. Item 25 (Social Support System) loaded as part of the "Adaptive Behavior" factor on the general factor structure, while Item 21 (Economic Disincentives) loaded on "Vocational Qualifications." Given that this general area was identified on both the FAI and PCQ for TBI patients, it might be suggested that it accounts for a unique component of the variance which does not appear to be as notable for a general rehabilitation population.

6) Factor 6, "Upper Body Functioning," is a singlet which was not identified on the general factor structure. Rather, Item 9 (Upper Extremity Functioning) loaded on "Motor Functioning." However, it is consistent with the "Upper Body Functioning" factor on the TBI factor structure.

7) Factor 7, "Decision Making," is made of two items which loaded on the "Adaptive Behavior" factor on both the general factor structure and on the TBI factor structure.

8) Factor 8, "Absence from Work," is a singlet which was not identified on the general factor structure. Rather, it loaded on "Physical Condition."

9) Factor 9, "Speech" is a singlet which loaded on the "Communication" factor on both the general factor structure and the TBI factor structure.

10) Factor 10, "Work History," is a singlet which loaded on the "Vocational Qualifications" factor on the general factor structure.

11) Factor 11, "Hearing," is also a singlet not identified in the general factor structure. Rather, item 6 (Hearing) loaded on the "Communication" factor. However, it was also identified as a singlet on the TBI factor structure.

Overall, it is easily seen that the factor structures derived for both the FAI and PCQ are not as comprehensive as that suggested by Crewe and Athelstan (1984). However, there are some similarities which suggest that the general factor structure may be used to interpret TBI ratings. In particular, all three factor structures have some combination of items that were identified as "Adaptive Behavior" by Crewe and Athelstan (1984) which accounted for the largest proportion of the variance in each analysis. The next factor on each of the analyses was labeled either "Motor Functioning" or "Physical Function," which suggests that physical abilities account for a significant part of the variance for both TBI patients and patients from a general rehabilitation population. "Cognition" appears as the third factor on both the general factor structure and the PCQ factor structure, although does not appear on the FAI factor structure for TBI patients. Finally, "Communication" appears on both the general factor structure and on the FAI factor structure for TBI patients, but not on the PCQ factor structure. Comparison beyond these factors is difficult due to the number of singlets which were seen on both of the TBI analyses. It might be suggested that an "External Support" or "Social Support" factor, seen on both of the TBI analyses but not on the general factor structure, may be unique to TBI patients. However, a much larger sample would need to be evaluated before any firm conclusions on the overall factor structures could be made. At present, it may only be suggested that the present results are not incompatible with those proposed by Crewe and Athelstan (1984).

Based on the factors identified in the general factor structure identified by Crewe and Athelstan (1984), it should be possible to develop a percentile rank of factor scores for a given client in order to show the relative intensity of problems in various areas. In addition, the overall means and standard deviations for each factor may help determine which general area(s) of functioning will have the greatest impact on successful return to work following brain injury. For example, factor scores for any individual patient could be compared to the mean factor scores based on the normative data, which would allow identification of areas of deficit that could then be addressed directly in treatment.

Item Analyses of the FAI and PCQ

Examination of the individual item scores on the FAI-FL and PCQ-FL reveal variations in the areas that clinicians and patients rate as the most severely impaired. Clinicians identified two areas of dysfunction that may be broadly categorized as "cognitive" (learning and memory) and "physical" (mobility, capacity for exertion, endurance, and loss of time from work). With reference to the FAI factor structure seen in Table 8, these items would be most consistent with "Adapative Behavior" and "Physical Function." These two factors accounted for the largest proportion of the variance in the analysis for TBI patients. With reference to the general factor structure, these items loaded heavily on the "Cognition" and "Physical Condition" factor.

In contrast, the items rated as the most severely impaired by patients on the PCQ-FL consisted only of the items of "capacity for exertion", and "endurance". Neither of these items reached significance for loading on the PCQ factor structure seen in Table 9, although they are included in Crewe and Athelstan's (1984) "Physical Condition" factor. Within the PCQ-FL factor structure, "capacity for exertion" had loadings of .51 on Factor

8, .47 on Factor 2, and .45 on Factor 1. "Endurance" was similarly split across several factors, with a loading of .55 on Factor 2, .37 on Factor 6, and .38 on Factor 10. Thus, items rated as most severely impaired on the PCQ-FL appear to affect a number of different areas, somewhat like "memory" loaded across factors on the FAI-FL. In addition, the stringent criteria used for interpretation on the factor structures helps explain why these items did not appear in the factor loadings. With a larger sample size, a loading of greater than .50 would likely be considered statistically significant. Alternatively, the inclusion of "normals" in a factor analysis of the FAI and PCQ might be helpful in order to show the possible importance of items rated as most severely impaired for TBI patients. Such an analysis might increase the variance across these items, and demonstrate the possible importance of these items for a TBI population.

Comparison to severity ratings on the FAI suggest that clinicians rated the severity of impairment on cognitive factors, particularly in the areas of learning and memory, as greater than did patients. In addition, although clinicians and patients made comparable ratings in the areas of capacity for exertion and endurance, patients did estimate their impairments in mobility and loss of time from work as less severe than did clinicians.

Examination of the frequency distributions for the items on the FAI-FL and PCQ-FL reveal similar discrepancies in the frequency with which clinicians and patients endorse certain items. The most frequently endorsed items by clinicians were "memory" (86.4%) and "learning" (84.1%), followed by "endurance" (79.5%) and "capacity for exertion" (75.0%). Like the ratings for severity of impairment, items endorsed more than 50% of the time on the FAI-FL may be grossly categorized as "cognitive" and "physical." On the other hand, the most frequently endorsed items on the PCQ-FL were "capacity for exertion" (72.7%), "endurance" (68.2%), and "motor speed" (61.4%).

The frequency of endorsement for "capacity for exertion", "endurance" and "motor speed" was relatively consistent across the PCQ-FL and FAI-FL. However, the remaining items endorsed more than 50% of the time on the FAI were certainly not endorsed with a similar frequency on the PCQ. For example, there was a lower frequency of endorsement of "learning" (50%) and "memory" (50%) by patients, although these were the two problem areas most often reported by clinicians. Similar reductions in frequency were also seen in patients' ratings for "mobility", "loss of time from work", "access to job opportunities", "requirements for special working conditions", "accurate perception of abilities", and "problem-solving." These findings suggest that not only do patients rate themselves as less severely impaired than do clinicians, the frequency with which they endorse items most often identified by clinicians is also reduced.

On the other end of the frequency spectrum are those items which were the least likely to be endorsed on the FAI-FL and PCQ-FL. Items endorsed less than 25% of the time on the FAI-FL included the "ability to read and write in English", "vision", "hearing", "speech", "stability of condition", "work history", "personal attractiveness", "economic disincentives", "social support", and "desire to work". Items endorsed less than 25 % of the time of the PCQ were many, and included "reading and writing in English", "hearing", "language", "absence from work", "stability of condition", "work record", "acceptability to employers", "personal attractiveness", "work skills", "economic disincentives", "work habits", "social support", "getting along with others" and "desire to work." Items endorsed less than 25% of the time across the FAI-FL and PCQ-FL at initial testing included the "ability to read and write in English", "hearing", "stability of condition", "work record", "personal attractiveness", "economic disincentives", "social support", and "desire to work."

Examination of the variables least likely to be endorsed across both scales provided several possible explanations for why these items are seldomly endorsed. First, requirement of the present study was that all patients have adequate reading and language abilities, and hearing sufficient enough to hear a voice from a tape recorder. This requirement would likely result in very few, if any, endorsements of the items referring to reading and writing in English, and hearing. Second, given that all injuries were a result of

TBI, and all patients had been discharged from an acute care hospital, the item dealing with stability of condition was not usually endorsed. Third, a requirement of the study was that patients had stable work histories, and none had been out of work for more than one year at the time of initial testing, the item dealing with work record was not really applicable. Fourth, since all patients voiced an interest in returning to work at some point in the future, economic disincentives and desire to work were rarely identified as problem areas. Fifth, the majority of patients had family and/or friends that were supportive and involved in the rehabilitation process, so social support was generally not considered a problem area for many patients. Finally, many of the patients involved in the present study were in a very structured rehabilitation program, and had supportive care outside of the program, so difficulties with personal appearance or hygiene were either not a problem or had already been addressed.

Examination of the strength items may provide some qualitative indications of characteristics which may offset functional limitations. Similar to the ratings on the FAI-FL and the PCQ-FL, there were discrepancies in the frequency with which clinicians and patients rated that various strength items. On the FAI, the most frequently endorsed items were "extremely motivated to succeed vocationally" and "job available with a current or previous employer", both of which is endorsed 50% of the time. However, strength items endorsed on the PCQ more than 50% of the time included "has a very pleasing personality", "excellent educational credentials", "extremely supportive family", "absolutely determined to get a job", "job available with a previous or current employer" and "unusually good common sense." Comparatively speaking, the primary difference between the strength ratings on the FAI and PCQ appears to be in the ratings of interpersonal skills. Thus, it appears that early after injury, patients not only rate themselves as less impaired relative to clinicians' ratings, but actually see themselves as having a greater number of strengths.

The PCQ was re-administered six months after initial testing. The patients' ratings at this time reflected increasing acknowledgment of cognitive deficits, and mildly decreased emphasis on physical impairments. Items rated as most severely impaired on the PCQ-FL after six months were "endurance" and "memory." In addition, there was an increase in the severity of impairment ratings on "learning." Although "endurance" was rated as one of the two areas most severely impaired at initial testing, there was no acknowledgment of memory or learning problems at that time. Finally, "capacity for exertion" was no longer rated as significantly impaired.

Examination of the frequency distribution of PCQ-FL items at six months revealed an expanded list of items endorsed more than 50% of the time. This list now included "learning," "memory", "visual perception", "work record", "special job requirements" and "problem-solving", none of which were included at initial testing. There was no noticeable change in the frequency of endorsement on "motor speed", and there was a reduction in the frequency of endorsement for "capacity for exertion" and "endurance". On the PCQ strength items, there was also a reduced frequency of endorsement of items, with only "pleasing personality", "extremely understanding family", and "unusually good common sense" rated more than 50% of the time.

This pattern of reduced severity ratings and lesser frequency of endorsement by patients supports the literature which suggests that patients' judgement of deficits may be impaired post-injury. Several studies have found that patients tend to underestimate the frequency of problems compared to relatives' reports (Oddy et al., 1985; Prigatano et al., 1986) and staff ratings (Fordyce & Roueche, 1986). Prigatano et al. (1986) found that persons with greater difficulty being productive, maintaining personal relationships, and being actively involved in rehabilitation activities all insisted that they were totally aware of their deficits, while those who were more successful across these areas reported that there were areas of deficit present. It also appears that the primary difference between clinicans' and patients' ratings in the present study were due to ratings of cognitive and interpersonal skills while more similar ratings were seen for physical impairments. Such discrepancies between ratings of physical deficits and more complex cognitive and interpersonal skills has also been reported in the literature (Prigatano et al., 1990).

In summary, comparison of the overall scores on the FAI and PCQ suggests that TBI patients not only exhibit a decreased awareness of work-related deficits relative to clinicians' ratings, but also overestimate their personal strengths. The differences seen between the FAI and PCQ suggest that these scores can be used to accurately identify these tendencies in a TBI population, and to assist with the counseling process for both the patient and his/her family. Identification of these tendencies may be especially helpful in situations where there is a lack of awareness or of acceptance of disabilities.

The present study also provides the first available field research using the PCQ for any population. It was found that TBI patients assessed in the first 12 months post-injury underreported the number and severity of functional limitations relative to ratings made by clinicians. As previously noted, both the FAI and PCQ were designed to evaluate vocationally relevant strengths and weaknesses. The finding that patients generally underestimated their deficits, and overestimated their personal strengths, suggests that the PCQ may be a useful tool to rate not only awareness of deficits, but also work readiness. In addition, it appears that the PCQ may be used to monitor changes in patients' self-perception over time, especially in the cognitive realm.

Return to Work

The present study found that 43.2% of the patients returned to competitive employment, as indicated by earned income levels at the time of the six month follow-up. It was found that there was a significant relationship between age and employment post-injury, but examination of the means for each age group indicates that the 40-50 year old age group had a higher percentage of patients who returned to work than did the two younger age groups. This finding is not consistent with much of the previous research (Wrightson & Gronwall, 1981; Brooks et al., 1987; McMordie et al., 1990; Ip, Dornan &

Schentag, 1995), who found a negative correlation between increasing age and employment status. However, it is compatible with the findings of Crepeau and Scherzer (1993), who found no negative correlation between age and employment until after age 60. There are several possible explanations that might account for this result. First, it may be that the result is spurious because of the relatively low number of patients in the 40-50 year old age category (n=9). Alternatively, it might have been that these older patients sustained less serious injuries. However, review of the levels of injury severity for this group does not support this suggestion, as four of the nine patients sustained severe injuries, three had moderate injuries, and two had mild injuries. Finally, it might be suggested that these patients had longer and more stable job histories, which aided them in their initial return to work efforts. There is some support for this suggestion, as four of the six patients who returned to work in the "Professional, Technical and Managerial Occupations" category were over 40 years of age. Further follow-up over an extended period of time is needed in order to determine if this pattern was maintained beyond six months, or if these patients had increased difficulty remaining at their previous levels of occupation.

Other studies have also found a relationship between education and better vocational outcome (Rimel et al., 1981; Wehman et al. 1988), as well as severity of injury and return to work (Klonoff & Snow, 1991). The present study did not support these results, as no significant relationship between education and return to work was seen, nor between severity of injury and work status. However, there was a significant age by education correlation, which suggests that a higher level of education was present for the older subjects. The lack of correlation between severity of injury and return to work, however, is consistent with findings reported by Ip et al. (1995) who found that return to work status was not significantly related to GCS score, coma length, and/or CT scan results. Finally, gender had no significant correlation with return to work status.

Review of Table 12 suggests that the greatest rate of return to work was seen in the "Machine Trades" and the "Clerical and Sales" occupational categories. Although the overall percentage in each occupational category is similar for pre-injury and post-injury employment samples, it can be seen that the rate of return to work within each occupational category relative to pre-injury status reveals some differences in the rate of return to work within each category. For example, based on pre-injury job status, the largest number of patients (34.1%) were employed in the "Professional, Technical and Managerial Occupations" category, followed by "Clerical and Sales Occupations" and Service Occupations." However, the rate of return to work within each of these categories after six months indicates that the greatest return to work was seen in the "Machine Trades Occupations" (100%) and the "Clerical and Sales Occupations" (71.4%), whereas the rate of return to work in the "Professional, Technical and Managerial Occupations" was at 40%. In other words, only 40% of the original number of patients employed in the "Professional, Technical and Managerial Occupations" returned to work, whereas 100% of those employed in "Machine Trades Occupations" and 71.4% of those in "Clerical and Sales Occupations" returned. With the exception of two patients, all patients who resumed employment after six months were working in the same job category as they were prior to injury. Of the two exceptions, one patients went from "Miscellaneous Occupations" to "Clerical and Sales Occupations" and the other went from "Structural Work Occupations" to "Professional, Technical and Managerial Occupations." In addition, 75% of the patients who returned to work were employed on a full-time basis. These results do not directly support Lubusko et al. (1994) or Stambrook et al. (1990), both of whom suggested that TBI patients who return to work generally do so at a lower occupational status or at significantly reduced hours. However, it appears that it was more difficult for persons in the "Professional, Technical, and Managerial" occupations to return to work than it was for other categories. So, although many of the patients who returned to work went back to the same level of employment, it appears that some jobs may have been more difficult to return to. In addition, caution should be used in interpreting the present results because of the short duration of follow-up. It may be that results would be more in line with previous findings if a longer follow-up was used.

Initial Variables and Return to Work Status

Mean scores for LM, PASAT, BDI, and BC at initial testing for patients who returned to work and patients who did not were not significantly different. In addition, none of these variables reached significance as a predictor of return to work after six months, which was unexpected. Brooks et al. (1987) found that within a battery of neuropsychological tests administered to TBI patients, immediate Logical Memory scores and the longest string at fast speed from the PASAT accounted for 29% of the variance in a stepwise regression analysis with return to work as the dependent variable. Gronwall (1977) also suggested that the primary difficulty for some patients after return to work appears to be related to their inability to process information as rapidly as normal, which may be measured by performance on the PASAT. On the other hand, the present findings support Hart and Hayden (1986) and Mysiw et al (1989), both of whom suggest that neuropsychological test results have limited correlation with real-world activities, including work readiness.

Furnham (1984) found that unemployment was associated with attributions related to depression and mental illness. Lubusko et al. (1994) suggest that negative cognitive beliefs may be associated with decreased post-injury employment status. A relationship between depressive symptoms and return to work was not seen in the present study, as BDI scores were not a significant predictor of return to work status after six months.

Finally, the BC did not add to the prediction of post-injury income. Other researchers have found that impairments in executive functions may impact employment outcome. Miller (1993) reported that "frontal" signs such as impaired initiative and apathy, lack of critical capacity, defective social judgement and egocentricity, inability to plan or sustain activity, impulsivity, irritability, and low frustration tolerance are likely to have a detrimental impact on post-injury employment. Lyons and Morse (1988) also found that problems with behavior and social skills frequently have a detrimental effect on employment. Kaplan (1988) indicated that subjects' major adjustment problems at 13 months post-injury were psychosocial and family oriented, and that employment post-injury was heavily dependent on the ability to engage in socially appropriate interactions. These findings suggest that a substantial disruption in work may exist even when the physical and cognitive capacity to work is present. The question arises, then, as to why similar results were not seen with the BC in the present study. One possibility is that the BC needs to be more detailed so that a range of impairment may be rated, rather than just the presence or absence of symptoms. Also, it may be that executive function deficits that would impact a job setting were not seen in a more structured and less demanding rehabilitation environment. Therefore, deficits may not have been rated accurately. Finally, it may be that the BC scores are not a valid measure of executive functions. It may be that other measure of executive function would have identified deficits associated with work outcome. Further research with an expanded BC may shed further light on these possibilities.

Prediction of Return to Work

In the present study, it was seen that the initial scores for the FAI-FL and PCQ-FL were slightly lower for the patients employed at six months follow-up, compared to scores for patients who were unemployed. However, the wide intra-group variability in scores may have prevented these differences from being statistically significant. However, this trend is what would be expected from measures designed to assess vocational strengths and weaknesses. Although the available number of patients in the present study prevented the use of individual items on the FAI and PCQ to be entered as possible predictor variables, it was possible to evaluate the overall functional limitations scores in combination with other psychometric and psychosocial variables. Within the overall regression analysis, it was seen that the best predictor of earned income levels after six months was the patients' self-ratings of functional limitations on the PCQ. Since earned income was directly related to employment outcome, it may be suggested that overall PCQ-FL scores may be used to predict employment outcome following traumatic brain injury.

The question of whether functional limitations are consistently related to employment outcome was one of the bases for the present study. Previous reports by Crewe and Athelstan (1984) have suggested that scores on the FAI may be used to aid prediction of employability. In a stepwise multiple regression, they found that the total functional limitations score on the FAI was the strongest predictor of employability in a general rehabilitation population after 30 to 36 months, followed by the overall strength score, age, endurance (item 14), work habits (item 24), physical appearance (strength item 31), loss of time from work (item 15) an pleasing personality (strength item 32). In a stepwise multiple regression, they also found the best predictor of earnings after 30 to 36 months was the FAI-FL score, followed by work habits (item 24), Adaptive Behavior (Factor 1 on the general factor structure), effective interaction with people (item 27), endurance (item 14), stability of condition (item 16), marital status, and loss of time from work (item 15). Examination of the individual functional limitations items which were included as significant predictors of both employability and of earnings reveal that all of the items loaded in the area of "Adaptive Behavior" (work habits, effective interaction with others) or on "Physical Condition" (endurance, loss of time from work, stability of condition). However, they were not able to include results from the PCQ in order to determine what, if any, impact that patients' ratings might have on predictions of return to work.

The only other study which examined the usefulness of the FAI in the prediction of return to work following TBI found that the FAI-FL score was significantly associated with work status. Mysiw et al. (1989) determined that patients with scores below 20 on the FAI were more likely to return to competitive employment or vocational training, while patients with scores above 20 were more likely to be in supported employment or unemployed. Ho\ ver, these findings are of uncertain value for several reasons. First of all, there was no control for previous employment, as was done in the present study. Therefore, it was difficult to interpret "return to work" when there were patients who had been unemployed prior to injury. Secondly, Mysiw et al. (1989) did their statistical comparisons using multiple t-tests, which increased the chance for Type 1 error. A more appropriate statistical analysis of their results might have been a discriminant functions analysis to distinguish the various work levels based on test scores.

Based on the present study, the PCQ-FL score was a stronger predictor of post-injury earnings than was the FAI-FL. Interestingly, the overall FAI-FL score and the additional variables did not account for any additional variance. Based on results of previous research, which suggest that the FAI-FL does predict return to work, it was expected that it would also be a useful predictor in the present study. However, none of the previous work included PCQ results, which may have altered the significance of the FAI as a predictor of return to work. Based on the results of the present study, it might be suggested that the PCQ-FL is a better predictor than the FAI-FL, and that when both measures are included in a regression equation, the PCQ-FL takes out the common variance with the FAI-FL so that the FAI-FL will no longer enter. As seen in Table 10, the PCQ-FL score had a greater correlation with return to work status that did the FAI-FL score. Therefore, it may not be that the present results are inconsistent with previous work, but rather that the inclusion of the PCQ-FL provides increased predictive power.

In addition to being the only significant predictor within the group of variables chosen on an a priori basis, post-hoc regression analysis using both test scores and sociodemographic variables indicated that the PCQ-FL continued to be the best predictor of post-injury income even when age and severity of injury are included in the regression equation. These results are not inconsistent with the results of met-analyses performed by Crepeau and Scherzer (1993) which suggested that age and severity of injury have prognostic value only in certain cases, but are generally not strongly related to return to work status.

As noted previously, items rated as most severely impaired on the PCQ-FL at initial testing were "capacity for exertion" and "endurance," and items most frequently endorsed were "capacity for exertion," "endurance," and "motor speed." Within the general factor structure proposed by Crewe and Athelstan (1984), all of these items are accounted for by either "Motor Functioning" of "Physical Condition" factors. Although further research with a greater number of patients would be needed before making any firm conclusions, it might be hypothesized that the physical impairments rated most frequently and as most severely impaired on the PCQ-FL are the basic reason that the PCQ-FL was a significant predictor of post-injury earnings. In other words, it may be impairments in physical condition and motor functioning that have the greatest impact on post-injury earning potential.

This hypothesis is somewhat inconsistent with previous work which has proposed that cognitive and psychosocial factors have a greater impact on vocational outcome than do physical disabilities (Bruckner & Randle, 1972; Weddell et al., 1980; Ben-Yishay & Diller, 1983; Lezak, 1987; Parker, 1990). However, it is not inconsistent with reports that impairment in physical function is a factor in lower post-injury occupational status (Stambrook et al., 1990). It is possible that physical factors played a relatively large role in return to work efforts in the present study because of the recency of injury for many of the patients. In other words, it may not be that difficulties with cognition and psychosocial adjustment are not present, but rather that these difficulties are outweighed by the impact of physical problems in the first 12 months post-injury. Further follow-up on those patients who returned to work would be helpful in determining if cognitive and/or psychosocial factors began to play a larger role in the maintenance of employment after physical deficits such as fatigue, endurance and motor speed are diminished.

The finding that patient-generated data was a better predictor of income levels than was clinicians' ratings was somewhat unexpected. As noted previously, TBI patients have difficulty in assessing their strengths and deficits accurately. In fact, such difficulties have been noted by a number of studies examining lack of awareness of deficit following TBI (Oddy et al., 1985; Fordyce & Roueche, 1986; Prigatano et al., 1986). In addition, it has been suggested that ratings by others familiar with the brain-injured patient are more accurate at predicting vocational outcome. Walker, Blankenship, Ditty and Lynch (1987) found that self-ratings of TBI patients who successfully returned to work, school or a sheltered workshop setting did not differ from relatives' ratings on the nine item Quality of Life Scale. However, there was a significant difference seen in the ratings for patients who were unsuccessful in returning in that patients who were not able to return to work, school or sheltered employment rated themselves markedly higher than those patients who were successful. It was found that while relatives' ratings were a significant predictor of "recovery", patients' self-ratings were not.

Follow-Up Testing

In order to further examine possible changes in neuropsychological performance, emotional status, and/or perception of functional limitations over time, a subgroup of subjects (n=16) was retested at the six month follow-up. The FAI and the Behavior Checklist were not repeated as the majority of patients were not working closely with a mental health professional at that time. Of primary interest was the possible changes of these variables over time. Such changes, or lack thereof, may provide further information on the reliability of these measures as predictors of vocational outcome.

The results of repeated testing after six months suggest that, with the exception of the PASAT, scores at initial testing remained relatively stable across six months. With reference to memory, it was not surprising to see no significant improvement over time, since scores at initial testing were within the average range relative to age norms. In addition, previous research suggests that although mnemonic strategies may help compensate for memory deficits, there is little actual "recovery" of memory function after TBI (Sohlberg & Mateer, 1989; Prigatano et al., 1984).

Although not statistically significant, the trend toward increasing BDI scores at the six month follow-up is also consistent with previous work. Fordyce et al. (1983) found that brain-injured patients referred for neuropsychological testing within six months of injury were less emotionally distressed than those referred for testing more than six months post-injury. Lezak (1987) reported that closed head injured patients reported the greatest number of depressive symptoms between seven and twelve months after injury. In an initial evaluation of TBI patients at six months post-injury, it was found that patients underreported that severity of their behavioral impairments relative to family/significant other' ratings (Godfrey et al., 1993). However, they found that the same patients at one year and two to three year follow-ups demonstrated increased self-ratings of behavioral impairment, as well as higher levels of emotional dysfunction. The trend seen in the present study may indicate that patients are beginning to experience greater depressive symptoms six months after the initial evaluation. These results add some support the idea that the lack of depressive symptoms at initial testing was due to lack of awareness of deficit, rather than the idea that depressive symptoms were either not present or were transient early after injury.

More interestingly, the lack of significant change in the PCQ-FL scores indicates that patients' perception of their functional limitations did not change over a six month period. PCQ-FL scores at the time of follow-up testing remained higher than the original FAI-FL scores, although the difference was no longer statistically significant. This finding is likely due to the approximate three point decrease in PCQ-FL scores by the time of six-month follow-up, which suggests that the direction of the change in ratings is consistent with an increase in awareness of deficit. A number of factors may be considered as possible explanations for the lack of change over time. First, it must be considered whether or not patients are accurate with their initial self-ratings. Although there is no way to be entirely sure of the accuracy of any rating of a patient's behavior, the fact that it was the patients' ratings which predicted return to work, rather than the clinicians', suggests that the patients' ratings have some validity in identifying vocational strengths and weaknesses. The lack of significant change in PCQ-FL scores over six months may be due to a combination of factors, including that fact that testing was completed very soon after injury for most patients, and that the follow-up was completed in a relatively short period of time. As suggested for depressive symptoms, it may be that more than six months is needed before TBI patients are able to fully assess their functional limitations. Given the trend toward decreasing PCQ-FL scores after six months, such a suggestion seems plausible. This suggestion is also supported by previous literature. For example, Godfrey et al. (1993) found that patients assessed at six months post-injury underreported the severity of their behavioral impairments, and termed this inaccurate appraisal "Post-Traumatic Insight Disorder." It was not until one to three years post-injury that patients began to demonstrate increasing insight into their deficits. Thus, it may be that many TBI patients do not begin to be fully cognizant of their impairments until at least one-year post-injury. This is not to say that all patients will improve their awareness, but that this time frame should be considered in treatment planning (Prigatano, 1989, 1991).

Another factor which may affect a patient's judgement of functional limitations early on may be the availability of accurate and relevant feedback from others. In many cases, the early emphasis in rehabilitation is on physical recovery, which is not unreasonable given the seriousness of many TBI's. The improvements in physical functioning often seen in the first several weeks and months may also influence beliefs about expected improvements in the more subtle cognitive and emotional deficits sometimes present. Finally, the physical deficits are more concrete and more easily "seen", whereas the cognitive, emotional and functional deficits may not be as readily apparent.

The one area that did improve after six months was the patients' speed of information processing, as measured by the PASAT. It was seen that all patients tested at follow-up exhibited an improvement in their speed of processing, although there was no difference in initial PASAT scores based on return to work status. This finding suggests that the PASAT may be used to assess attentional changes early in recovery, as well as to provide a useful index of the extent of the recovery of function over time. The increase in the speed of information processing is consistent with previous studies across various levels of severity of TBI. Gronwall and Wrightson (1974) compared performances on the PASAT of mild head injured patients at several points during recovery (24 hours to 70 days). Although scores were initially decreased for all patients, processing speed improved over subsequent testing sessions. In addition, improved performance on the PASAT was associated to a decrease on other post-concussive symptoms. Ponsford and Kinsella (1992) also determined that performance on the PASAT in the first 12 months post-injury demonstrated that severely head injured patients were unable to sacrifice speed of performance for greater accuracy at an externally determined pace, even when they were able to do so on tasks that were not externally paced. Gronwall (1977) demonstrated the usefulness of the PASAT as a measure of ability to return to work, and suggested that the PASAT may be used as a guide to rehabilitation and eventual return to work in that employment difficulties experienced by brain injured patients may be related to their deficits in processing information as rapidly as normal. Although not included in the regression equation as a significant predictor of earned income, it might still be proposed that use of the PASAT to monitor processing speed would be useful in planning return to work.

Summary and Future Directions

Prediction of work outcome for persons with brain injury will facilitate effective rehabilitation programs which will ultimately improve that injured person's quality of life. However, as shown by the present study, prediction of return to work is a difficult process, with a wide variety of possible influences.

The strengths of the present study include the range of predictors used, the fact that employment pre-injury was controlled for, and that follow-up was completed on the same patients at six months. Thus, the changes seen over time, or lack thereof, may be directly inferred based on follow-up data. Also, given the lack of significant change in LM, BDI, and PCQ-FL, it may be inferred that the follow-up group is a valid representation of the original sample.

Areas that might improve the present study include extending the limited time before follow-up (e.g., to 12 and/or 24 months), adding a control group, expanding the detail on the Behavior Checklist (e.g., to a Likert Scale format), and by having the BC completed by patients and/or families in addition to clinicians. Another measure of executive function would also be useful to evaluate the concurrent validity of the BC. It would also be interesting to have a family member or significant other complete that FAI, in order to provide comparisons to clinicians' ratings. In addition, it would be potentially valuable to collect additional information on other factors such as alcohol use post-injury, sleep disturbances, and personality variables in order to provide a more detailed picture of difficulties present post-injury. Finally, given the emphasis put on physical disability by patients on the PCQ, it may be worthwhile to include a greater number of questions regarding physical function, especially in the first year following injury.

Overall, the results of the present study suggest that the PCQ-FL may be used to predict post-injury income levels in the first year following TBI. In addition, it demonstrated that the FAI and the PCQ may be used to identify the differences between patients' and clinicians' perceptions of vocational strengths and weaknesses. It supported previous findings that speed of information processing improves significantly in the first 12 months after TBI. Finally, it provided the first available normative data for use of the FAI for a TBI population, and the first normative data on the PCQ available for any population. Continued research as to the role of functional limitations and work status may provide further valuable information with regards to these measures.

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Appendix 1

Occupational Code Classifications of the Dictionary of Occupational Titles

Occupational Categories (first digit):

0/1 Professional, Technical, and Managerial Occupations
2 Clerical and Sales Occupations
3 Service Occupations
4 Agricultural, Fishery, Forestry, and Related Occupations
5 Processing Occupations
6 Machine Trades Occupations
7 Benchwork Occupations
8 Structural Work Occupations
9 Miscellaneous Occupations

Worker Functions Ratings (middle three digits):

Data (4th digit)	People (5th digit)	Things (6th digit)
0 Synthesizing	0 Mentoring	0 Setting Up
1 Coordinating	1 Negotiating	1 Precision Working
2 Analyzing	2 Instructing	2 Operating-Controlling
3 Compiling	3 Supervising	3 Driving-Operating
4 Computing	4 Diverting	4 Manipulating
5 Copying	5 Persuading	5 Tending
6 Comparing	6 Speaking Signaling	6 Feeding-Offbearing
	7 Serving	7 Handling
	8 Taking Instructions-Helping	

*Taken from: Dictionary of Occupational Titles (1991), p xii-xiii

Appendix 2

Information Form: Prediction of Return to Work Following Traumatic Brain Injury:

Many people who sustain a traumatic brain injury have difficulty returning to their pre-injury occupation. The purpose of this study is to see how well people can return to work after experiencing a head injury. I am interested in what kind of work you did before and what kind of work you might have done since your injury. I am also interested in how well you can do certain kinds of things, such as working out problems quickly in your head and recalling things that you have heard. In addition, we would like to know how you feel about any change in your abilities since the injury, as well as how others may feel your abilities have changed. This information will increase our understanding of how head injury affects ability to return to work. There may not be any direct benefit for you as a result of participation, but you will be helping to improve our understanding of head injury, which may help improve therapy and other services offered to people with similar injuries.

I plan to examine the usefulness of a combination of neuropsychological and functional assessment measures with individuals who have sustained a traumatic brain injury. This will be done by examining the performance on two common neuropsychological measures of memory and information processing, and a self-report questionnaire, as well as comparing responses of the injured person and of the rehabilitation professional on a functional assessment inventory. If you agree to participate as a subject in this research project, you will be asked to:

1. Complete a brief interview of about 15-30 minutes.
2. Complete the neuropsychological tests, which takes approximately 30 minutes.
3. Complete two paper and pencil rating scales which takes approximately 15-30 minutes.

You would also be asked to:

1. Sign a consent to participate which also states that you may withdraw at any time.
2. Sign a release of information form to allow me to contact professionals who have been involved in your rehabilitation program, and to permit access to medical records.

This research is aimed to increase our understanding of the effect of a traumatic brain injury on a person's ability to work. It will also help identify different areas that may need to be addressed in rehabilitation. For these reasons, I would appreciate your participation in this project. Thank you for taking the time to read the above information.

Appendix 3

Informed Consent Forms

UNIVERSITY OF VICTORIA

DEPARTMENT OF PSYCHOLOGY
NEUROPSYCHOLOGY PROGRAM

CONSENT TO ACT AS A RESEARCH SUBJECT

Ms. Shannah Biggan, M.A., is conducting a study for her Ph.D. research project related to the prediction of vocational outcome following traumatic brain injury. All persons who have sustained a traumatic brain injury are potential participants in this research. If I agree to participate, the following will happen to me:

1. I will be asked to sign a special consent form to release relevant parts of my medical history to the researcher. Specifically, this information may include Glasgow Coma Scale scores or other scores/measurements indicative of the severity of my head injury; dates of rehabilitation services received; types of rehabilitation services received; previous psychometric testing.

2. If I agree to participate, Ms. Biggan and/or her colleagues will outline the purpose of the research project to me and any other family members I wish to invite to the initial interview session.

3. I will be asked to complete two questionnaires and standard neuropsychological tests.

4. I will be contacted in approximately six months to evaluate my work status at that time, and for possible re-testing of the above mentioned measures.

5. Feedback concerning the outcome of the research will be provided for me and my family upon request.

I understand that the research records will be kept strictly confidential to the extent provided by law. Each patient will be identified by a code number, and their names will not be known to others beyond the principal investigator and her associates. Interview information and testing information will be kept in a locked filing cabinet. Furthermore, I understand that my name will not be attached to any published results.

I understand that there are no real risks associated with this study. No interviews or testing sessions will be videotaped or audiotapes. I further understand that I will not necessarily receive any direct benefit from this study, but that I will be providing information that may aid others in the future. If I have any questions or research related problems, I may reach the investigators at (602) 529-3829. My participation is entirely voluntary. I may refuse to participate or withdraw at any time without jeopardy to the services I receive from the referring institution or private clinic.

I agree to participate.

____
Subject's Signature

____
Date

____
Experimenter

Appendix 4

Consent Form for the Release of Medical Information

UNIVERSITY OF VICTORIA

DEPARTMENT OF PSYCHOLOGY
NEUROPSYCHOLOGY PROGRAM

AUTHORIZATION FOR RELEASE OF INFORMATION

I, ______________________________________, hereby authorize

____

____

(Name of Agency/Person releasing the information)
to release the following information:

____

____

____

(describe)
from the time of: ____________________to________________________

to Ms. Shannah Biggan, M.A. to be used in the research study entitled "Predictive Validity of Functional Assessment and Neuropsychological Test Scores in the Vocational Outcome of Persons with Traumatic Brain Injuries."

I consent to the use of this information by the authorized recipient only for the purposes of the present study.

I hereby release the health care agency/person authorized to release this information, it's employees and agents, from any claims which may result from the release of the above information.

I am 19 years of age or older.

Dated: ______________________________________
Witness: ____________________________________

This authorization will expire 12 months from the above date

Appendix 5

Data Collection Sheet

DEMOGRAPHICS:

Name: ____________________________ Male/Female

DOB: _____/_____/_____ Age:_____
mo day yr

Address:____
____

Telephone: (home)______________ (work)_________________
Identification #:________________ Referral Source:_____________

Handedness: R __ L __ Both __

Consent Forms completed: _____

Would you like a debriefing session: Yes_____ No_____

EDUCATION:

Pre-Injury:

Last grade completed:

A) less than grade 8 _____ D) college _____
B) grade 9 to 12 _____ E) trade school _____
C) G.E.D. _____ F) university _____

Special Programs: Yes _____ No _____
(specify)

Assistance received in school: Yes _____ No _____
(specify)

Learning difficulties: Yes _____ No _____
(specify)

Technical training: Yes _____ No _____
(specify institution or on the job)

Post-Injury:

Last grade completed:

A) less than grade 8 _____ D) college _____
B) grade 9 to 12 _____ E) trade school _____
C) G.E.D. _____ F) university _____

Special Programs: Yes _____ No _____
(specify)

Assistance received in school: Yes _____ No _____
(specify)

Learning difficulties: Yes _____ No _____
(specify)

Technical training: Yes _____ No _____
(specify institution or on the job)

WORK HISTORY INFORMATION:

Pre-injury

Employed ___ Unemployed ___

Number of jobs held in 6 months prior to injury ___

If unemployed:
supported on unemployment insurance coverage ___
supported on welfare ___
supported on disability pension ___

Last job held prior to injury: ______________________________
____

Looking for work: Yes ___ No ___
If yes, describe what type: ______________________________
____

If employed:
Occupation (name and describe): ____________________________
____
____

Employer: ____________________________
Date started: ____________________________
Hours/week ____________________________
Hourly Wage ____________________________
DOT # ____________________________

Estimated income from job for 6 months prior to injury: ________

WORK INFORMATION HISTORY (continued):

Post-Injury:
Employed ___ Unemployed ___
Length of time in rehabilitation:______________________________
Have you tried to work since the initial assessment:__________
Number of jobs held in 6 months since assessment: ____________
Want/need to work:____________
Judged competitively employable: _________________

If unemployed:
supported on unemployment insurance coverage ___
supported on welfare ___
supported on disability pension ___

Last job held since assessment: ______________________________

Looking for work: Yes ___ No ___
If yes, describe what type:____________________________________

If employed:

In last 6 months: $\dfrac{\text{\# days / weeks / months worked}}{\text{\# days/ weeks /months could have worked}}$ =

For current or last job post-injury:
Occupation (name and describe): ______________________________
____
____
Employer: ______________________________
Date started: ______________________________
Hours/week ______________________________
Hourly Wage ______________________________
DOT # ______________________________

Estimated income for 6 months since assessment:________

Has the job been modified because of your injury: ______________
If so, describe: ____
____
May we contact the employer (present or last) for measure of work duties? If yes, please note name, address and phone number.
____
____

MEDICAL INFORMATION:

Date of injury: _____/_____/_____
mo day year

Age at time of injury: _____

Records available at : ______________________________________
Referral Agency

Cause of injury: ____

Glasgow Coma Scale score: _____

Length of coma: ___________________

Length of time in rehabilitation: _____________________________

Current Medications: ____
____
____

Appendix 6

Behavior Checklist

The following are behaviors that some individuals may experience after sustaining a traumatic head injury. Please check any behaviors that you feel may be exhibited by this client:

___ 1) difficulty attending to relevant information (e.g., easily distractible, tangential)

___ 2) dissociation between what he/she says, sees, or understands, and what he/she seems to do or feel (e.g., inappropriate emotional responses)

___ 3) decreased spontaneity and production of behavior (e.g., reduced initiative, apathetic, unmotivated)

___ 4) difficulties making mental or behavioral shifts (e.g., perseveration, rigidity)

___ 5) does not seem to recognize when he/she makes errors

___ 6) little or no anxiety, unconcerned, or not seemingly bothered by things (e.g., unawareness of deficit)

___ 7) increased impulsiveness or disinhibition

___ 8) does not seem to pick up on social cues, makes socially inappropriate comments, lacks social tact

___ 9) poor abstraction, takes things at face value (e.g., concrete attitude)

___ 10) poor planning, organization and foresight

___ 11) limited insight into consequences of actions

___ 12) emotional lability and/or irritability

Appendix 7

Summary of One-Way ANOVA's With an Independent Variable of Severity of Injury, and Dependent Variables of LM, PASAT, BDI, PCQ-FL, PCQ-S, FAI-FL, FAI-S, BC, and DIFF Scores

	SS	df	MS	F	p
LM	207.136	2	103.568	1.036	.364
PASAT	.379	2	.189	.814	.450
BDI	45.879	2	22.939	.409	.667
PCQ-FL	129.428	2	64.174	1.060	.356
PCQ-S	3.636	2	1.818	.274	.762
FAI-FL	345.045	2	172.523	1.424	.252
FAI-S	.095	2	.0470	.011	.989
BC	23.26	2	11.630	2.050	.142
DIFF	340.436	2	170.218	1.342	.272

Appendix 8

Means and Standard Deviations of Individual Items of the Behavior Checklist
(0=absent, 1=present)

Item	Mean	S. D.
1	.32	.47
2	.05	.21
3	.25	.44
4	.32	.47
5	.11	.32
6	.27	.95
7	.23	.42
8	.11	.32
9	.27	.45
10	.27	.45
11	.30	.46
12	.27	.45

Appendix 9

Frequency Distribution of Individual Items of the Behavior Checklist

Item Number	Value	Frequency	Valid Percent	Cum Percent
1	.00	30	68.2	68.2
	1.00	14	31.8	100.0
2	.00	42	95.5	95.5
	1.00	2	4.5	100.0
3	.00	33	75.0	75.0
	1.00	11	25.0	100.0
4	.00	30	68.2	68.2
	1.00	14	31.8	100.0
5	.00	39	88.6	88.6
	1.00	5	11.4	100.0
6	.00	37	84.1	84.1
	1.00	7	15.9	100.0
7	.00	34	77.3	77.3
	1.00	10	22.7	100.0
8	.00	39	88.6	88.6
	1.00	5	11.4	100.0
9	.00	32	72.7	72.7
	1.00	12	27.3	100.0
10	.00	32	72.7	72.7
	1.00	12	27.3	100.0
11	.00	31	70.5	70.5
	1.00	13	29.5	100.0
12	.00	32	72.7	72.7
	1.00	12	27.3	100.0

Appendix 10

Means and Standard Deviations of Individual Items of the Beck Depression Inventory
(0=not present, 1=mild, 2=moderate, 3=severe)

Item	Mean	S.D.
1	.57	.95
2	.36	.53
3	.18	.50
4	.48	.63
5	.07	.25
6	.39	.89
7	.27	.50
8	.50	.59
9	.11	.32
10	.57	.87
11	.68	.98
12	.25	.58
13	.45	.73
14	.32	.60
15	.61	.65
16	.57	.82
17	.89	.54
18	.25	.49
19	.75	1.10
20	.50	.66
21	.34	.71

Appendix 11

Frequency Distribution of Individual Items of the Beck Depression Inventory

Item Number	Value	Frequency	Valid Percent	Cum Percent
1	.00	29	65.9	65.9
	1.00	9	20.5	86.4
	2.00	2	4.5	90.9
	3.00	4	9.1	100.0
2	.00	29	65.9	65.9
	1.00	14	31.8	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
3	.00	38	86.4	86.4
	1.00	4	9.1	95.5
	2.00	2	4.5	100.0
	3.00	0	0	100.0
4	.00	25	56.8	56.8
	1.00	18	40.9	97.7
	2.00	0	0	97.7
	3.00	1	2.3	100.0
5	.00	41	93.2	93.2
	1.00	3	6.8	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
6	.00	35	79.5	79.5
	1.00	5	11.4	90.9
	2.00	0	0	90.9
	3.00	4	9.1	100.0
7	.00	33	75.0	75.0
	1.00	10	22.7	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0

Appendix 11 continued

8	.00	24	54.5	54.5
	1.00	18	40.9	95.5
	2.00	2	4.5	100.0
	3.00	0	0	100.0
9	.00	39	88.6	88.6
	1.00	5	11.4	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
10	.00	27	61.4	61.4
	1.00	12	27.3	88.6
	2.00	2	4.5	93.2
	3.00	3	6.8	100.0
11	.00	25	56.8	56.8
	1.00	13	29.5	86.4
	2.00	1	2.3	88.6
	3.00	5	11.4	100.0
12	.00	36	81.8	81.8
	1.00	5	11.4	93.2
	2.00	3	6.8	100.0
	3.00	0	0	100.0
13	.00	30	68.2	68.2
	1.00	8	18.2	86.4
	2.00	6	13.6	100.0
	3.00	0	0	100.0
14	.00	33	75.0	75.0
	1.00	8	18.2	93.2
	2.00	3	6.8	100.0
	3.00	0	0	100.0
15	.00	21	47.7	47.7
	1.00	19	43.2	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0

Appendix 11 continued

16	.00	26	59.1	59.1
	1.00	13	29.5	88.6
	2.00	3	6.8	95.5
	3.00	2	4.5	100.0
17	.00	9	20.5	20.5
	1.00	31	70.5	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0
18	.00	34	77.3	77.3
	1.00	9	20.5	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
19	.00	28	63.6	63.6
	1.00	4	9.1	72.7
	2.00	7	15.9	88.6
	3.00	5	11.4	100.0
20	.00	26	59.1	59.1
	1.00	14	31.8	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0
21	.00	33	75.0	75.0
	1.00	9	20.5	95.5
	2.00	0	0	95.5
	3.00	2	4.5	100.0

Appendix 12

Means and Standard Deviations of Functional Limitations Items of the Functional Assessment Inventory (0=normal, 1-mild, 2=moderate, 3=severe)

Item	Mean	S.D.
1	1.30	.85
2	.32	.64
3	1.16	.64
4	.43	.62
5	.30	.59
6	.02	.15
7	.18	.45
8	.25	.44
9	.39	.65
10	.45	.73
11	.82	.79
12	1.06	.89
13	1.34	1.06
14	1.66	1.10
15	1.07	.93
16	.25	.58
17	.32	.71
18	.61	.95
19	.14	.35
20	.59	.87
21	.27	.73
22	.70	.82
23	.70	.79
24	.50	.85
25	.16	.48
26	.66	.71
27	.48	.66
28	.55	.73
29	.18	.50
30	.70	.76

Appendix 13

Means and Standard Deviations of Functional Limitations Items of the Personal Capacities Questionnaire (0=normal, 1=mild, 2=moderate, 3=severe)

Item	Mean	S.D.
1	.59	.73
2	.23	.52
3	.68	.80
4	.41	.66
5	.55	.82
6	.09	.29
7	.30	.51
8	.05	.21
9	.66	.83
10	.39	.62
11	.75	.69
12	.48	.76
13	1.07	.85
14	1.36	1.18
15	.36	.81
16	.16	.43
17	.25	.49
18	.32	.71
19	.09	.47
20	.32	.67
21	.25	.65
22	.39	.75
23	.50	.85
24	.09	.36
25	.18	.45
26	.41	.69
27	.11	.32
28	.45	.55
29	.14	.35
30	.45	.76

Appendix 14

Frequency Distribution of Individual Items of the FAI-FL

Item Number	Value	Frequency	Valid Percent	Cum Percent
1	.00	7	15.9	15.9
	1.00	21	47.7	63.6
	2.00	12	27.3	90.9
	3.00	4	9.1	100.0
2	.00	34	77.3	77.3
	1.00	6	13.6	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0
3	.00	6	13.6	13.6
	1.00	25	56.8	70.5
	2.00	13	29.5	100.0
	3.00	0	0	100.0
4	.00	28	63.6	63.6
	1.00	13	29.5	93.2
	2.00	3	6.8	100.0
	3.00	0	0	100.0
5	.00	34	77.3	77.3
	1.00	7	15.9	93.2
	2.00	3	6.8	100.0
	3.00	0	0	100.0
6	.00	43	97.7	97.7
	1.00	1	2.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
7	.00	37	84.1	84.1
	1.00	6	13.6	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0

Appendix 14 continued

8	.00	33	75.0	75.0
	1.00	11	25.0	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
9	.00	31	70.5	70.5
	1.00	9	20.5	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0
10	.00	30	68.2	68.2
	1.00	8	18.2	86.4
	2.00	6	13.6	100.0
	3.00	0	0	100.0
11	.00	16	36.4	36.4
	1.00	22	50.0	86.4
	2.00	4	9.1	95.5
	3.00	2	4.5	100.0
12	.00	18	40.9	40.9
	1.00	18	40.9	81.8
	2.00	5	11.4	93.2
	3.00	3	6.8	100.0
13	.00	11	25.0	25.0
	1.00	15	34.1	59.1
	2.00	10	22.7	81.8
	3.00	8	18.2	100.0
14	.00	9	20.5	20.5
	1.00	9	20.5	40.9
	2.00	14	31.8	72.7
	3.00	12	27.3	100.0
15	.00	12	27.3	27.3
	1.00	22	50.0	77.3
	2.00	5	11.4	88.6
	3.00	5	11.4	100.0

Appendix 14 continued

16	.00	36	81.8	81.8
	1.00	5	11.4	93.2
	2.00	3	6.8	100.0
	3.00	0	0	100.0
17	.00	35	79.5	79.5
	1.00	5	11.4	90.9
	2.00	3	6.8	97.7
	3.00	1	2.3	100.0
18	.00	27	61.4	61.4
	1.00	11	25.0	86.4
	2.00	2	4.5	90.9
	3.00	4	9.1	100.0
19	.00	38	86.4	86.4
	1.00	6	13.6	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
20	.00	27	61.4	61.4
	1.00	10	22.7	84.1
	2.00	5	11.4	95.5
	3.00	2	4.5	100.0
21	.00	38	86.4	86.4
	1.00	1	2.3	88.6
	200	4	9.1	97.7
	3.00	1	2.3	100.0
22	.00	21	47.7	47.7
	1.00	17	38.6	86.4
	2.00	4	9.1	95.5
	3.00	2	4.5	100.0
23	.00	20	45.5	45.5
	1.00	19	43.2	88.6
	2.00	3	6.8	95.5
	3.00	2	4.5	100.0

Appendix 14 continued

24	.00	30	68.2	68.2
	1.00	8	18.2	86.4
	2.00	4	9.1	95.5
	3.00	2	4.5	100.0
25	.00	39	88.6	88.6
	1.00	3	6.8	95.5
	2.00	2	4.5	100.0
	3.00	0	0	100.0
26	.00	20	45.5	45.5
	1.00	20	45.5	90.9
	2.00	3	6.8	97.7
	3.00	1	2.3	100.0
27	.00	27	61.4	61.4
	1.00	13	29.5	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0
28	.00	25	56.8	56.8
	1.00	15	34.1	90.9
	2.00	3	6.8	97.7
	3.00	1	2.3	100.0
29	.00	38	86.4	86.4
	1.00	4	9.1	95.5
	2.00	2	4.5	100.0
	3.00	0	0	100.0
30	.00	20	45.5	45.5
	1.00	18	40.9	86.4
	2.00	5	11.4	97.7
	3.00	1	2.3	100.0

Appendix 15

Frequency Distribution of Individual Items of the PCQ-FL

Item Number	Value	Frequency	Valid Percent	Cum Percent
1	.00	22	50.0	50.0
	1.00	20	45.5	95.5
	2.00	0	0	95.5
	3.00	2	4.5	100.0
2	.00	36	81.8	81.8
	1.00	6	13.6	95.5
	2.00	2	4.5	100.0
	3.00	0	0	100.0
3	.00	22	50.0	50.0
	1.00	15	34.1	84.1
	2.00	6	13.6	97.7
	3.00	1	2.3	100.0
4	.00	30	68.2	68.2
	1.00	10	22.7	90.9
	2.00	4	9.1	100.0
	3.00	0	0	100.0
5	.00	28	63.6	63.6
	1.00	9	20.5	84.1
	2.00	6	13.6	97.7
	3.00	1	2.3	100.0
6	.00	40	90.9	90.9
	1.00	4	9.1	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
7	.00	32	72.7	72.7
	1.00	11	25.0	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0

Appendix 15 continued

8	.00	42	95.5	95.5
	1.00	2	4.5	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
9	.00	25	56.8	56.8
	1.00	9	20.5	77.3
	2.00	10	22.7	100.0
	3.00	0	0	100.0
10	.00	30	68.2	68.2
	1.00	11	25.0	93.2
	2.00	3	6.8	100.0
	3.00	0	0	100.0
11	.00	17	38.6	38.6
	1.00	21	47.7	86.4
	2.00	6	13.6	100.0
	3.00	0	0	100.0
12	.00	29	65.9	65.9
	1.00	10	22.7	88.6
	2.00	4	9.1	97.7
	3.00	1	2.3	100.0
13	.00	12	27.3	27.3
	1.00	19	43.2	70.5
	2.00	11	25.0	95.5
	3.00	2	4.5	100.0
14	.00	14	31.8	31.8
	1.00	11	25.0	56.8
	2.00	8	18.2	75.0
	3.00	11	25.0	100.0
15	.00	34	77.3	77.3
	1.00	7	15.9	93.2
	2.00	0	0	93.2
	3.00	3	6.8	100.0

Appendix 15 continued

16	.00	38	86.4	86.4
	1.00	5	11.4	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
17	.00	34	77.3	77.3
	1.00	9	20.5	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
18	.00	35	79.5	79.5
	1.00	5	11.4	90.9
	2.00	3	6.8	97.7
	3.00	1	2.3	100.0
19	.00	42	95.5	95.5
	1.00	1	2.3	97.7
	2.00	0	0	97.7
	3.00	1	2.3	100.0
20	.00	34	77.3	77.3
	1.00	7	15.9	93.2
	2.00	2	4.5	97.7
	3.00	1	2.3	100.0
21	.00	37	84.1	84.1
	1.00	4	9.1	93.2
	2.00	2	4.5	97.7
	3.00	1	2.3	100.0
22	.00	32	72.7	72.7
	1.00	9	20.5	93.2
	2.00	1	2.3	95.5
	3.00	2	4.5	100.0
23	.00	29	65.9	65.9
	1.00	11	25.0	90.9
	2.00	1	2.3	93.2
	3.00	3	6.8	100.0

Appendix 15 continued

24	.00	41	93.2	93.2
	1.00	2	4.5	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
25	.00	37	84.1	84.1
	1.00	6	13.6	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
26	.00	30	68.2	68.2
	1.00	11	25.0	93.2
	2.00	2	4.5	97.7
	3.00	1	2.3	100.0
27	.00	39	88.6	88.6
	1.00	5	11.4	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
28	.00	25	56.8	56.8
	1.00	18	40.9	97.7
	2.00	1	2.3	100.0
	3.00	0	0	100.0
29	.00	38	86.4	86.4
	1.00	6	13.6	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
30	.00	30	68.2	68.2
	1.00	9	20.5	88.6
	2.00	4	9.1	97.7
	3.00	1	2.3	100.0

Appendix 16

Frequency Distribution of Strength Items on the FAI

Item Number	Value	Frequency	Valid Percent	Cum Percent
31	.00	35	79.5	79.5
	1.00	9	20.5	100.0
32	.00	29	65.9	65.9
	1.00	15	34.1	100.0
33	.00	38	86.4	86.4
	1.00	6	13.6	100.0
34	.00	42	95.5	95.5
	1.00	2	4.5	100.0
35	.00	35	79.5	79.5
	1.00	9	20.5	100.0
36	.00	26	59.1	59.1
	1.00	18	40.9	100.0
37	.00	31	70.5	70.5
	1.00	13	29.5	100.0
38	.00	22	50.0	50.0
	1.00	22	50.0	100.0
39	.00	22	50.0	50.0
	1.00	22	50.0	100.0
40	.00	42	95.5	95.5
	1.00	2	4.5	100.0

Appendix 17

Frequency Distribution of Strength Items on the PCQ

Item Number	Value	Frequency	Valid Percent	Cum Percent
31	.00	29	65.9	65.9
	1.00	15	34.1	100.0
32	.00	9	20.5	20.5
	1.00	35	79.5	100.0
33	.00	25	56.8	56.8
	1.00	19	43.2	100.0
34	.00	24	54.5	54.5
	1.00	20	45.5	100.0
35	.00	19	43.2	43.2
	1.00	25	56.8	100.0
36	.00	9	20.5	20.5
	1.00	35	79.5	100.0
37	.00	23	52.3	52.3
	1.00	21	47.7	100.0
38	.00	14	31.8	31.8
	1.00	30	68.2	100.0
39	.00	15	34.1	34.1
	1.00	29	65.9	100.0
40	.00	9	20.5	20.5
	1.00	35	79.5	100.0

Appendix 18

Varimax Rotated Solution of the Principal Components Analysis of the Functional Assessment Inventory

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.62186	-.07384	.31398	.17591	.42875
2	-.15210	.08126	.72925	-.11657	.01824
3	.41705	.02573	.31989	-.08416	.58495
4	.05324	.18762	.02310	.00151	.74167
5	-.16769	.18612	-.00156	.29804	.16972
6	.07029	-.09922	-.09042	-.12824	-.10998
7	.33343	.03367	.76931	.23929	.15277
8	.19682	.02618	.74467	.21236	.02564
9	-.00620	.24947	.07707	.86876	-.05247
10	.18236	.10675	.21669	.87083	.04682
11	.14078	.44713	.16864	.34623	.43049
12	.08094	.84140	.05970	.07693	.00418
13	.02539	.68060	-.12983	.52765	.17367
14	-.07995	.53396	.13067	.27133	.06174
15	.26020	.47483	.36670	.12630	.33790
16	.11892	.25946	-.16293	.19050	.11061
17	.43840	.35285	.04782	-.04406	-.33859
18	.61859	.16399	.18660	.42563	.10207
19	.38529	.40109	.14769	.02303	-.11563
20	.50760	.22769	.20023	.11583	.18121
21	.37042	-.06935	.00328	.11699	.13020
22	.43676	.40209	.56976	.13205	.38609
23	.31430	.56685	.15105	.37925	.35533
24	.77653	.17980	.02996	.07173	.05710
25	.19013	.11420	.03875	-.00971	.03747
26	.65958	-.22905	-.02291	-.12863	.21436
27	.77681	.03741	.28920	.20516	.06857
28	.85607	.14100	.18076	.17481	.01997
29	.79630	.19153	-.23972	.03319	-.21135
30	.79221	.12098	.17876	-.08026	.16822

Appendix 18 (continued)

Item	Factor 6	Factor 7	Factor 8
1	-.15197	.16785	.00230
2	.21816	.00873	-.24501
3	-.23992	.21998	-.06236
4	.27896	-.11774	-.08119
5	.59015	-.00837	-.11453
6	-.02631	.02966	.75271
7	.13069	-.00545	.16073
8	-.17301	.04606	.00558
9	.09613	-.01653	-.05067
10	.10040	.05814	.00347
11	-.02768	.09773	-.13492
12	.00819	-.09157	-.12660
13	-.05070	-.00217	.02567
14	-.00693	.08163	.57489
15	.06370	-.11140	.10233
16	-.60550	-.01512	-.27644
17	-.13656	.28364	-.34755
18	-.05996	.43320	-.09322
19	.36588	.33842	.05070
20	-.16747	.51348	.16616
21	.68158	.02444	-.11243
22	.08320	.09075	.04221
23	-.23878	.17459	.05751
24	-.08649	.19696	.05238
25	-.07848	-.85298	-.02154
26	-.02064	-.16972	.02115
27	.05806	-.25992	.16910
28	.07496	-.05761	-.10276
29	.24549	-.04180	-.16172
30	.00711	-.03710	.07339

Appendix 19

Suggested Factor Structure of the Functional Assessment Inventory

Factor Name	Item	Factor Loading	Item Descriptor	Variance
1. Adaptive Behavior	29	.823	Desire to Work	.200
	28	.797	Judgement	
	30	.777	Problem Solving	
	26	.700	Accurate Perception	
	27	.672	Effective Interaction	
	24	.632	Work Habits	
	25	.586	Social Support System	
2. Motor Functioning	10	.852	Hand Function	.145
	9	.803	Upper Extremity Function	
	11	.689	Motor Speed	
3. Cognition	1	.827	Learning	.092
	2	.755	Ability to Read and Write	
	3	.743	Memory	
	4	.722	Perceptual Organization	
4. Physical Condition	13	.672	Capacity for Exertion	.056
	14	.785	Endurance	
	15	.683	Worktime Loss	
	16	.610	Stability of Condition	
5. Communication	6	.837	Hearing	.050
	7	.872	Speech	
	8	.831	Language	
6. Vocational Qualifications	17	.531	Work History	.038
	18	.654	Acceptability to Employers	
	19	.449	Personal Attractiveness	
	20	.428	Work Skills	
	21	.476	Economic Disincentives	
	22	.629	Access to Job Opportunities	
7. Vision	5	.923	Vision	.034

*Taken from Crewe & Athelstan (1984), p. 46

Appendix 20

Varimax Rotated Factor Solution of the Principal Components Analysis
of the Personal Capacities Questionnaire

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.21356	.18229	.73341	.36741	.14485
2	.08604	-.18605	.17672	.52305	-.12649
3	-.00685	-.11825	.68401	.03693	.27483
4	-.13640	.30765	.72568	-.09787	-.04506
5	.07657	.43143	.21414	-.21383	.03842
6	.07372	-.06895	.06716	-.04940	.12505
7	.03980	-.03385	.08214	-.00753	-.05001
8	-.09965	-.02835	-.07721	.82248	-.01219
9	.20234	.28985	.06039	-.00251	.09724
10	.43768	.40274	-.38157	.39682	-.09313
11	-.01836	.84260	.16047	-.07186	-.03191
12	.13412	.83863	.09918	.08755	-.00108
13	.44489	.46587	.00514	-.04847	.05858
14	.15762	.55425	.07061	.28771	.16782
15	.02150	.14044	.06651	.26959	-.10023
16	.02181	.37291	.30142	-.12189	.33363
17	.15993	.04103	.10343	-.16059	.06698
18	.21092	.25738	.15078	.11044	.34238
19	.86975	-.05414	.00186	-.00771	-.07905
20	.83846	-.00678	-.10263	.01173	-.04361
21	-.03206	-.15275	.16924	-.08959	.75399
22	.68081	.26107	-.06282	-.03470	-.10237
23	.62605	.37454	.26468	-.08551	.21164
24	.40433	.17974	.59050	-.06690	.11423
25	-.07847	.12769	.03362	-.06591	.80566
26	.74455	-.03388	.10156	-.16495	.05825
27	-.06167	.06887	.18499	.7740	-.15180
28	.02187	-.04576	.17690	.25043	-.14064
29	-.09764	-.10798	-.14119	.16061	.28058
30	.68201	.16518	.43523	.13823	-.10831

Appendix 20 continued

Item	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11
1	-.27494	.04336	-.09311	.11873	.07557	-.09828
2	-.26679	-.41439	.47397	-.01067	.06489	-.00077
3	.31340	-.21797	.23969	-.0559	-.11910	.25444
4	-.08495	-.00834	.17125	.05634	.18768	-.24713
5	-.22738	-.08282	.12752	-.17792	-.40323	.32805
6	-.03208	-.16376	-.05264	-.12586	-.09824	-.87266
7	-.03707	.00904	.06484	.89475	.03577	.09867
8	.15266	.13603	.10821	.05901	-.01542	.04255
9	.81835	-.01449	-.02373	-.06207	-.03091	.03473
10	.21022	.01836	-.20047	.00486	.04075	-.05494
11	.14476	.03287	-.02072	.01430	.17066	.02331
12	-.02424	-.10047	.14712	.05683	-.23203	.05838
13	.22574	.08940	.51175	.07933	.07331	-.14836
14	.36830	-.29668	.03716	-.08085	.37754	.05118
15	-.00440	.08658	.77441	.02832	-.00045	.10613
16	-.40598	.18923	-.00284	-.26013	.00731	-.04734
17	-.08976	.13155	.04098	.01575	.86967	.11177
18	-.44463	-.07892	-.33157	.38765	.12809	.18758
19	.06468	.05602	.07675	-.05316	.22843	-.04354
20	.02540	-.17398	.02991	-.11298	.01531	.09310
21	.26435	-.04831	-.01913	-.04385	-.05331	.22129
22	-.03138	-.06232	-.10108	.47712	-.14936	-.10783
23	.08709	-.20083	.25611	.01928	.15726	.10330
24	.18980	.10582	-.23663	.09666	-.00491	.12860
25	-.12815	.14206	-.08831	-.02036	.10197	.03405
26	.02009	.02458	-.11481	.24577	-.02145	.21720
27	-.17040	.28078	.18377	-.09562	-.18508	.00613
28	-.04855	.70470	-.07792	-.11711	.26336	.18380
29	-.02167	.78694	.17608	.07993	-.01849	.04909
30	-.00851	.11082	.12825	-.05129	-.03257	-.13167

Appendix 21

Pearson Correlation Matrix For LM, PASAT, BDI, and PCQ-FL at Six Month Follow-Up

	BDI2	LM2	PASAT2	PCQFL2	PCQS2
BDI2	1.0000 P= .	-.0689 P= .807	.0004 P= .999	.7699 P= .000	-.1661 P= .539
LM2	-.0689 P= .807	1.0000 P= .	-.2054 P= .463	-.2044 P= .465	-.2931 P= .289
PASAT2	.0004 P= .999	-.2054 P= .463	1.0000 P= .	.1841 P= .495	-.0646 P= .812
PCQFL2	.7699 P= .000	-.2044 P= .465	.1841 P= .495	1.0000 P= .	-.2316 P= .388
PCQS2	-.1661 P= .539	-.2931 P= .289	-.0646 P= .812	-.2316 P= .388	1.0000 P= .

Appendix 22

Frequency Distribution of Items on the Beck Depression Inventory at Six Months Follow-Up

Item Number	Value	Frequency	Valid Percent	Cum Percent
1	.00	9	56.3	56.3
	1.00	5	31.3	87.5
	2.00	0	0	87.5
	3.00	2	12.5	100.0
2	.00	11	68.8	68.8
	1.00	5	31.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
3	.00	12	75.0	75.0
	1.00	3	18.8	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
4	.00	7	43.8	43.8
	1.00	8	50.0	93.8
	2.00	0	0	93.8
	3.00	1	6.3	100.0
5	.00	15	93.8	93.8
	1.00	1	6.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
6	.00	10	62.5	62.5
	1.00	3	18.8	81.3
	2.00	0	0	81.3
	3.00	3	18.8	100.0
7	.00	13	81.3	81.3
	1.00	3	18.8	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0

Appendix 22 continued

8	.00	5	31.3	31.3
	1.00	9	56.3	87.5
	2.00	1	6.3	93.8
	3.00	1	6.3	100.0
9	.00	10	62.5	62.5
	1.00	4	25.0	87.5
	2.00	1	6.3	93.8
	3.00	1	6.3	100.0
10	.00	12	75.0	75.0
	1.00	2	12.5	87.5
	2.00	1	6.3	93.8
	3.00	1	6.3	100.0
11	.00	7	43.8	43.8
	1.00	8	50.0	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
12	.00	9	56.3	56.3
	1.00	4	25.0	81.3
	2.00	2	12.5	93.8
	3.00	1	6.3	100.0
13	.00	7	43.8	43.8
	1.00	6	37.5	81.3
	2.00	3	18.8	100.0
	3.00	0	0	100.0
14	.00	11	68.8	68.8
	1.00	3	18.8	87.5
	2.00	2	12.5	100.0
	3.00	0	0	100.0
15	.00	5	31.3	31.3
	1.00	8	50.0	81.3
	2.00	3	18.8	100.0
	3.00	0	0	100.0

Appendix 22 continued

16	.00	7	43.8	43.8
	1.00	4	25.0	68.8
	2.00	2	12.5	81.3
	3.00	3	18.8	100.0
17	.00	4	25.0	25.0
	1.00	9	56.3	81.3
	2.00	3	18.8	100.0
	3.00	0	0	100.0
18	.00	12	75.0	75.0
	1.00	3	18.8	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
19	.00	15	93.8	93.8
	1.00	0	0	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
20	.00	9	56.3	56.3
	1.00	4	25.0	81.3
	2.00	3	18.8	100.0
	3.00	0	0	100.0
21	.00	10	62.5	62.5
	1.00	3	18.8	81.3
	2.00	0	0	81.3
	3.00	3	18.8	100.0

Appendix 23

Means and Standard Deviations for the Beck Depression Inventory at Six Months Follow-Up

Item	Mean	S.D.
1	.69	1.01
2	.31	.48
3	.31	.60
4	.69	.79
5	.06	.25
6	.75	1.18
7	.19	.40
8	.88	.81
9	.56	.89
10	.44	.89
11	.63	.62
12	.69	.95
13	.75	.78
14	.44	.73
15	.88	.72
16	1.06	1.18
17	.94	.68
18	.31	.60
19	.13	.50
20	.63	.81
21	.75	1.18

Appendix 24

Means and Standard Deviations for Items on the PCQ-FL at Six Month Follow-Up

Item	Mean	S.D.
1	.94	.93
2	.56	.81
3	1.19	.98
4	.56	.51
5	.44	.51
6	.13	.34
7	.37	.50
8	.06	.25
9	.56	.81
10	.50	.82
11	.81	.83
12	.50	.73
13	.81	.91
14	1.00	1.32
15	.75	1.18
16	.31	.60
17	.69	.70
18	.56	.96
19	.44	.81
20	.50	.89
21	.06	.25
22	.44	.81
23	.81	1.05
24	.19	.54
25	.25	.45
26	.31	.48
27	.13	.50
28	.44	.51
29	.25	.58
30	.63	.72

Appendix 25

Frequency Distributions of Items on the PCQ-FL at Six Month Follow-Up

Item Number	Value	Frequency	Valid Percent	Cum Percent
1	.00	5	31.3	31.3
	1.00	9	56.3	87.5
	2.00	0	0	87.5
	3.00	2	12.5	100.0
2	.00	10	62.5	62.5
	1.00	3	18.8	81.3
	2.00	3	18.8	100.0
	3.00	0	0	100.0
3	.00	5	31.3	31.3
	1.00	4	25.0	56.3
	2.00	6	37.5	93.8
	3.00	1	6.3	100.0
4	.00	7	43.8	43.8
	1.00	9	56.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
5	.00	9	56.3	56.3
	1.00	7	43.8	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
6	.00	14	87.5	87.5
	1.00	2	12.5	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
7	.00	10	62.5	62.5
	1.00	6	37.5	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0

Appendix 25 continued

8	.00	15	93.8	93.8
	1.00	1	6.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
9	.00	10	62.5	62.5
	1.00	3	18.8	81.3
	2.00	3	18.8	100.0
	3.00	0	0	100.0
10	.00	10	62.5	62.5
	1.00	5	31.3	93.8
	2.00	0	0	93.8
	3.00	1	6.3	100.0
11	.00	6	37.5	37.5
	1.00	8	50.0	87.5
	2.00	1	6.3	93.8
	3.00	1	6.3	100.0
12	.00	10	62.5	62.5
	1.00	4	25.0	87.5
	2.00	2	12.5	100.0
	3.00	0	0	100.0
13	.00	7	43.8	43.8
	1.00	6	37.5	81.3
	2.00	2	12.5	93.8
	3.00	1	6.3	100.0
14	.00	9	56.3	56.3
	1.00	2	12.5	68.8
	2.00	1	6.3	75.0
	3.00	4	25.0	100.0
15	.00	10	62.5	62.5
	1.00	3	18.8	81.3
	2.00	0	0	81.3
	3.00	3	18.8	100.0

Appendix 25 continued

16	.00	12	75.0	75.0
	1.00	3	18.8	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
17	.00	7	43.8	43.8
	1.00	7	43.8	87.5
	2.00	2	12.5	100.0
	3.00	0	0	100.0
18	.00	11	68.8	68.8
	1.00	2	12.5	81.3
	2.00	2	12.5	93.8
	3.00	1	6.3	100.0
19	.00	11	68.8	68.8
	1.00	4	25.0	93.8
	2.00	0	0	93.8
	3.00	1	6.3	100.0
20	.00	11	68.8	68.8
	1.00	3	18.8	87.5
	2.00	1	6.3	93.8
	3.00	1	6.3	100.0
21	.00	15	93.8	93.8
	1.00	1	6.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
22	.00	11	68.8	68.8
	1.00	4	25.0	93.8
	2.00	0	0	93.8
	3.00	1	6.3	100.0

Appendix 25 continued

23	.00	8	50.0	50.0
	1.00	5	31.3	81.3
	2.00	1	6.3	87.5
	3.00	2	12.5	100.0
24	.00	14	87.5	87.5
	1.00	1	6.3	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
25	.00	12	75.0	75.0
	1.00	4	25.0	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
26	.00	11	68.8	68.8
	1.00	5	31.3	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
27	.00	15	93.8	93.8
	1.00	0	0	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
28	.00	9	56.3	56.3
	1.00	7	43.8	100.0
	2.00	0	0	100.0
	3.00	0	0	100.0
29	.00	13	81.3	81.3
	1.00	2	12.5	93.8
	2.00	1	6.3	100.0
	3.00	0	0	100.0
30	.00	8	50.0	50.0
	1.00	6	37.5	87.5
	2.00	2	12.5	100.0
	3.00	0	0	100.0

Appendix 26

Frequency Distribution of Strength Items on the PCQ at Six Months Follow-Up

Item Number	Value	Frequency	Valid Percent	Cum Percent
31	.00	12	75.0	75.0
	1.00	4	25.0	100.0
32	.00	4	25.0	25.0
	1.00	12	75.0	100.0
33	.00	15	93.8	93.8
	1.00	1	6.3	100.0
34	.00	12	75.0	75.0
	1.00	4	25.0	100.0
35	.00	9	56.3	56.3
	1.00	7	43.8	100.0
36	.00	5	31.3	31.3
	1.00	11	68.8	100.0
37	.00	11	68.8	68.8
	1.00	5	31.3	100.0
38	.00	12	75.0	75.0
	1.00	4	25.0	100.0
39	.00	10	62.5	62.5
	1.00	6	37.5	100.0
40	.00	4	25.0	25.0
	1.00	12	75.0	100.0