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Predictors of Long Term Psychosocial Outcome Following Traumatic Brain Injury

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University of Wales, Swansea

2005

Declaration

This work has not previously been accepted in substance for any degree and is not being currently submitted in candidature for any degree.

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Date……………………1-9-05…………………………..

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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Summary

Outcome after brain injury has, until recently, been assessed using few dimensions, and little attention has been paid to outcome at very late stages of recovery. A broad range of variables have been found to be predictive of outcome after brain injury, but the nature of the relationship between predictors and outcome is unclear. This study aimed to include the majority of variables that have been reported as predictors, and used a model by Kendall and Terry (1996), based on a theory of stress and adjustment, as a framework to identify significant variables when predicting and explaining multidimensional long term outcome.

131 brain injured participants that were over 10 years post injury, were interviewed and neuropsychologically assessed. They also completed a set of questionnaires providing information about psychosocial variables.

Results suggested that long term outcome can be good in this population, specifically in terms of quality of life and emotional adjustment. However, other outcomes, such as employment and community integration, were more severely compromised. Cognitive abilities showed no evidence of deterioration over time, but were still impaired in comparison to pre-injury estimates. Statistical analyses did not generally support the model depicting that appraisal and coping would act as mediators between predictors and outcome. Further analyses also rejected the notion that appraisal and coping were moderators. Predictors varied between dimensions, however, good self-concept, low neuroticism and high self-efficacy were found to be the most consistent significant variables when predicting all outcomes, and they also contributed the most to predictive models.

When identifying predictors that directly influence outcome at late stages after brain injury, the findings indicated that the specific dimension of outcome being considered is all important. Furthermore, Kendall and Terry's model did not provide a useful framework to explain psychosocial adjustment.

Contents

Chapter 1: Introduction

1.1 Background

Traumatic brain injury refers to a head injury caused by external physical force sufficient to produce an alteration in consciousness and subsequent neurological and/or neurobehavioural dysfunction. The injury is sudden, it occurs in the context of everyday life, and is non-congenital. Causes include road traffic accidents, physical assaults and falls (Kay & Lezak, 1990).

Two categories have traditionally been used to classify head injuries. One category refers to open head injuries, where the skull is penetrated causing localised brain damage. The pathophysiology of closed head injury, the second category, is more complex, because the mechanical forces involved usually result in diffuse brain damage. For example, after a blow to the head, lacerations and contusions to the brain are common, and are caused by the impact of the brain on bony protrusions and rough membranes within the skull (Jennett & Teasdale, 1981). Road traffic accidents lead to accelerative and decelerative forces being placed on the brain. These shake the brain, incurring damage and bruising at several sites due to the impact of the brain against the skull at opposite points, as well as strain on nerve fibres and blood vessels. In addition to the primary injury sustained, there is also a risk of a secondary injury. This refers to physiological processes that occur as a result of the primary damage. Haemorrhages, and their consequences, such as tissue swelling, and changes in blood volume and flow, are the most prevalent cause of secondary brain damage.

The incidence of traumatic brain injury is greater than for cerebral palsy, multiple sclerosis, and spinal cord injury combined (Kurtzke, 1982). Johnson and Roethig-Johnston (1989) state that more than a million people suffer traumatic brain injuries each year in the UK alone and estimates of the incidence in the UK vary between 1.5 and 4.7 per 1000 (Tennant, 1995). Estimates of the worldwide incidence range from 200 to 300 per 100,000 of the population (Jennett, 1996). The majority of people who suffer a traumatic brain injury, are either young adults or the elderly, and the male:female ratio is 2:1 for those aged between 15-60 (Hewer & Tennant, 2003). Advances in medical technology have decreased mortality rates following brain injury (Kay & Teasdale, 2001), however, the prevalence of significant disablement as a result of brain injury has been estimated to be between 100 and 150 per 100,000 of the brain injured population (Greenwood & McMillan, 1993). Inevitably great cost is incurred by society because many individuals are no longer employable and therefore rely on other sources of income, many also require care that was not previously necessary. However, Malec, Smigielski, DePompolo and Thompson (1993) identified a mean cost of $21,377 per patient and concluded that this should not be seen as a grave drain on resources in society because at least a human life had been salvaged.

1.2 Summary of Outcome Studies

Serious traumatic brain injury clearly increases the potential for long term disability and reduces employability. As a consequence, a large literature exists relating to outcome after traumatic brain injury. Much research has tried to identify relationships between cerebral pathology and behavioural change. Efforts have also been made to identify factors that influence and predict the course and quality of recovery.

Pre-injury variables that can influence development of symptoms after traumatic brain injury include intelligence and personality (Hanks, Rapport, Millis, & Deshpande, 1999; Malec, Brown, & Moessner, 2004). Other important factors are poor occupational adjustment, presence of psychiatric illness, and history of substance abuse (Dawson & Chipman, 1995; Thomsen, 1992). Post-injury factors that have been found to determine outcome are severity of injury, type of injury, presence of seizures, and type and timing of post-acute rehabilitation (Eames, Cotterill, Kneale, Storrar, & Yeomans, 1995; Johnson & Roethig-Johnston, 1989; Malec et al., 1993).

Psychological variables that influence a person's longer term recovery include attribution of blame associated with injury, coping style, presence of emotional symptoms, such as anxiety and depression, as well as social factors, such as recent life events and social support (Leach, Frank, Bouman, & Farmer, 1994; Linn, Allen, & Willer, 1994; Morton & Wehman, 1995).

Cognitive functioning is often significantly reduced after brain injury (Dikmen, Machamer, Powell, & Temkin, 2003; Rimel, Giordani, Barth, Boll, & Jane, 1981), and behavioural disturbances are frequently reported by relatives, often exhibited as aggression associated with low tolerance of frustration (Brooks & McKinlay, 1983). Neurobehavioural symptoms such as these are often associated with personality changes (Prigatano, 1992) that can lead to difficulty initiating and/or maintaining personal relationships that, in turn, can lead to increased social isolation (Oddy, Coughlan, Tyerman, & Jenkins, 1985; Thomsen, 1992).

Several outcome studies have suggested that individuals have difficulty returning to work, not only to their previous occupation, but to any kind of paid employment (O'Neill et al., 1998). In addition, poor community re-integration has been reported (Dawson & Chipman, 1995). At a subjective level of outcome, people have often been found to rate their Quality of Life (QoL) as reduced (Dijkers, 2004).

1.3 Purpose of Study

A large number of studies have attempted to predict outcome after brain injury. However, it is still not clear what factors significantly influence psychosocial outcome because much research only describes the course of recovery. An in depth approach to identify the most important factors that determine outcome would move research forward, and provide more meaningful findings that can be applied at a practical level.

Measurement of outcome has often been one-dimensional. The most frequently used outcome measure has been the ability to resume employment, yet outcome comprises a number of dimensions, such as the ability to perform daily activities, integrate into the community and perform social roles, as well as subjective well-being and QoL. As such, a comprehensive, multifaceted approach to assessing outcome is required (Boake & High, 1996). Also, whilst many factors have been associated with outcome, these have often been reported in isolation, ignoring the interaction between possible risk factors and their collective influence. As a consequence, too much emphasis may be placed on the influence of just one variable. Using this methodology, variables that have been found to be associated with outcome include pre-injury employment status, early neuropsychological functioning, injury severity, level of social support, self-perception and functional competency. Participant samples reported in the outcome literature are often small, or selected from a limited number of sources. For example, the most comprehensive and longer term outcome studies often include only those with most severe injuries (Thomsen, 1992). This approach does not allow generalization of findings, and therefore data are only relevant to a particular section of the brain injured population.

An area that needs more attention is the assessment of very long term outcome. Studies have focused on acute recovery (up to 12 months post injury) (Dikmen, Ross, Machamer, & Temkin, 1995; Johnstone, Mount, & Schopp, 2003), and several reports have been published documenting outcome between 2-7 years post injury (Brooks, McKinlay, Symington, Beattie, & Campsie, 1987; Oddy et al., 1985). However, only a few attempts have been made to carry out very long term follow-ups (i.e. >10 years) and evaluate the influence of potential predictors at this late stage (Hoofien, Gilboa, Vakil, & Donovick, 2001; Rappaport, Herrero-Backe, Rappaport, & Winterfield, 1989). Still fewer studies have related findings to any practical or theoretical model (Sbordone, Liter, & Petter-Jennings, 1995), making it difficult to put potential risk factors and outcome variables into context. Providing a conceptual framework helps to interpret findings and structure a discussion, which in turn can lead to the end goal of establishing therapeutic interventions applicable to rehabilitation.

The research reported in this thesis attempts to fill many of the gaps left by previous studies when assessing outcome after traumatic brain injury. The cohort is large and consists of participants that have sustained brain injuries that cover a broad range of severity. Very long term outcome is reported (10-30 years) and outcome is assessed in a multidimensional way, incorporating both standardised objective measures and subjective ratings. An all encompassing approach has been taken that incorporates many possible predicting factors previously identified in the literature. The nature of the relationship between predictors with each dimension of outcome has been explored. The resulting information provides a framework for a comprehensive discussion regarding important factors that predict multidimensional, psychosocial outcome at very late stages following brain injury, and the means by which each of the predictors influence the process of recovery.

1.4 Outline of Thesis

The following chapter provides a review of relevant literature concerning outcome from brain injury. A distinction is made between outcome dimensions of independent living, community integration, emotion, employment status, and QoL. Findings reported in the literature are described and methodologies evaluated, before examining the notion that outcome is a multidimensional construct. The chapter concludes by reviewing literature outlining neuropsychological impairment experiences after brain injury.

Chapter 3 outlines the variables reported to be predictive of outcome after brain injury. Predictor variables are classified into three categories: demographic, cognitive and psychosocial. The nature and degree of the associations between predictors and outcome are discussed and literature is reviewed.

Multivariate models that have been suggested as being capable of explaining prediction of outcome after brain injury are described in Chapter 4. The section begins by describing a broad conceptual framework of disablement, the ICIDH-2 (WHO, 2001), and moves on to detail multivariate studies that are relevant to brain injury. Finally, a comprehensive model that was proposed by Kendall and Terry (1996) is depicted and fully explained.

Chapter 5 contains the aims and hypotheses of the study. Aims include the evaluation of different outcomes and their associations with each other, along with identifying relationships between predictor variables and outcomes.

Chapter 6 describes the methodology of how long term outcomes after brain injury and predictor variables are assessed. Details of the cohort, neuropsychological assessment materials and investigation procedures are presented. The psychometric instruments are described and validation information is given.

The results, presented in Chapter 7, suggest that there is room for optimism when evaluating very long term outcome after brain injury. Further sections report correlations between variables before outlining findings of the analyses investigating predictive associations. The model proposed by Kendall and Terry (1996) explaining psychosocial adjustment was not generally supported because the mediating role played by appraisal and coping variables, between predictors and outcomes, was not identified.

The final chapter, Chapter 8, consists of a general discussion. Findings are summarised as they relate to the aims and hypotheses. Additional issues that may account for the findings are discussed. Limitations of the study and future directions are considered. The implication of the findings, regarding the long term prognosis and rehabilitation of those with brain injury, are presented. The chapter closes with conclusions of the study.

Chapter 2: Literature Review of Outcome

One common theme running throughout much of the outcome literature is the tendency to focus on one measure of outcome, for example employment. Few studies consider several outcome measures simultaneously. Therefore, in order to provide a context for the research presented later in the thesis, this chapter reviews published outcome studies, with each outcome measure being discussed separately.

2.1 Independent Living

The level of supervision required to enable independent living after brain injury is an important dimension of outcome. Although rather limited in the classification used, Dikmen et al. (2003) reported that 92% of their cohort were living in unrestricted situations. This is defined as living alone, or with others, including family, and was contrasted with a restricted situation, for example a care home, hospital, or group home. Using a more elaborative classification for assessing living arrangements, Hoofien et al. (2001) found that 64.5% were living with their spouse, 17% were living with parents, 14.5% were living alone, and 4% were sharing a residence with a friend. These findings compare favourably with the cohort in Colantonio et al.'s study (2004), even though mean time since injury of both cohorts is very similar (Hoofien et al. - mean 14.1 years; Colantonio et al. – mean 14.2 years). In the latter study, only 40.2% of participants were living with spouses, 23.5% were living alone, 17% were living with parents, whilst 9.2%

were living in institutional settings. The difference in the proportion of participants living with a spouse, between studies by Hoofien et al. and Colantonio et al., may be because the studies were carried out in Israel and America respectively. The fact that the cohort from Israel showed a greater increase in numbers getting married between injury and follow-up (Hoofien et al. - 28% at Time 1 and 64.4% at follow-up; Colantonio et al. – 35% at Time 1 and 40.2% at follow-up) could be a reflection of different cultures. Both these studies should be considered in the knowledge that they employed retrospective follow-up methodologies, and the cohorts used were not representative of the traumatic brain injury population, containing a higher representation of those with more severe injuries. Furthermore, in Colantonio et al.'s study inconsistent methods were used to obtain information, such as self-report, informant's responses, and telephone interview.

The topic of independent living was investigated by Boake (1996) when devising the Supervision Rating Scale (SRS), a measure of the degree of physical supervision required by an individual. Of 114 patients included in his study, 10 were living independently, 95 were living in the community with support, and 9 were living in a facility. Interpreting these findings using the five sub-sections of the SRS finds 30 of the cohort classed as living independently, 6 requiring overnight supervision, 49 having part-time supervision, 18 needing full-time indirect supervision, and 12 needing full-time direct supervision. Clearly, when comparing results across studies, consideration must be given to both the location from which the sample is drawn, and also method of classification used. The latter is likely to differ, particularly when standardised tools have not been used. Overall, studies that have focused on living arrangements after traumatic brain injury are quite positive, with a high proportion of cases achieving a good degree of independence.

2.2 Community Integration

Community integration is a composite measure of outcome, incorporating a number of different dimensions. The investigation of community integration in those who have suffered disability, has a reasonably long history (Jacobs, 1989), however, a definition of community integration has still to be agreed. It is generally recognised that the concept involves relationships with others, independence in the living situation, and activities that fill the person's time (McColl et al., 1998). After a large qualitative study, McColl et al. gave a more specific idea of what community integration means from a brain injured person's perspective. Nine indicators were identified: orientation, acceptance, conformity, close and diffuse relationships, living situation, independence, productivity and leisure. Using this definition, it is evident that community integration is an all-encompassing and complex process in recovering from traumatic brain injury (Minnes et al., 2003).

The most frequently used measure to assess community integration after brain injury is the Community Integration Questionnaire (Willer, Rosenthal, Kreutzer, Gordon, & Rempel, 1993). Using this measure, Willer, Ottenbacher and Coad

(1994) found that brain injured participants had reduced level of community integration in comparison to non-injured controls, however the control group were generally better educated than participants with brain injury, a variable that possibly influenced their findings. When comparing pre and post injury CIQ scores, Corrigan and Deming (1995) found community integration ratings to be lower after injury. This study employed a retrospective methodology to gain the pre-injury data which (although only three months post injury) may have affected the respondent's ratings. Seale et al. (2002) reported that of 32 severely injured participants, 59.4% were classified as having a more positive degree of community integration when followed up at least one month after discharge from a post-acute rehabilitation programme, compared to the day of admission. The sample had undergone rehabilitation within one year of their injury. An improving trend is also reported by Corrigan, Smith-Knapp and Granger (1998) who found increasingly better community integration over a four year follow-up period, between one and five years post injury. Therefore, it would appear that although levels of community integration are compromised after brain injury, potential exists for this measure of outcome to improve. However, findings must be interpreted with caution because the results reported by Corrigan et al. were based on separate groups of participants at varying times post injury. Although the groups appeared to be well matched in terms of pre-injury and injury related characteristics, they consisted of small numbers, limiting the ability to generalise their findings. In addition, Colantonio et al. (2004) reported reduced community integration, when compared to normal populations, up to 24 years post injury.

2.3 Emotion

Emotional sequelae of brain injury have been found to be prevalent, yet Williams, Evans and Fleminger (2003), whilst providing an overview of the area, suggested that anxiety related disorders may even be under-diagnosed in this population because symptoms may be difficult to identify in the context of other issues. When reviewing the prevalence of depression, Fleminger, Oliver, Williams and Evans (2003) suggested that a useful distinction can be made between those studies reporting depression during the first year after injury, and those of a longer duration. Jorge et al. (1993) found 22.2%, 23.2%, and 18.6% of their cohort were experiencing major depression at 3, 6, and 12 months post injury respectively. Kersel, Marsh, Havill and Sleigh (2001) reported 24% of a severely injured sample as being clinically depressed, at both 6 and 12 months post injury. Kinsella, Moran, Ford and Ponsford (1988) found that within two years after severe head injury, 33% of their participants could be classified as depressed and 26% as suffering from anxiety. In a more recent study, Seel et al. (2003) discovered that at a mean time of 35.3 months post injury, 27% of a cohort consisting of 666 patients were classified as depressed, when assessed by the Neurobehavioural Functioning Inventory (Kreutzer, Seel, & Marwitz, 1999). Longer follow-up studies, such as that by Hoofien et al. (2001) at a mean time of 14.1 years post injury, have also found a high prevalence of emotional disorders. They reported that 45% of their sample suffered from depression, although the fact that more than half of their cohort were army veterans may be a confounding factor in their study. From the studies just mentioned, it is clear that emotional symptoms are evident in a significant proportion of people having suffered a head injury, and this appears to be regardless of the time since injury. Indeed, Fordyce, Rouche and Prigatano (1983) concluded from their study that not only do emotional problems such as anxiety and depression exist, but they can also worsen over time. McKinlay, Brooks, Bond, Martinage and Marshall (1981) found that anxiety and depression was reported in over half of their 55 participants at 3, 6 and 12 months post injury, and they also found that at least an equal proportion of the cohort still suffered emotional problems after five years (Brooks, Campsie, Symington, Beattie, & McKinlay, 1986). However, the longitudinal research reported by McKinlay et al. relied on relative's ratings as a measure of emotional symptoms, not formal questionnaires, as in more recent studies. This might account for the high prevalence of emotional problems reported in their sample. Furthermore, type of recovery made by individuals, or severity of injury sustained, do not seem to be correlated with these emotional sequelae. Brooks et al. reported the existence of anxiety and depression across all levels of recovery, as judged by relatives, whilst Levin and Goldstein (1989) described mild levels of anxiety and depression in 10 participants who had made a good recovery.

2.4 Employment Status

Another major outcome criterion is resumption of employment. It is often a focus for individuals and their families and, as such, becomes an important goal in psychosocial recovery (Brown & Vandergoot, 1998). The importance placed on returning to employment illustrates the role it plays in defining and maintaining the social role of individuals, as well as giving structure to life and providing stability to promote an independent lifestyle (Lezak, 1986; O'Neill et al., 1998). As a consequence, employment has been extensively documented in outcome studies. However, large variation exists in reported rates of returning to employment. This is partly explained by different ways of defining employment, and also variation in samples between studies. For example, Thomsen (1989) reported data from a Danish cohort showing that just 12.5% had resumed work, after very severe traumatic brain injury. However, Possl, Jurgensmeyer, Karlbauer, Wenz and Goldenberg (2001) found that stable re-employment was achieved by 53% of a sample with severe acquired brain injuries. Studies have often found a large reduction in the number of participants employed post injury in comparison to pre-injury. A recent study showed that the increase in unemployment after a 1-year follow-up period was 38% (Johnstone et al., 2003). Brooks et al. (1987) stated that numbers employed reduced from 89% before injury to 29% between 2 and 7 years after injury, whilst Colantonio et al. (2004) found a reduction in employment at a longer time since injury (mean 14.2 years), with 29.1% of participants in full-time employment, compared to 64% at injury. The re-employment of people with brain injuries has also been found to be compromised in comparison to other clinical groups. Paniak, Shore, Rourke, Finlayson and Moustacalis (1992) reported an interesting study using a control group consisting of spinal-cord injured patients. They found a significant difference between those with closed head injuries and the control group, in relation to the proportion of pre-morbidly employed people who had returned to the same level of employment 2 years after injury. Only 4/36 of the head injured group had done this, whereas 12/36 of those with spinal-cord injuries had. However, this information was collected through postal questionnaires and, as such, the added cognitive difficulties experienced by participants with closed head injury, may have influenced their ability to complete measures accurately. When evaluating literature reporting employment rates after brain injury, the time of assessment has been found to be important. After reviewing the literature, Oddy (2003) suggested that most people who are to return to work will have done so within 2 years of injury. Brooks et al. did not find any evidence to suggest an increase in the proportion of their cohort working between 2 and 7 years, and Johnson (1998) found that just 2 out of 64 patients who were not in work 2 years post injury were working 10 years after injury.

2.5 Quality of Life

The final concept to be discussed, which has been used as a measure of outcome after brain injury, is that of Quality of Life (QoL). When defining QoL, it is important to distinguish that measures of this concept are not just a reflection of disability. This confusion may go some way to explaining why the concept has not been reported as an outcome measure after brain injury until recently. The relationship between disease or injury to QoL is not clear because patients with severe disease do not necessarily report a poor QoL (Carr, Gibson, & Robinson, 2001). Although Post, de Witte and Schrijvers (1999) suggested that the term QoL should be abandoned, in the process of reviewing the literature, they have provided clarification regarding the relationship between QoL and other measures of outcome that are affected by brain injury. They suggested that an individual's life satisfaction is judged against role performance in social functioning, such as marital or vocational status. In addition, they proposed that the sense of overall well-being is dependent on somatic sensations (i.e. feelings of pain, fatigue etc.), perceived health, and life satisfaction. As such, QoL is an important concept when assessing outcome (Rosenthal, 1996). However, interpreting the findings of studies that have reported this concept is difficult because of the multi-faceted definition (and often subjective interpretation) frequently given to the term. In a review article, Carr et al. suggested that there is no consensus regarding what is meant by the concept, and studies that have addressed the issue have varied in their approach, choosing to concentrate on areas of health, mood, social role and life satisfaction (Klonoff, Costa, & Snow, 1986; Webb, Wrigley, Yoels, & Fine, 1995). Seibert et al. (2002) found gender differences concerning those elements that were found to comprise an acceptable QoL. Men were found to be concrete in their perceptions of QoL, associating it with enjoying social and recreational activities; ability to perform self-care tasks, household chores and jobs; ability to drive, live independently; to learn new things; and happiness and a spiritual life. In contrast, women did not consistently report any particular elements as being associated with QoL.

In a review of the literature, Dijkers (2004) found that reduced QoL after injury was a common finding, and furthermore, ratings of people with traumatic brain injuries were often lower than comparison groups. Particular outcome studies reporting QoL among people with acquired brain injuries include a study by Dawson, Levine, Schwartz and Stuss (2000). Unfortunately almost half of their original cohort were lost to follow-up, introducing potential bias to their findings. However, they report that 18.4% of the follow-up cohort rated their QoL as being poor or fair, 38.8% as being good, and 42.8% as being very good or excellent. An interesting finding by Talbot and Giroux (2000) shows that those with minor head injuries tend to underestimate their perceived QoL when compared to close relative's ratings, whereas more severely injured people over-estimated their rating. This finding may relate to the difference in levels of awareness often evident in the two groups. Less severely injured have a more accurate level of insight into their difficulties. Using life satisfaction as a measure of perceived QoL, Smith, Magill-Evans and Britnell (1998) found that a cohort who were broadly representative of the population with brain injury, reported comparable ratings to a different study consisting of spinal cord injured people (Fuhrer, Rintala, Hart, Clearman & Young, 1992), but a lower overall rating than a study with non-injured adults (Willer et al., 1994). A lot of studies investigating QoL have done so in the context of it being the dependent variable of several predictor variables. As such, specific values representing QoL variables or their interpretation are not stated (Brown, Gordon, & Haddad, 2000; Heinemann & Whiteneck, 1995). As a consequence it is difficult to obtain a consistent picture of the degree of life satisfaction or QoL as perceived by the brain injured population.

2.6 Multidimensional Outcome

The range of factors that comprise psychosocial adjustment, which have been discussed so far, include independent living, community integration, emotional disorders, employment status, and QoL. However, very few studies have used this broad scope of measures to assess outcome after brain injury. The limited number of outcome measures used by some studies, and variability of these measures, restricts the scope for applying the findings across outcomes. However, if there is a strong association between various dimensions of outcome, a more restricted approach could be justified. Hall, Bushnik, Lakisic-Kazaic, Wright and Cantagallo (2001) found that measures of functional competency and community participation were highly correlated, whilst life satisfaction has been reported to be influenced by both breakdown of personal relationships (Warren, Wrigley, Yoels, & Fine, 1996), and employment status (Corrigan, Bogner, Mysiw, Clinchot, & Fugate, 2001). Heinemann and Whiteneck (1995) reported evidence of a relationship between measures of disability, community integration and life satisfaction in a large sample (N=758), however methods used to gain information were inconsistent, i.e. a combination of self-report, assisted report and significant other's reports. Furthermore, measures of disability and life satisfaction were primitive and not standardised. Using more standardised measures with a severely injured group, Mailhan, Azouvi and Dazord (2005) found emotional status to be correlated with life satisfaction, and interestingly, a non-linear relationship between disability and life satisfaction. However, even though relationships between outcome dimensions have been found, Boake and High (1996) argued that multidimensional measures should be used to comprehensively assess psychosocial outcome, emphasising three dimensions; 1) need for assistance with self-care; 2) employment or productivity, and 3) social relationships. Further investigation needs to be carried out into the exact nature of associations between different dimensions of outcome and if these relationships are strong enough to warrant the completion of a reduced number of measures when assessing outcome. Evidence to date suggests that to comprehensively evaluate outcome, a variety of measures need to be used, but this has not been the case in the majority of outcome studies.

2.7 Neuropsychological Impairment

Neuropsychological status is frequently reported as an outcome measure after brain injury. However, it is apparent that whilst many studies have reported cognitive abilities at the initial assessment post injury, they have failed to conduct a formal neuropsychological assessment at later follow-ups. This may be because it is time consuming to carry out the second assessment however, the result is that many follow-up studies have relied on questionnaire information on cognitive function. By omitting detailed assessments at follow-up, we are denied knowledge regarding the course of possible cognitive change post injury, and the influence of traumatic brain injury on cognitive ageing (which may have an impact on other outcome measures).

A relationship appears to exist between cognitive functioning and severity of injury (Dikmen, Ross et al., 1995), the most serious deficits being associated with severe injuries classified by Post Traumatic Amnesia greater than 24 hours (Jennett, Teasdale, Braakman, Minderhoud, & Knill-jones, 1976) or a Glasgow Coma Score of less than 9 (Teasdale & Jennett, 1974). Using such criteria, Tate, Fenelon, Manning and Hunter (1991) reported details of 100 severely injured patients admitted to a rehabilitation facility and assessed one year post injury. 57% had deficits in learning and memory and 34% were slow in processing information. Overall 70% had some type of neuropsychological impairment. A longer term study by Dikmen et al. (2003) assessed neuropsychological outcome between 3 and 5 years after injury. The severely injured individuals in their cohort were found to have deficits on a test of learning and memory as well as on a measure of attention and information processing speed. A more comprehensive assessment at follow-up, this time after a mean of 14.1 years post injury, was reported by Hoofien et al. (2001). 76 severely injured participants were involved in their study, but the cohort was from Israel, which may introduce cultural determinants, and also included those with combat injuries, which limits the extent to which their findings can be generalised. However, marked deficits were again evident on tests of verbal learning and manual speed and dexterity. However, less compromised ability was seen on verbal and figural memory tests, which were performed in the average range. Similarly, verbal and full-scale intelligence were found to be in the average range, although non-verbal intelligence was more impaired, falling within the limits of the low average range.

Cognitive impairment in those with mild injuries, classified by a Post Traumatic Amnesia of less than 1 hour (Jennett et al., 1976) or a Glasgow Coma Score of greater than 13 (Teasdale & Jennett, 1974), is less clear. Rimel et al. (1981) found that mild neuropsychological impairment was evident on the vast majority of the Halstead-Reitan Neuropsychological Test Procedures, after assessment of 69 mildly head injured individuals at just 3 months post injury. Areas where impairment was found included tests of higher level cognitive functioning, new problem solving skills, attention and concentration. However, Dikmen, Machamer, Winn and Temkin (1995) reported that neuropsychological status of a mildly head injured group is comparable with that of a non head injury trauma control group, at one year post injury. The authors claimed that these findings supported previous research in this area, by demonstrating that mild head injuries are not associated with long term cognitive deficits (Dikmen, McLean, & Temkin, 1986; Gentilini et al., 1985; Levin, Mattis et al., 1987).

Leininger and Kreutzer (1992) reviewed literature concerning neuropsychological assessment of those with mild head injuries. It is clear that a great amount of variability exists between studies in this area, and the authors cite some obstacles that prevent a true comparison of each of the studies. Often, time points of each assessment differ, as do content of assessments, and also selection criteria of participants vary. Despite these difficulties, Leininger and Kreutzer concluded that this population exhibit reduced information processing speed, and weaknesses of concentration, learning and memory, and reasoning. When considering the variation in findings of mildly injured cohorts, other factors should also be considered. These include the motivation of individuals (Bernstein & de Ruiter, 2000), and whether the participants also report post concussive symptoms (Leininger, Gramling, Farrell, Kreutzer, & Peck III, 1990).

2.8 Relating Outcome Literature To Aims

The length of follow-up varies greatly within the literature, the majority of studies reporting on the first seven years after injury. Comparatively few studies have investigated very long term outcome, 10 years post injury. A longitudinal approach is necessary to establish long term adaptation to the effects of injury. Accordingly, the current study aimed to follow-up a group of head injured individuals more than 10 years post injury. Specifically, psychosocial outcome was assessed in terms of independent living, community integration, life satisfaction, anxiety, depression, employment status, and QoL. Furthermore, the relationship between different dimensions of outcome is not well established, indeed many studies have not included a multidimensional approach to assessing outcome. Therefore, associations between dimensions need to be explored further to enable a judgement to be made regarding continued use of the umbrella term 'outcome'. Chapter 5 details the specific aims and hypotheses regarding the evaluation of each outcome dimension and their interrelationships.

Chapter 3: Literature Review of Predictors

It is apparent that much variation exists between the findings of different outcome studies. This is due in part, to the wide range of methodologies employed. Some studies are retrospective, such as Sbordone, Liter and Petter-Jennings (1995), whilst others are prospective, such as Dawson, Levine, Schwartz and Stuss (2004). McKinlay and Brooks (1984) made early observations regarding problems associated with more specific procedural aspects, such as whether information is obtained from the brain injured person or a significant other. They concluded this difference is an important one and will account for some variation in the literature. However, perhaps a more significant consideration, when reviewing the outcome literature as a whole, is variation between participants in different studies. One factor that was alluded to, in the previous section, as possibly being influential, was injury severity. Furthermore, much outcome research is concerned with early years post injury. Only more recent studies have focused on longer term outcome, and this area is still under-investigated. Therefore, time since injury could also influence the type of outcome reported in different studies. These and other factors will be discussed in this chapter, in terms of their value in predicting outcome following traumatic brain injury.

3.1 Demographic Variables

Some demographic variables that have been found to be predictive of outcome after brain injury will be discussed in this section. For example age at injury, gender, level of education, pre-injury employment, and relationship status. Other variables that have been reported to influence outcome relate to the injury itself. These include neurological factors, such as injury severity. Furthermore, variables relating to the time of the injury have also been found to be important, including the time since injury when outcome is assessed.

One factor frequently mentioned in the literature on outcome is the effect of age. Ruff et al. (1993) reviewed the literature and found consistent reports of older adults having a poorer outcome than younger adults. Therefore the authors selected age as one of their variables in their 12 month outcome study. Their findings supported the prediction that age, along with several other factors, was significantly related to returning to work or school. Groswasser, Melamed, Agranov and Keren (1999) in a review article, also found evidence that suggests age is a determinant of outcome in patients with traumatic brain injury. They cited a study by Najenson, Groswasser, Mendelson and Hackett (1980), which found 45 years as a specific upper age limit to good recovery. Lewin, Marshall and Roberts (1979) conducted an early outcome study that incorporated a large cohort (N = 291) with severe injury between 10 and 24 years earlier, and they identified age at onset of injury as being a predictor of long term outcome in terms of neurophysical disability, social life and occupation. However, it is interesting to note that Lewin et al.'s study considered age in conjunction with severity of injury, and their findings imply that more severe injuries have a greater impact on older people.

The majority of individuals suffering brain injuries are young, but also male. Therefore gender is important when identifying those people who are more likely to suffer a brain injury. Indeed it has also been reported that males are likely to sustain more severe injuries (Slewa-Younan, Green, Baguley, Gurka, & Marosszeky, 2004). However, studies that have included gender as a possible predictor of outcome have not found any association with life satisfaction and neurobehavioural symptoms, including depressed mood (Corrigan et al., 1998; Deb, Lyons, & Koutzoukis, 1999). This is surprising, because affective disorders are suffered more by women than men and, as such it would be expected that gender would have an effect on outcome after brain injury. A possible explanation for the discrepancy could be the uneven proportion of each gender in the studies by Corrigan et al. and Deb et al., where the cohorts were male dominated and therefore, more representative of a brain injured population. Also, the influence of gender may have been masked by other predictor variables in the studies e.g. injury severity and level of education. Seibert et al. (2002) did find that gender differences influenced perceptions of QoL, although this study also incorporated unequal numbers of each gender. Significantly more females (69%) reported a worse overall QoL than males (21%) after brain injury. Dijkers (1997) reviewed the literature concerning community integration, and identified studies that have reported gender as influential over this dimension of outcome. However, findings depend on the type of integration concerned, with level of home integration biased towards females, and males obtaining a greater level of productive activity.

It has been found that number of years spent in full time education is associated with outcome and psychiatric morbidity in a cohort with predominantly mild injuries (Deb et al., 1999). In agreement with this finding, Rimel et al. (1981) also found those who had a higher level of education were more likely to have returned to work 3 months after suffering a minor head injury. Using more severely injured participants who were one year post injury, studies by Greenspan, Wrigley, Kresnow and Fine (1996), and Wagner, Hammond, Sasser and Wiercisiewski (2002) also found low pre-morbid educational levels as a factor determining post injury employment and successful return to productive activity, an observation further supported by data from the TBI Model Systems database (Sherer, Sander et al., 2002). Only 10% of those with less than a high school diploma at the time of injury were in work 2 years later, compared to twice the number who had graduated from high school. There was no obvious relationship between employment outcome and severity of injury in this study, suggesting that pre-accident cognitive ability was the important factor determining outcome. The latter three studies cited above included large cohorts and numerous other variables to investigate predictors of outcome. All found educational level to be influential. However, all studies were conducted in the US, and because level of education was assessed according to their system, the findings might not be applicable to the UK.

Although employment is often used as an outcome measure, it can also be considered as a predictor. Brooks et al. (1987) acknowledged the difficulty in assessing the influence of pre-morbid employment status on outcome, when prior to injury, the majority of participants were in full-time employment. Therefore, the majority of studies tend to only include participants who were in full time employment to control for this factor. However, outcome studies that have included pre-morbid employment status as a predictor have identified it as influential, specifically in relation to returning to work post injury (Felmingham, Baguley & Crooks 2001; Ponsford, Olver, Curran & King 1995). Employment status after injury has also been reported as influential. O'Neill et al. (1998) and Webb et al. (1995) found being in work to be related to outcomes such as QoL and community integration, even after consideration of many other possible influential factors. However, these two studies differ in methodology because Webb et al. assessed participants two years after injury and thus provide information about a very specific time point. In contrast O'Neill et al. included people who suffered their injury at least one year previously, but in some cases over 20 years post injury. This makes it difficult to interpret their findings in relation to the population with brain injury as a whole. A different aspect to an individual's pre-injury circumstances that may help to determine outcome is relationship status. Warren et al. (1996) reported that those participants who were married had a greater life satisfaction than those not married, a finding which was not replicated by Corrigan et al. (2001). However, the latter study did find the influence of marital status on life satisfaction decreased between one and two years post injury, and the authors suggested that the beneficial effect of being married diminishes over time. This study reports contradictory findings to most of the literature, possibly because of the small cohort (N = 25), but there was also no consideration of whether people were married before injury or married after injury, which may have confounded the results.

Characteristics of the injury, as opposed to the demographic situation of the person, have also been seen as influencing outcome. It has already been established that injury severity has been found to be related to cognitive recovery after brain injury (see section 2.7), however, it was also among the earliest variables to be associated with psychosocial outcome. Two methods have been suggested to assess severity, both based on changes in consciousness in the acute stages after injury. The Glasgow Coma Scale (GCS) (Jennett et al., 1976; Teasdale & Jennett, 1974) differentiates between eye, verbal and motor response, and allows improvement in each of these functions to be considered independently. A second classification system uses the period of amnesia experienced by the patient as a guide to indicate injury severity (Teasdale & Jennett, 1974). The period of post traumatic amnesia (PTA) begins at the time of injury and ends when the patient can continuously register experience (Lezak, 1995). Most studies have used a combination of measures, however, it is also evident that different measures of injury severity perform differently as predictors of outcome, depending on the sample and outcome measured (Katz & Alexander, 1994; Van Der Naalt, Van Zomeren, Sluiter, & Minderhoud, 1999). In an early attempt at assessing psychosocial outcome after very severe brain injury, Bond (1976) concluded that those with a PTA exceeding three to four weeks (i.e. a very severe injury) were disabled mentally, physically and socially to some extent.

However, it should be noted that 96% of the cohort had a PTA of at least one week and 52% exceeded 4 weeks. Furthermore, at this very early time of investigating such issues, the measures used to evaluate outcome were unsurprisingly not standardised and limited in their sensitivity. However, Young et al. (1981) concurred with Bond, this time assessing severity with GCS score, which they found to be a useful early predictor of outcome, as measured by the Glasgow Outcome Scale (Jennett & Bond, 1975). In addition, Jennett, Snoek, Bond and Brooks (1981) reported that those who suffer a PTA of less than four weeks will almost certainly become independent, albeit possibly with moderate disability. Not only is there variation in the methods used to measure injury severity, but there is also debate as to the most useful score to report regarding a patient's neurological state. Jennett et al. (1979) found that a better predictor of outcome was the best state rather than the initial or worse state, as reported in Young et al's study. Despite these procedural discrepancies it is agreed that injury severity influences such outcomes as physical disability and occupation (Cifu et al., 1997; Dikmen, Machamer, & Temkin, 1993; Doig, Fleming, & Tooth, 2001; Lewin et al., 1979; Ponsford et al., 1995; Ruff et al., 1993). A study by Van Zomeren and Van Den Burg (1985) enabled them to specify more closely complaints predicted by severity. They found that impairments such as forgetfulness, slowness and poor concentration, were related to injury severity, whereas complaints labelled 'intolerances', such as dizziness, intolerance of bustle, irritability, intolerance of light, headaches, increased need of sleep, and crying more readily, were not. Some studies have failed to find an association between injury severity and outcome (Felmingham et al., 2001; Sherer, Bergloff, High, & Nick, 1999), however, these studies included injury severity as one of a number of variables that might predict outcome and, as such, the influence of injury severity is diminished in relation to combinations of other more powerful predictors. Furthermore, these studies often used small and specific groups of participants. It has also been found that injury severity is less associated with returning to work as time progresses (Brooks et al., 1986; Groswasser et al., 1999). Therefore an interaction appears to exist between injury severity and time since injury.

One factor consistently referred to when reviewing outcome in this thesis, is time since injury. Follow-up intervals after injury have varied greatly between outcome studies, making comparison difficult. However, the vast majority of outcome research has been based on early years post injury (less than 10 years), and focused on psychosocial outcome, providing an indication of the degree of community integration (or social isolation) experienced by people after brain injury (Brooks, Campsie, Symington, Beattie, & McKinlay, 1987; Oddy et al., 1985). Average life expectancy of people after traumatic brain injury is 50 years (Chamberlain, 1995). Therefore, studies concerning very long term sequelae of traumatic brain injury are necessary to provide information regarding levels of support required, or the need for specific forms of rehabilitative therapy, to maintain or improve on recovery made in the short term. Sbordone et al. (1995) retrospectively studied a sample of ten participants at a mean of 10.3 years post injury. Ratings by relatives indicated mild to moderate problems in several areas, including cognitive, vocational, behavioural and social functioning. However, the findings also suggested an improvement over time in these domains, suggesting that some form of personal adjustment may take place that leads to better psychosocial outcome. Of course with just ten cases in the study, these findings are tenuous and would need to be confirmed using a more comprehensive cohort.

Thomsen (1984; 1987; 1989; 1992) reported outcome of a group of very severely injured participants (PTA>1 month) with a series of follow-up time points ranging from 4.5 months to 20 years post injury. The findings highlight areas that cause problems for both patients and their families. Help is required in order to adopt a new style of living to adapt to the change in behaviour of the patient. Lack of insight was also reported as being one of the most important negative factors in terms of re-integrating into society. Neurobehavioural difficulties such as these were found to be more debilitating than physical disability because they led to increased social isolation, caregiver stress and unemployment. These problems persisted for a number of years after the initial 2.5 year follow-up but after 10-15 years, Thomsen (1984) pointed to a late improvement in some of the cases *"It is especially remarkable that half the patients who could not be left alone two years or more after the accident became independent during the following years. Several of the sample regained some work capacity but generally not until years after the injury. The late results thus indicate that though the patient with very severe head injury may remain disabled, improvement in psychosocial functions can continue for several years"* (p. 267). Also, in her final follow-up, Thomsen

(1992) judged 23% of her sample to have good or very good psychosocial outcomes, although it is not clear on what basis this judgment was made. Although, Thomsen's series of follow-up studies can be considered as seminal pieces of work in the area of outcome after traumatic brain injury, the studies only include a maximum of 40 cases, all from Denmark. Some of the measures used to assess outcome were also inconsistent, varying between self-reports and reports of others, and many of the findings were based on subjective ratings.

More recent comprehensive long term outcome studies have been reported by Hoofien et al. (2001) and Colantonio et al. (2004). In the former study the cases were from Israel, and follow-up was at a mean time of 14.1 years post injury. Areas that were found to be most significantly affected were psychiatric symptoms, such as anxiety and depression, and family and social domains in relation to social isolation. However, as mentioned earlier, only mild difficulties were evident in cognitive, vocational and independent functioning, with 60.5% of participants in employment and 79% of participants living with a spouse or independently. As previously highlighted, cultural factors may have influenced the findings of this study which means comparing the results to other outcome research is problematic.

Colantonio et al. conducted a similar study and included participants between 7 and 24 years (mean = 14.2 years) post injury who had suffered moderate to severe brain injuries. Their findings include cognitive impairments, in terms of memory and information processing speed; generally good self-rated health, with 40% of the sample giving a rating of good or excellent; few participants (4-6%) were totally dependent in activities of daily living; a reduction from 64% to 29.1% in the proportion of the cohort in full-time employment. Once again, generalising the results from this study is difficult, primarily due to the fact that participants were recruited through a rehabilitation hospital in the US. Although participants were asked about the kinds of rehabilitation service they received, no consideration was given to the intensity of rehabilitation when evaluating outcome. Both Hoofien et al. and Colantonio et al. were only able to follow-up a small proportion of their original cohorts. Therefore, the extent to which the final samples were representative of the larger population is questionable, and the findings need to be interpreted with caution.

It is not clear if cognitive ability is also affected by time since injury because very few studies have been based on long term assessments. One of the few studies was by Walker and Blumer (1989) who found that over a 45 year interval, approximately 25% of their cohort displayed varying degrees of mental deterioration. Corkin, Rosen, Sullivan and Clegg (1989) also found evidence for late mental deterioration after head injury in 57 World War II missile injury survivors, aged 54-72, assessed 40 years post injury. Many had become less mentally "sharp", raising the possibility of premature ageing in their sample. Plassman et al. (2000) also found signs of early ageing, reporting a raised prevalence of Alzheimer's disease in World War II brain injured veterans 40-50 years after injury, compared with non head injured, age matched controls. However, in contrast to these data, Newcombe (1996) found no evidence of mental deterioration in her military sample with focal head injury, using a test-retest longitudinal and cross-sectional paradigm. Her study employed the Mill Hill Vocabulary test (Raven, 1982) (35 cases) as a measure of verbal ability and the Progressive Matrices as a non-verbal test (Raven, 1982) (26 cases). Two other tasks considered sensitive to lateralised lesions were employed, Mooneys Visual Closure Task (Mooney, 1960) (47 cases) and Babic's Stylus Maze Learning Task (Newcombe, 1969) (45 cases). There was no evidence of an accelerated decline in performance on these tests that could be interpreted as premature ageing.

Many of the studies that have focused on cognitive ageing have included participants who are ex-military and suffered injuries during combat. Being a large population who will have completed tests routinely early on post injury, who are also now elderly, makes their inclusion understandable. However, findings from this very select group cannot be generalised, and must be interpreted with caution. Injuries sustained during war are more likely to be in the rolandic and parietal regions of the brain, whereas injuries in civilian life tend to involve the frontal and temporal areas (Walker & Blumer, 1989). Therefore, to enable a fuller understanding of how cognitive abilities change over time prospective longitudinal studies must be conducted using civilian cohorts.

Having considered the variability in reports on cognitive and psychosocial outcome after brain injury, it is clear that such factors as injury severity, and the time elapsed since injury, will have a major influence on type and degree of outcome reported. Consequently, to allow true comparisons to be made between outcome studies, it is imperative that the sample for each study is carefully selected to fulfil clear criteria.

3.2 Cognitive Variables

Cognitive ability has been found to be reduced after brain injury and, to a large extent, is dependent on injury severity, which as discussed in the previous section, has been found to play a significant role in determining psychosocial outcome. Therefore, it would seem logical to suggest that cognitive ability would do the same. Evidence does support the view that greater impairment of cognitive ability is associated with poorer outcome, such as level of productivity (Boake et al., 2001; Sherer, Sander et al., 2002). Sherer, Novack et al. (2002) concluded that literature included in their review provides *"strong support for the relationship of neuropsychological test results to employment outcome after TBI"* (p. 176). Despite this conclusion, variation exists within the literature regarding the particular neuropsychological tests that are most predictive of outcome. An early attempt at identifying the most important neuropsychological factors that predict QoL after brain injury was carried out by Klonoff et al. (1986). They found that tests of motor functioning, memory and constructional ability were related most strongly to participant's QoL at 2-4 years post injury. Ross, Millis and Rosenthal (1997) suggested that the Trail Making Test (Reitan & Wolfson, 1985), measuring speed of information processing, along with age, significantly predicts psychosocial outcome one year after severe injury. However, Ruff et al. (1993) found the vocabulary subtest of the Wechsler Adult Intelligence Scale – Revised (Wechsler, 1981) to be the strongest predictor of returning to work within one year post injury, although they also found performance on the Trail Making Test to contribute to the prediction. The different findings between studies can partly be explained by variation in tests administered, even though the cognitive domains assessed often overlap. The majority of studies do not include a comprehensive battery of tests and choice of tests often differs between studies. This obviously makes it difficult to directly compare findings.

Although there is variation concerning particular cognitive tests, literature concerning cognitive ability and outcome is broadly in agreement when outcome is of a functional or psychosocial nature, such as employment or community integration. This is also true when considering the influence of cognitive ability on emotional outcome, such as depression, however, contrasting findings have been reported. Jorge et al. (1993) found no difference in cognitive impairment, using the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975), between a brain injured group suffering from major depression and a non-depressed brain injured group, throughout the first year after injury. However, their measure of cognitive functioning is very superficial, and is better seen as a screening tool. The sample in this study varied in severity of injury sustained, whereas a more specific group of mildly injured people were assessed by Ruttan and Heinrichs (2003) and no relationship was found between depression and a more comprehensive set of neuropsychological tests assessing areas of problem solving, visual-motor speed, short term memory, visual and verbal recall memory.

On initial inspection these findings are surprising because it has been reported that neuropsychological assessment can be inaccurate in people with low mood. Cognitive performance is affected because emotional dysfunction impacts on motivation and the ability to perform to optimum capability (Lezak, 1995; Reitan & Wolfson, 1997, p.6). However, after conducting a literature review in this area, Reitan and Wolfson concluded that emotional disturbance itself was not a reliable predictor of poor neuropsychological test performance, and the literature cited above supports this claim.

3.3 Psychosocial Variables

A number of predictors of outcome after traumatic brain injury are not characteristics of the injury or demographics of the person. Often psychological and social characteristics of the individual have been found to significantly influence the kind of long term recovery achieved.

3.3.1 Functional Ability

Although measures of disability are often used as outcome measures, it is also important to identify how performance on these measures impact on other outcomes, such as employment status, community integration or QoL. Doig et al. (2001) investigated patterns of community integration between 2 and 5 years post injury, and concluded that those with poor community integration were found to have more severe brain injuries and greatest functional disability. The study employed a retrospective design and, as in other studies, the method of collecting the information varied, some participants completed the measures themselves, whilst some data was from significant others. This procedure introduces doubt as to the accuracy of the information presented. However, Doig et al.'s finding was supported by Heinemann and Whiteneck (1995) who found significant associations between measures of disability and handicap. Furthermore they also found that disability was related, albeit weakly, to life satisfaction, however, the measures used to represent each outcome dimension were quite limited (see section 2.6). The influence of disability has also been documented in relation to returning to work (Greenspan et al., 1996). These findings make it clear that the ability of the individual to perform functional tasks is an important factor when trying to predict real life outcomes.

3.3.2 Personality

A change of personality is often cited as a major consequence of brain injury (Prigatano, 1986b). Some of the disturbances seen in patients after traumatic brain injury include irritability, agitation, impatience, restlessness, emotional lability, and a lack of awareness of deficits (Prigatano, 1992). It should be noted that any combination of these changes can be experienced, and evidence suggests there is no relationship between the degree of the specific disturbance and severity of injury (Hinkeldey & Corrigan, 1990; Van Zomeren & Van den Burg, 1985). Oddy and Humphrey (1980) reported that irritability was the most common affective change, experienced by 39% of their cohort. Thomsen (1984) found a similar proportion (38%) still experienced irritability 2.5 years after injury. In her long term outcome studies, Thomsen (1992) explained that from a cohort existing of 31 patients, followed up 20 years after trauma, 32% still had marked aggressiveness and/or disinhibited sexual behaviour. Work done by Oddy and colleagues shows that a perceived change in personality could be associated with inability to return to work (Oddy et al., 1985; Weddell, Oddy, & Jenkins, 1980). Therefore, such changes in personality and behaviour act as obstacles to re-integrating individuals back into the community, particularly in obtaining or sustaining employment.

Although the literature consistently documents personality changes after brain injury, most research in this area refers to characteristics of personality rather than actual personality type. Kurtz, Putnam and Stone (1998) investigated whether personality traits remained stable after brain injury. They compared relative's ratings of pre-injury personality, rated retrospectively up to 30 days post injury, and ratings at a six month follow-up. They found that a significant change was evident on the extraversion subscale of Form-R of the NEO Five-Factor Inventory

(Costa & McCrae, 1991), and in this case there was a reduction in extraversion traits. The patients had a higher than normal pre-injury rating of extraversion, and ratings only reduced to levels that were comparable to those of a control group at follow-up. The authors also found that subjective ratings of relatives regarding the patient's change in personality at follow-up, reflected an increase in traits associated with neuroticism. Using retrospective ratings is problematic, and the contrast between subjective ratings and those on a standard questionnaire used in that study may reflect this methodology. However, similar findings using the same procedure were obtained by Tate (2003). She also investigated stability of personality traits after brain injury and used the same follow-up time point as Kurtz et al. (1998). An increase in neuroticism and a decrease in extraversion were found, changes that were maintained at follow-up twelve months post injury.

Having identified that changes in personality traits do appear to take place after brain injury, their influence on outcome should be assessed. Schretlen (2000) investigated the potential influence that personality type had on psychosocial outcome, when both variables were concurrently assessed eight years post injury. Only 39 participants were included, and outcome was measured using the Katz Adjustment Scale (Katz & Lyerly, 1963), which was originally derived as a measure for those with psychiatric disorders. Nevertheless, Schretlen reported that those with a better behavioural adjustment had a lower trait of neuroticism. When predicting outcome, as measured by participation and independence, from measures of pre-injury personality, neuroticism has again been found to contribute (Malec et al., 2004). Interestingly, Malec et al. (2004) further explored the relationship between neuroticism and outcome by investigating the ability to predict outcome of just six aspects of neuroticism: anxiety, anger, hostility, depression, self-consciousness, impulsiveness, and vulnerability. They found that only the depression construct made a significant contribution to the prediction of outcome. Indeed, the contribution made by the more specific measure of depression was greater than the overall neuroticism factor. In order to obtain pre-injury measures of personality, participants and significant others completed measures retrospectively up to 90 days after injury. Therefore the current state of the injured participant, both psychologically, and in terms of their social capabilities, would undoubtedly have affected responses to questionnaires. However, if the findings are taken at face value they suggest that early evaluation of depression is desirable and may increase the probability of achieving a good recovery.

3.3.3 Awareness

One neurobehavioural deficit that has received a lot of research attention is that of reduced awareness and insight (Stuss & Benson, 1986). Within the literature, awareness is recognised as being a difficult concept to define. Two explanations of the concept by Crosson et al. (1989) and Fleming and Strong (1995) divide awareness into three components. Crosson et al. suggested that *intellectual awareness* is the ability to understand that a particular function is impaired. *Emergent awareness* is dependent on intellectual awareness and is the ability to recognize a problem that is actually happening. *Anticipatory awareness* is the ability to anticipate that a problem will occur as the result of a deficit and is, in turn, dependent on both previous types of awareness. Each of these levels of awareness describes the ability to recognise problems caused by impaired brain function at different stages in performing actions. Fleming and Strong described a model incorporating three distinct aspects of self-awareness that are very similar to those suggested by Crosson et al. The first relates to self-awareness of deficits that result from the injury itself, such as physical and cognitive changes. The second refers to self-awareness of the functional consequences of injury, such as on work, driving and everyday activities. The final aspect of the model is concerned with the ability to set realistic goals, which allows for realistic expectations of the future. Although, more specific components of awareness may exist, much research does not make the distinction, but instead treats awareness as encompassing all aspects described above.

Lack of awareness is a common legacy of brain injury and causes a great deal of distress to relatives and as a consequence, to brain injured individuals themselves (Willer, Allen, Liss, & Zicht, 1991). Several studies have found it to be a significant barrier to social reintegration due to the difficulty participants have in realising the extent of their problems, and as such, it has been suggested as being one of the most significant predictors of poor late psychosocial outcome and employment (Brooks & McKinlay, 1983 ; Prigatano & Schachter, 1991; Sherer, Oden, Bergloff, Levin, & High, 1998; Thomsen, 1984, 1989) An interesting study by Ownsworth, McFarland and Young (2002) attempted to establish the underlying causes of deficits in self–awareness. Their findings suggested that neuropsychological variables were more directly related to self awareness than psychological factors, such as coping style and personality change. However, it should be noted their participants ranged from 0.5 to 36 years post injury. A cohort with such a wide range of chronicity, although all encompassing, does not control for changes in awareness over time. Obtaining greater insight has not always been found to be beneficial as other problems can develop as a result. Fleminger et al. (2003) reported greater risk of suffering depression once awareness had increased, possibly due to a realisation that expectations about recovery would not be met.

3.3.4 Life Events

All previously discussed factors that have been found to affect outcome after brain injury have been primarily determined by the brain injury itself. For instance cognitive and neurobehavioural deficits are impairments determined by the injury; and the variable of injury severity is a neurological factor. However, social variables that have an impact on psychosocial outcome also need examination. These include social support and experience of life events. Experiencing life stressors has been found to be associated with depression (see Kessler (1997) for a review). A relationship is apparent between both severity and degree of exposure of the life event, with the depressive episode experienced as a result (Brown, Bifulco, & Harris, 1987; Holahan & Moos, 1991). However, when considering the brain injured population, Elsass and Kinsella (1987) found that those with head injuries suffered less stressful life events in the previous year in comparison to a control group, and that people with head injuries also had reduced social interaction. The implication is that sufferers of head injuries become isolated and withdrawn, thereby reducing the exposure to stressful life events.

3.3.5 Social Support

As indicated in the previous section, amount of social support and existence of a social network have been shown to be reduced after brain injury (Thomsen, 1992). A social network can be defined as the number of relationships and frequency of contact with those relations. In a series of studies over time, Oddy and colleagues consistently found that when compared to a matched control group, the head injured group had fewer friends and indeed less contact with these friends (Oddy et al., 1985; Oddy & Humphrey, 1980; Oddy, Humphrey, & Uttley, 1978; Weddell et al., 1980). 15% of the sample reported not having a single friend or acquaintance. Thomsen (1992) supported these findings as she found that 61% of her sample had no friends or acquaintances and only had contact with members of their family. Changes to a person's social network were also found by Zencius and Wesolowski (1999). They reported that 66% of the social network of 70 participants in their study, consisted of family members, and a further 14% were staff at rehabilitation units. All participants in this study were residents at brain injury rehabilitation units, so it should not be a surprise to find this cohort had a limited social network. Wesolowski (1987) himself has reported the large difference in size of social network between people with brain injuries in rehabilitation and those who are not. This latter point is interesting because it has been suggested that the carer of the patient takes on the role of friend and companion to a greater extent with the passage of time (Liss & Willer, 1990), and this may well be the case when a patient is receiving rehabilitation. However, the carer of course may not only be members of staff, but also the spouse or partner, particularly when the patient lives at home. This extra responsibility can create additional stress for the partner and as such, intimate relationships have been shown to be highly vulnerable. Wood and Yurkadul (1997) identified that 49% of 131 brain injured adults had divorced or separated over a 5-8 year period after injury.

The presence of a good social network has been identified in several studies as central to achieving a good recovery after brain injury (Oddy et al., 1985; Webb et al., 1995). Furthermore, perceived social support has been found to exert an even stronger influence over satisfaction with life, when adjusting to illness, than actual social support (Fuhrer et al., 1992; Goodenow, Reisine, & Grady, 1990; Schulz & Decker, 1985), and perception of social support has also been found to be positively associated with life satisfaction in studies including people with brain injury (Holosko & Huege, 1989; Smith et al., 1998).

3.3.6 Coping

The ways people cope with adverse, stressful life events has been shown to affect their adjustment after the event (Endler & Parker, 1990; Ganster, Fusilier, &

Mayes, 1986). Therefore, the influence of other psychosocial variables on outcome after brain injury, such as experiencing stressful life events and availability of social support, could be mediated by coping methods. Psychosocial variables influence the resources available to individuals. The selection of coping strategies is based on the available resources, in turn coping methods directly influence psychological adaptation to the event. Coping itself is often poorly defined, due to reliance on the environment and context to explain its meaning (Karlovits & McColl, 1999). Willer et al. (1991) investigated practical coping methods used by spouses with brain injuries and found they often turned to family and friends for support. Meanwhile, Malia et al. (1995) evaluated coping strategies of brain injured people, and found that four methods were used: problem-focused, emotion focused, avoidance, and wishful thinking. Use of the former strategy predicted the best chance of psychosocial functioning. The 'self-controlling' coping style and 'positive reappraisal' coping strategy was found by Moore and Stambrook (1992) to be associated with lower mood disturbances, less physical disability and less depression, when combined with lower external locus of control. However, it should be noted that their cohort consisted only of males, and was older than most studies investigating traumatic brain injury (mean = 38.28 years). Despite these limitations, they related these findings to Taylor's model (1983) of cognitive adaptation, which outlines a process of coping in the aftermath of a life threatening event. Here, the person searches for meaning in the experience (positive reappraisal), attempts to gain mastery over the event and their life in general (self-controlling), and makes efforts to restore their self-esteem (lower external locus of control). In a further paper, Moore and Stambrook

(1994) identified coping strategies of repression, escape and denial, as being associated with poorer outcome. Correspondingly, Finset and Andersson (2000) found that avoidant coping was associated with depression, and a lack of active-approach coping was associated with apathy.

3.3.7 Perceptions of the Self

Many of the psychosocial variables that have been found to be predictive of outcome interact with one another. For example a particular coping style may be reflected in a person's self esteem (Gudjonsson & Sigurdsson, 2003; Rector & Roger, 1996), which has also been found to be compromised after brain injury (Wright & Telford, 1996). Wright and Telford studied people with minor head injuries and found a profound loss of self exhibited by their participants six months and three years post injury. Ethnographic research performed by Krefting (1989) supports this notion. She explains that her participants suffered a tragic loss of identity and goes on to describe methods of coping in those aware of their loss, as concealment and redefining their situation. Tyerman and Humphrey (1984) were keen to take account of participant's perceptions, when investigating changes in self-concept after brain injury. They found 72% of their cohort reported some negative changes in their self-concept at just seven months post injury, in comparison to pre-injury ratings. As mentioned, self-perceptions may be related to coping style, with reduced self-efficacy being a result of avoidant coping. Avoidance of the situation that caused the injury may lead to reinforcement of this coping approach because anxiety associated with the trigger situation is not experienced. However, this behaviour may then lead the person to have negative cognitive distortions, resulting in the individual feeling they cannot cope, and in turn having low self-efficacy (McMillan, Williams, & Bryant, 2003). At three years post injury, reduced self-concept has been found to be associated with poorer QoL and higher levels of depressive symptoms (Vickery, Gontkovsky & Caroselli, 2005). However, these findings are based on a small sample consisting of participants with a heterogenous range of acquired brain injuries. Therefore, as the authors acknowledge, the findings should be treated with caution.

3.3.8 Causal Attribution

A further variable that has been found to be related to coping style is that of attribution style. Work carried out by Bulman and Wortmann (1977) established a relationship between self-blame and coping in a group of participants with spinal-cord injuries. They found that those who blamed others and felt they could have avoided the accident, had poor coping styles, whereas self-blame was a predictor of good coping. The degree to which a person blames others or themselves for their situation may affect outcome. This notion has also been reported by Williams, Williams and Ghadiali (1998) who found that participants who attribute the cause of their injury to external factors, suffered greater anxiety and depression. Furthermore, Moore and Stambrook (1992) determined that the combination of a problem solving coping style, along with an external attribution for the brain injury, but an internal attribution for day to day events, led to a positive outcome by returning to employment. The type of injury may also influence attribution because Hart, Bogner, Whyte and Polansky (2003) found that those suffering violence-related traumatic brain injuries tend to blame others more readily than those who have suffered accidental injuries, although this finding may reflect the factual causes of each type of injury. They also suggested that self-blame could be a constructive coping mechanism. However, in a review article, McMillan et al. (2003) noted that self-blame in victims of assault or abuse may be inappropriate, and in this case may not be predictive of better outcome. Indeed, Andrews, Brewin, Rose and Kirk (2000) found that degree of self-blame in crime victims within the first month since trauma, was related to severity of post traumatic stress disorder at six months post trauma.

3.4 Relating Literature Of Predictors To Aims

The literature review of this chapter demonstrates that numerous studies focus on predictors of outcome after brain injury, however, inconsistency exists in terms of the number and type of factors investigated. Consequently, many specific factors have been associated with outcome without accounting for the influence of other possible predictive variables. The primary aim of this project therefore was to investigate associations between demographic, neurological, neuropsychological and psychosocial predictor variables, and their relationship with multidimensional psychosocial outcome. More specific aims regarding the hypothesised nature of the relationship between individual predictors and outcome dimensions are stated in Chapter 5.

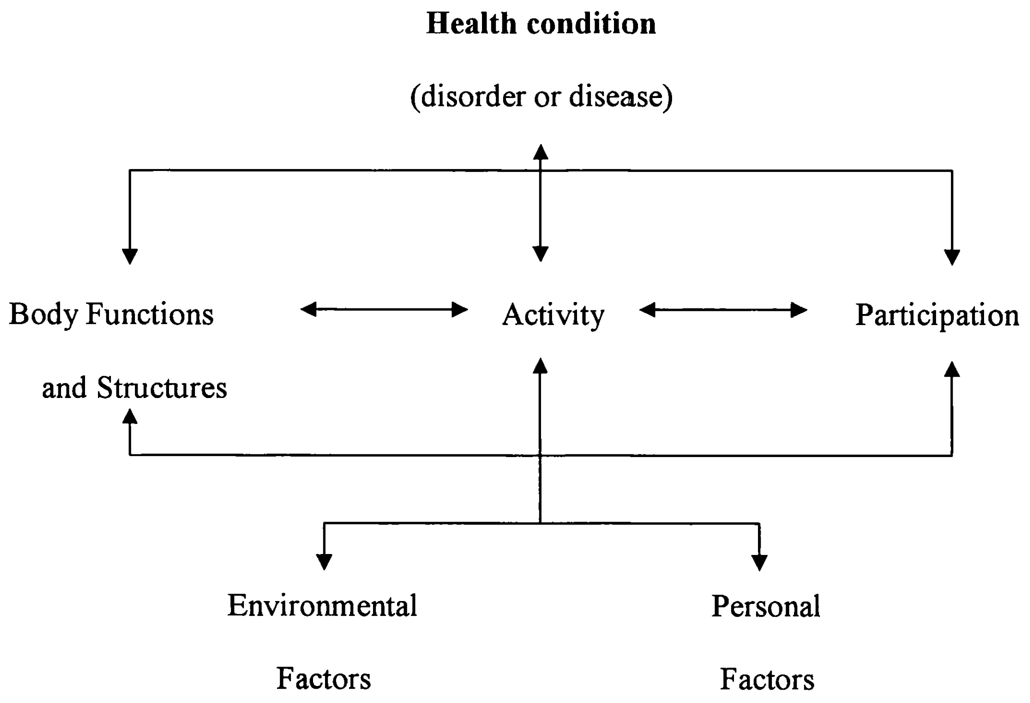
Chapter 4: Multivariate Models of Prediction

Brain injury outcomes and factors that contribute to outcome have been reviewed in the previous two chapters. Although relatively little is known about the collective influence of prognostic variables (Martelli, Zasler, & MacMillan, 1998), the very fact that numerous variables have been identified as important when predicting outcome suggests that recovery is a dynamic and multidimensional process. However, Novack, Bush, Meythaler and Canupp (2001) suggested that the importance of predictor variables may be diminished when included in a multivariate study. Consequently, when investigations do not include a comprehensive set of predictors, too much emphasis may be placed on the influence of just a few variables, relative to the interactive and collective influence of many other factors that impact on recovery. There are studies that have reported variables influencing outcome indirectly, or in conjunction with additional moderator variables (Klonoff et al., 1986; Ross et al., 1997; Ruff et al., 1993). These begin to hint at a more dynamic and complex explanation of outcome. Several models have been proposed that attempt to account for interaction between predictors (Moore & Stambrook, 1995; Novack et al., 2001), and as such have provided a theoretical basis for future studies that incorporate a wide range of independent variables.

4.1 A Framework of Psychosocial Functioning and Disablement

One model that provides a theoretical framework of functioning and disability is the International Classification of Functioning, Disability and Health (ICIDH-2) (WHO, 2001) (see Figure 4.1).

Figure 4.1 Diagrammatic representation of ICIDH-2 (WHO, 2001)



The ICIDH-2 model emphasises the positive aspect of a disablement experience, and incorporates five components: ‘impairments’ (in body functions and structures), ‘activity’, ‘participation’, ‘environmental factors’ and ‘personal factors’.

- Impairments are defined as "*...problems in body function or structure such as a significant deviation or loss.*" (WHO, 2001, p.8)

- Activity is defined as the "*... execution of a task or action by an individual.*" (WHO, 2001, p.8)

- Participation is defined as the "*...involvement in a life situation.*" (WHO, 2001, p.8)

- Environmental factors "*...make up the physical, social and attitudinal environment in which people live and conduct their lives.*" (WHO, 2001, p.8)

- Personal factors are "*...the particular background of an individual's life and living, and are composed of features of the individual that are not part of a health condition or health states.*" (WHO, 2001, p.15)

The most recent revision of the model, presented here, has incorporated additional dimensions of 'environmental and personal factors' which were not in earlier versions. These 'contextual factors' enable the model to account for the influence of extrinsic and intrinsic variables that are distinct from the health condition. A further amendment to the model was to incorporate bi-directional arrows when explaining the relationship between components. These clarify the dynamic interaction that inevitably takes place between components, and the interrelationship between each dimension of the model.

When applying the ICIDH-2 model to traumatic brain injury, the *health condition* would be the actual injury sustained in terms of its physiological nature. The *impairments* component would be loss of, or reduced function, e.g. poor memory. The *activity* concept would refer to level of competency that is affected by reduced function, e.g. inability to remember appointments. Therefore the *participation* level would explain the difficulty in performing a role e.g. not being able to keep appointments.

In a clinical review article, Wade and de Jong (2000) pointed to a weakness in the ICIDH-2 model in that it fails to explicitly consider Quality of Life (QoL) or allow for the subjective experience of individuals with disability. Spiker (1996) noted that the ICIDH-2 model accounts for only the objective component of QoL. However, the individual's perspective regarding their well-being is also an important factor when attempting to describe their disablement experience (Dijkers, 2004), which is why Post et al. (1999) regard QoL as having a dual role, being both an objective evaluation of health as well as providing a subjective sense of well-being in the individual. Heinemann and Whiteneck (1995) found that well-being, as determined by life satisfaction, was associated with social and productive dimensions of handicap and improved as a result of decreased disability. They proposed an extension of the ICIDH model with a causal link from handicap (*participation* in the most recent version of the model) to life satisfaction, a suggestion endorsed by Post et al. (1999). However, using ICIDH-2 terminology, Mailhan et al. (2005) found that life satisfaction was not linearly related to measures of impairment, activities and participation, although their cohort reported a high level of well-being, which may have been due to the cohort consisting of those with severe injuries at only 2 years post injury. Therefore, these individuals were likely to have poor insight, and thus provide inaccurate ratings of the other outcome dimensions. It is clear that the way measures of subjective well-being relate to the components of the ICIDH model needs further research (Fuhrer, 1994).

4.2 A Literature Review of Multivariate Studies

The ICIDH-2 model appears to provide a useful framework explaining the process of disablement, however, it is a very broad based model, one not specific regarding clinical populations. Research that investigates multivariate predictors of outcome, after brain injury, provides more specific information of how all aspects of disability influence outcome. Ponsford et al. (1995) included a set of predictor variables consisting of demographic variables, injury characteristics and a measure of disability, when trying to prospectively account for employment status 2 years post injury. The authors reported that a high proportion (74%) of the sample could be correctly classified, in terms of employment status, by considering only the variables of age, injury severity and disability, rated at an earlier time post injury. This study used the Disability Rating Scale (Rappaport, Hall, Hopkins, Belleza, & Cope, 1982), a well established measure of disability, but used a limited classification of employment status, either part-time or full-time work. As such, no consideration was given to the quality or type of work of participants at follow-up.

Tate and Broe (1999) reported findings from a predictive study whereby all variables were assessed between 3.4 and 9.7 years post injury in a cohort of very severely injured individuals (mean PTA of 65.26 days). A comprehensive set of predictor variables were included, comprising demographic factors such as age, gender and years of schooling; injury related variables, such as length of post traumatic amnesia and chronicity; neuropsychological functioning in areas of memory, cognitive speed, concept formation and behavioural regulation of cognitive abilities; and a measure of neurophysical impairment. The outcome of interest was psychosocial adjustment, as determined by the Psychosocial Disability Scale (Tate, Lulham, Broe, Strettles, & Pfaff, 1989). After consideration of all the above variables, findings suggested that chronicity, level of self-esteem and neurophysical and neuropsychological impairments were the most significant predictors of psychosocial adjustment. Although Tate and Broe report one of the more comprehensive multivariate studies, they failed to include any social factors as predictors. This omission possibly resulted in injury characteristics (e.g. chronicity) being found to have more influence over outcome, at a late stage of recovery, than would otherwise have been the case.

Webb et al. (1995) conducted a study assessing the influence of a number of possible predictor variables on QoL. Variables such as race, financial status, self-blame and family support were included as well as rehabilitation, change in employment status and functional independence. The findings were related to a conceptual model formed from reviewing outcome literature. Each variable was hypothesised as having a direct or indirect relationship with QoL in relation to other independent variables. Employment was found to be a strong direct predictor of QoL, whilst family support and self-blame were found to exert influence indirectly through reducing residual impairments, which increased the likelihood of employment. Family support and self-blame were also found to influence functional independence, which in turn affected QoL. This study included those who were two years post injury, so is not a good account of adjustment in the longer term. However, the conceptual model that was derived to form the framework for analyses, enabled predetermined causal relationships to be examined, and therefore the findings provide useful information to help explain quality of life post brain injury.

Moore and Stambrook (1995) presented a conceptual model describing relationships between cognitive ability, self-efficacy beliefs, coping strategies, and QoL. The basis to the model is the learned-helplessness theory of Seligman (1975), which refers to loss of motivation, reduced learning ability and resulting depression when experiencing uncontrollable outcomes. A further construct that is at the base of the model is locus of control. This refers to the causal belief one has regarding the degree of control over the environment of internal (within the person) or external (outside the person) forces. The model suggests that negative effects of traumatic brain injury induce learned helplessness, alter locus of control cognitive beliefs and lead to feelings of low personal control over the environment. In turn this cognitive style is applied to all areas of the individual's life, including those unaffected by the brain injury, which then serves to exacerbate symptoms, resulting in the inappropriate selection of coping methods and poorer QoL. Moore and Stambrook reviewed their own work to help produce the conceptual model. One study they cited, that is central to the model, found that patients reporting use of multiple coping strategies, external locus of control beliefs and negative attributional style for negative events, have a poorer QoL (Moore, 1989). The model provides a focus for rehabilitation interventions because it clearly identifies cognitive belief systems acting as moderators between sequelae of brain injury and outcome, and suggests that cognitive beliefs cause inappropriate selection of coping strategies and result in poor outcome. However, the focus is still too restrictive as only some psychological variables are included as predictors. No attempt has been made to account for the influence of pre-injury demographics, injury characteristics, environmental factors or other social aspects. These other factors might influence cognitive belief systems further, and provide more appropriate directions for rehabilitation.

Novack et al. (2001) incorporated premorbid factors, cognitive status, emotional status, injury severity and functional status, in their research investigating factors influencing outcome at one year post injury. Outcome measures included by the authors were community integration, functional ability and productive activity. The model produced as a result of the study suggests that premorbid variables have a significant relationship with functional status, cognitive ability and outcome. Severity of injury significantly influenced functional and cognitive status only, whilst cognitive ability formed a strong relationship with outcome, supporting the hypothesis that the influence of injury severity on outcome reduces when other constructs are included. Limitations of this study primarily involve the sample used. The severity of injury sustained by the cohort varied, whilst being predominantly severe. The sample also appeared to be more impaired in terms of functional skills and also had a poorer rate of return to employment than reported elsewhere. The surprising finding that emotional status was not significantly related to either injury severity or outcome was attributed by the authors to a lack of sensitivity in the measure that was used, the Neurobehavioural Rating Scale (Levin, High et al., 1987). Despite the limitations outlined, a cross validation study carried out by Bush et al. (2003) showed that the model adequately fitted data from a larger cross-validation sample drawn from two distinct centres for brain injury, further supporting the finding that injury severity indirectly influences outcome through its effects on cognitive and functional status. Therefore, the authors concluded that efforts to improve cognitive and functional status could impact on levels of community integration and productive activity at one year post injury.

The studies mentioned above attempt to identify important factors that predict outcome, in the context of multivariate predictors. However, when evaluating these studies, limitations are evident. Even though multiple independent variables are included, many possible predictors are not considered. Webb et al. (1995) emphasised the influence of psychosocial variables specifically family support, whereas Tate and Broe (1989) focused primarily on impairments and psychological factors, such as self-esteem. Moore and Stambrook (1995) also concentrated on psychological factors, primarily the cognitive belief system. Novack et al.'s (2001) study improved on many studies by incorporating a more comprehensive set of multivariate predictors. However, they too omitted several variables that could be important, and the influence on outcome of psychosocial factors not included in the study, such as social support, coping style and experienced life events, also needs evaluating. They also used a poor measure of emotion, which prevented this construct being included in the latter supporting study, and therefore, this variable requires further investigation.

A further problem with the majority of studies is that they use a limited number of outcome measures. Therefore, identified predictors cannot be generalised across outcomes. Ponsford et al. (1995) suggested that focusing on employment status, in comparison to neuropsychological test results, is justifiable because it is a real world outcome that directly affects the daily life of the brain injured survivor. Whilst this is undeniably the case, other outcomes such as community integration and QoL also directly affect the individual's daily life, but are not addressed in the study.

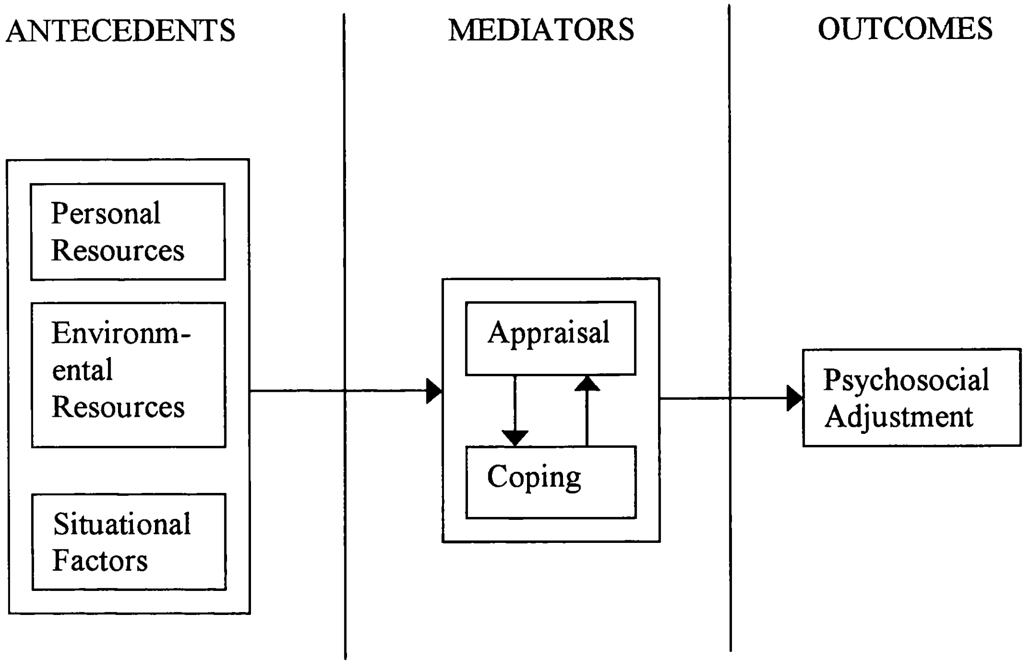
4.3 A Model of Psychosocial Adjustment

Kendall and Terry (1996) provided a comprehensive model that overcomes many of the issues outlined in the previous section, and in doing so, provided an explanation for individual differences in psychosocial outcome after traumatic brain injury. The framework from which this model is derived is the cognitive-phenomenological theory of stress and adjustment (Lazarus & Folkman, 1984) (see Figure 4.2).

The theory is based on the view that adjustment following any life event depends on how it is subjectively evaluated rather than its factual characteristics. Two appraisals of the event take place. The primary appraisal assesses whether the event is threatening or harmful, whilst the secondary appraisal assesses whether the demands placed on the individual's coping resources are too great, resulting in an inability to cope with or control the event. The appraisal process will influence the coping strategy chosen to combat stress caused by the event (Lazarus, 1993). If this is perceived as being controllable, a problem focused strategy is likely to be effective, whereas an uncontrollable event is better addressed with an emotion focused approach. A reduction in psychosocial well-being occurs when the chosen coping strategy is incompatible with the appraisal made (Lazarus, 1993).

The detailed model proposed by Kendall and Terry (1996) (see Figure 4.3) incorporates modifications to that of Lazarus and Folkman (1984), which are applicable to brain injury. Modifications include accounting for premorbid psychosocial functioning, neurological and cognitive factors, situational variables, personal and environmental resources. The revised model explains that many of these constructs act as antecedents to the appraisal of, and coping with, problems associated with head injury. In turn, the type of appraisal that is made, and the coping strategies used, determine psychosocial outcome. The particular

Figure 4.2 Diagrammatic representation of the theory of stress and adjustment (Lazarus & Folkman, 1984)

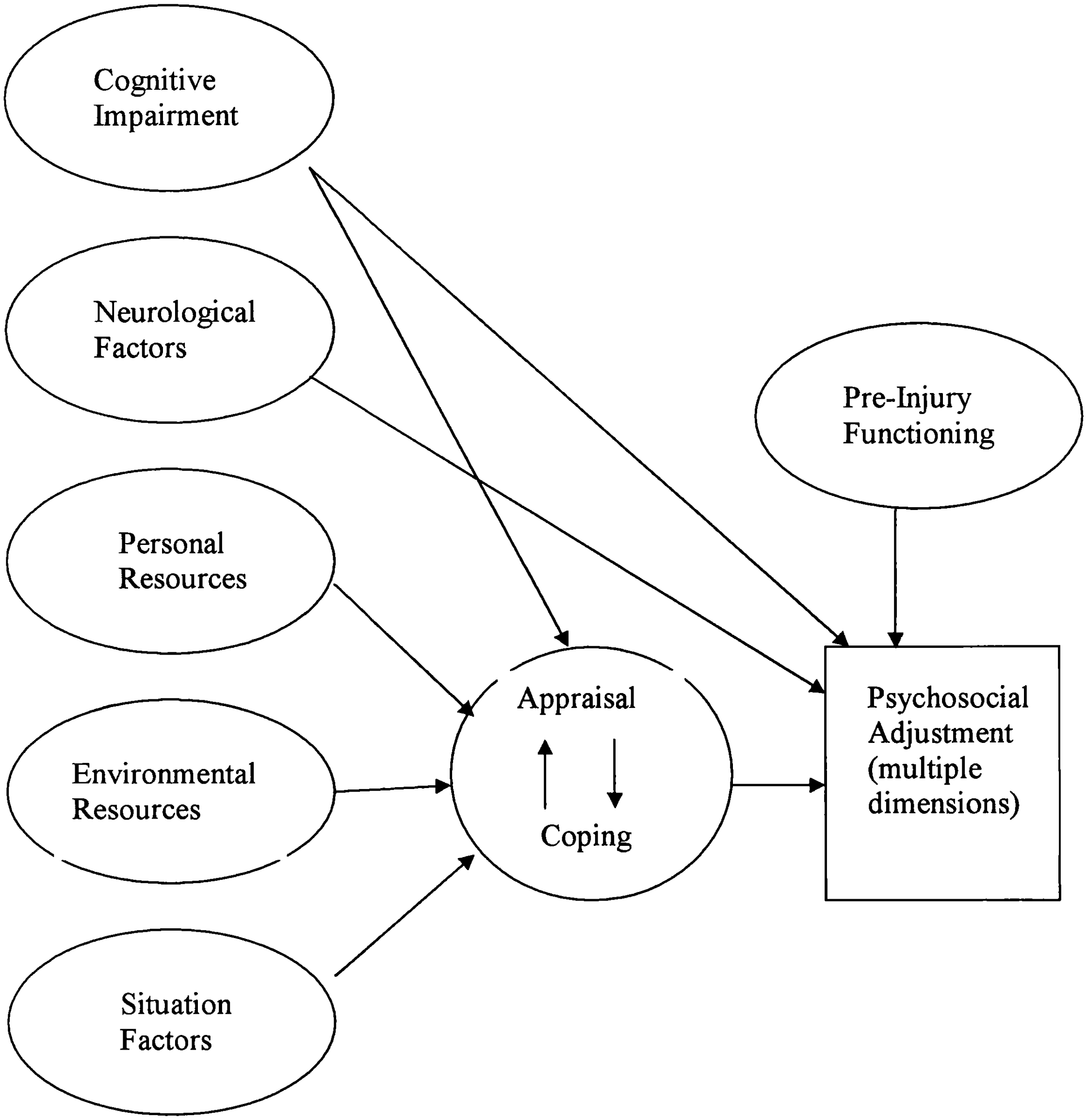


antecedent components included in the model are selected because of evidence within the literature linking them to psychosocial outcome after head injury. *Pre-injury psychosocial functioning* incorporates employment status prior to injury. Strong evidence links this to outcome, therefore, Kendall and Terry suggested that this antecedent component will directly impact on psychosocial adjustment. Injury severity and locus of lesion make up the component representing *neurological factors*, which is also depicted as directly predicting outcome.

The influence of *cognitive impairment* on outcome is not so clear and is represented in the model by two pathways. The direct influence suggests the cognitive impairment of the individual acts independently of appraisal and coping, and refers to the attainment of poor outcome (i.e. inability to work or maintain roles within the community) due to the impairment present. However, the indirect pathway represents the impact that cognitive impairment has on accurate appraisal or selection of appropriate coping methods, which then influences the outcome that is achieved. *Personal and environmental resources* incorporate those variables that an individual can draw upon when coping with traumatic events. Self-image and locus of control are two factors that Kendall and Terry cited as personal resources, whereas social support and financial status are examples of environmental resources. The model implies that these resources are antecedents which only affect psychosocial adjustment through the mediation of appraisal and coping. This is also the case for the final antecedent component representing *situation factors.* Kendall and Terry cited age and physical injuries as examples of objective factors that differ between individuals, which might influence appraisal and ability to cope after brain injury, again affecting outcome.

Kendall and Terry (1996) used findings of previous research that had investigated the relationship between predictors and outcome, to help select the relevant components of the model. As mentioned previously this research has often included a limited number of predictor variables, and the strength of any relationship between a factor and outcome could be weakened in the context of other multiple factors. Therefore, this approach may have led to the inclusion of unnecessary factors that only have minimal influence over outcome. Furthermore, in some cases, Kendall and Terry referred to literature that did not use a brain

Figure 4.3 The model proposed for the prediction of psychosocial adjustment (Kendall & Terry, 1996)



injured sample, as when justifying the inclusion of self-esteem and locus of control in their model. Therefore, this increases the uncertainty regarding the relevance of the potential predictor because it assumes little difference between clinical groups. The model itself provides a conceptual framework outlining factors that are considered to be important in explaining individual variations in outcome after brain injury. However, the particular contribution of each antecedent within the model is not specified, implying that each factor plays an equal part in determining outcome. Also, the model does not appear to have been tested in any way, let alone using longitudinal methodology, and therefore it needs empirical validation before being confirmed.

When using the model as a framework to evaluate very late stages of recovery after brain injury, Kendall and Terry's adaptation of the original theory of stress and adjustment, needs revising. When evaluating outcome after a greater time since injury, the degree of influence that some factors exert over outcome may have changed. Indeed some factors may now be deemed relevant for inclusion in the model, whereas at an earlier stage post injury, they were not considered. One example is the life stress that has been experienced in the intervening period since injury. This might include stressors that are independent of the earlier brain injury, but can influence presenting outcome at the late stage, and therefore should be considered. Several factors that are influential at early stages post injury may have less impact over time. For example, physical injuries may have healed or be compensated for through the development of strategies that help cope with them. Injury severity might also be less important (Brooks et al., 1987; Groswasser et al., 1999).

4.4 Relating Multivariate Models To Aims

Very few studies have investigated multiple predictors of multiple outcomes and only a few conceptual models have been proposed. One of the most comprehensive models proposed by Kendall and Terry (1996) suggests that a variety of situational, cognitive, pre-injury, neurological, personal and environmental antecedents influence the appraisal and coping process as described by Lazarus (1984), which in turn predicts psychosocial adjustment. However, this model has yet to be validated or tested. This model provides the conceptual framework in this study, for predictions regarding the relationship of each variable. It was hypothesised that the relationship between psychosocial variables (i.e. the personal and environmental resources, and situational factors of Kendall and Terry's model) and each of the outcome variables will be mediated by appraisal and coping variables. The theory underlying this hypothesis was that if psychosocial variables are favourable in nature (i.e. lots of social support, good self-concept, few life stressors, good functional competency), appraisals made will be less stressful and more appropriate methods of coping will be selected. As a consequence, better psychosocial outcome will be achieved. More specific hypotheses are stated in the next chapter, Chapter 5.

Chapter 5: Aims and Hypotheses

The background literature reviewed in the previous three chapters forms the basis for the following more specific aims and hypotheses:

Aim 1: To evaluate long term psychosocial outcome after brain injury. It was hypothesised that anxiety and depression would be prevalent; community integration and employment status would be reduced in comparison to pre-injury; QoL and life satisfaction would be low.

Aim 2: To investigate associations between each outcome variable. It was hypothesised that the presence of anxiety and depression would be associated with poorer community integration, less probability of returning to pre-injury employment status, and less independent living, which in turn would be associated with a poorer QoL and reduced life satisfaction.

Aim 3: To evaluate long term cognitive outcome after brain injury. It was hypothesised that cognitive impairments would be evident at both Time 1 and Time 2, particularly in areas of information processing speed, attention, memory and cognitive flexibility. Also that cognitive functioning at both Time 1 and Time 2 would have deteriorated in comparison to pre-injury estimates; cognitive functioning at Time 2 would be deteriorated in comparison to cognitive functioning assessed at Time 1.

Aim 4: To investigate associations of demographic variables with psychosocial outcomes. It was hypothesised that time since injury would be negatively associated with all outcome variables; years of education would be positively associated with employment status and community integration; age would be negatively associated with all outcome variables; gender would not be associated with any psychosocial outcomes.

Aim 5: To investigate whether demographic variables predict psychosocial outcome. It was hypothesised that demographic variables (as assessed at each of the time points of pre-injury, Time 1 and Time 2) would only be significantly predictive of returning to pre-injury levels of employment and community integration.

Aim 6: To investigate associations of cognitive functioning with psychosocial outcomes. It was hypothesised that measures of information processing speed would be positively associated with employment status, community integration, life satisfaction and QoL. However, no association was expected between cognitive functioning and emotional outcomes of anxiety and depression.

Aim 7: To investigate whether cognitive functioning predicts psychosocial outcome. It was hypothesised that cognitive functioning (as assessed at each of the time points of pre-injury, Time 1 and Time 2) would be significantly predictive of employment status, community integration, life satisfaction and

QoL. However, it was expected that cognitive functioning would not predict anxiety and depression.

Aim 8: To investigate whether appraisal and coping would mediate the relationship between cognitive functioning and psychosocial outcome. It was hypothesised that significant associations between cognitive functioning (as assessed at the time points of pre-injury, Time 1 and Time 2) and all outcome variables would become non-significant when appraisal and coping mediators were added to predictive models. This would imply that the relationship between cognitive functioning and psychosocial outcome is dependent on, and mediated by, appraisal and coping variables.

Aim 9: To investigate associations of psychosocial variables with psychosocial outcome. It was hypothesised that levels of awareness would be negatively associated with anxiety and depression; social support would be positively associated with all psychosocial outcomes; self-concept would be positively associated with all outcomes; recent life stress will be negatively associated with anxiety and depression; the personality type of neuroticism will be negatively associated with all outcomes.

Aim 10: To investigate whether appraisal and coping would mediate the relationship between psychosocial variables and psychosocial outcome. It was hypothesised that significant associations between psychosocial predictors and outcome variables would become non-significant when appraisal and coping mediators were added to predictive models. This would imply that the relationships between psychosocial predictors and psychosocial outcomes are dependent on, and mediated by appraisal and coping variables.

Chapter 6: Methodology

6.1 Pilot Study

6.1.1 Aim

To ensure brain injured participants were able to understand and complete the set of questionnaires reliably.

6.1.2 Method

Sample

Ten people with traumatic brain injury were recommended by Dr. Rodger Weddell (Consultant Clinical Neuropsychologist at Morriston Hospital, Swansea, Wales, UK) on the basis that they would give an honest view regarding their ability to complete a set of questionnaires. Of the 10 participants 6 (60%) were Male and 4 (40%) were Female. They had a mean age of 26.75 years (SD = 10.97, range = 16-49), and the mean length of education was 12.26 years (SD = 1.26, range = 10-13). The mean time post injury was 63.17 months (SD = 68.29, range = 1-180), and all participants had suffered severe injuries (Mean PTA = 4.26 days, SD = 3.61, range = 1-10).

Procedure

Each participant was approached by letter outlining the purpose of the study and the reason for requesting their participation. They returned a slip indicating whether they were willing to participate. If they replied positively they were contacted by telephone to arrange a convenient time and place to meet the researcher. Participants were asked to complete the measures. On completion, the researcher asked participants if they had experienced any particular difficulties or if they thought any measures should be changed to make them easier to complete.

Measures

The original set of measures was as follows:

Community Integration Questionnaire (Willer, Linn, & Allen, 1993)
Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985)
Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983)
Head Injury Semantic Differential (Tyerman & Humphrey, 1984)
Eysenck Personality Questionnaire – Revised (Eysenck & Eysenck, 1991)
Recent Life Changes Questionnaire (Miller & Rahe, 1997)
Social Support Questionnaire (Sarason, Levine, Basham, & Sarason, 1983)
Dysexecutive Questionnaire (Wilson, Alderman, Burgess, Emslie, & Evans, 1996)
Patient Competency Rating Scale (Prigatano & Altman, 1990)
Generalised Self-Efficacy Scale (Schwarzer, 1993)
Attributional Style Questionnaire (Peterson et al., 1982)
Coping Responses Inventory (Moos, 1990)

6.1.3 Results

The first five participants consistently reported difficulty in completing three of the measures: The Attributional Style Questionnaire, The Social Support Questionnaire, and The Coping Responses Inventory. The Attributional Style Questionnaire was found to be too long, and further problems were reported because the respondent is asked to think of themselves in hypothetical situations, something participants had great difficulty doing. The Social Support Questionnaire was found to be repetitive and also too long, whereas the response format of The Coping Responses Inventory caused confusion.

In response to this feedback the above measures were replaced by others that were felt to be more appropriate, as follows:

The Causal Dimension Scale II (McAuley, Duncan, & Russell, 1992)
The Significant Other Scale - Short Form (Milne, 1992)
The Brief COPE (Carver, 1997)

The remaining five participants did not report any further difficulties completing the revised set of questionnaires. The time to complete each of the measures was found to vary in accordance with the complexity and length of the particular questionnaire. However, it took an approximate time of 2 hours for participants to complete all of the questionnaires.

6.1.4 Summary

The pilot study showed that three of the questionnaires originally selected were too problematic for participants to complete, therefore, more suitable measures were substituted. The resulting set of questionnaires now included measures that participants with brain injury seemed able to understand and complete without difficulty.

6.2 Design

This project employed a cross-sectional follow-up design. Information was collected in a variety of ways; clinical interview, neuropsychological tests, self-report questionnaires, questionnaires completed by a significant other, and inspection of medical records. Information regarding all participants related to three time points: a) prior to injury (PI), to provide an idea of functioning before injury, b) at the time of baseline neuropsychological assessment (T1), to provide details at an early stage of recovery, and c) at the time of follow-up neuropsychological assessment (T2), to assess functioning many years post injury.

Full ethical approval was obtained from the Department of Psychology, University of Wales, Swansea, and the Local Research Ethics Committee of Iechyd Morgannwg Health Authority.

6.3 Sample

The cohort was drawn from two sources. The first was a medico-legal archive database of Professor Rodger Ll. Wood, Consultant Clinical Neuropsychologist, and primary supervisor to the author of this project. The database consisted of every patient neuropsychologically assessed for the purpose of a legal report relating to their compensation claim, as a result of sustaining head injury between 1975 and 1994 (N = 1123). The second source was archive files of Dr. Rodger Weddell, Consultant Clinical Neuropsychologist at Morriston Hospital, Swansea, Wales, UK. These consist of every patient neuropsychologically assessed as part of their hospital treatment after sustaining their head injury between 1986 and 1994 (N = 164).

To be included in the study, participants had to: 1) speak English, 2) have suffered only one traumatic brain injury, 3) be aged 16 or over at time of injury, 4) be aged under 75 years at T2, 5) be able and willing to give informed consent, 6) be at least 10 years post injury.

601 participants were identified as fitting the criteria. These were all approached using contact addresses from their files. 211 (35%) replies were received. Of these, 131 (62%) were positive and formed the cohort, 69 (33%) were negative, and 11 (5%) replies indicated that participants had died since baseline assessment. There were no significant differences in age (t(562) = -0.077, p = 0.235) or injury

severity (t(562) = -1.032, p = 0.119) between people who were not followed up and participants who formed the cohort.

Of 131 participants in the study 85 (65 %) were Male and 46 (35%) were Female. 101 (77%) suffered their injury in a road traffic accident, 18 (13%) as a result of a fall, 6 (5%) were assaulted, and 6 (5%) suffered 'static concussion' when hit on the head by a falling object. Injury severity was determined by the number of days of Post Traumatic Amnesia (PTA) because Glasgow Coma Scale scores were not available on all cases. PTA was measured as recommended by McMillan, Jongen and Greenwood (1996). 19 (14.5%) of the cohort had suffered a mild injury, 27 (20.6%) a moderate injury, 13 (9.9%) a severe injury, and 72 (55%) a very severe injury. Further demographic and injury related descriptive statistics are presented in Table 6.1

Table 6.1 Demographic and injury related statistics

	Mean (SD)	Range
Length of Education (Years)	12.07 (2.47)	9-19
Length of PTA (Days)	12.43 (20.33)	0-150
Age at injury (Years)	32.83 (13.08)	16-61
Age at T1 (Years)	34.66 (13.18)	17-63
Age at T2 (Years)	47.66 (12.69)	27-75
Time Since Injury at T1 (Years)	1.94 (2.51)	0.02-10.00
Time Since Injury at T2 (Years)	15.31 (4.87)	10.00-30.73

108 (82%) of the sample were involved in litigation after injury, and therefore, the possibility of malingering during neuropsychological assessment was considered. The Vocabulary-Digit Span difference score, which has been reported as a useful formula to identify malingerers (Mittenberg et al., 2001; Mittenberg, Theroux-Fichera, Zielinski, & Heilbronner, 1995), was used to assess difference in performance between litigants and non-litigants at both T1 and T2. The T1 assessment was carried out for either clinical or medico-legal purposes, whereas assessment at T2 was performed only for the purposes of this research. Therefore, if a difference was evident, it would have been expected during T1 assessments only. However, there was no difference between groups at T1 ($t(129) = -1.597$, $p = 0.113$) or T2 ($t(129) = -1.105$, $p = 0.271$) suggesting that being involved in litigation did not confound neuropsychological test performance in this sample.

6.4 Procedure

Each participant that fulfilled the inclusion criteria was approached by letter (see Appendix 1.1), with an information sheet about the study also enclosed (see Appendix 1.2). A reply slip was included that the participant was asked to complete, indicating whether they were willing to be contacted to discuss their participation further (see Appendix 1.3). They were asked to provide contact details, and return the reply slip in a stamped, addressed envelope. Those who replied positively were contacted by telephone. The researcher explained the aims of the study and requirements of participation more fully. If participants were willing to take part, a time and place for the follow-up assessment was arranged at their convenience.

Prior to assessment at T2, participant's archive files were studied and information relating to demographic characteristics at both the time of injury and of initial assessment (T1) was extracted. Time 1 neuropsychological assessment scores were also recorded. This procedure aimed to minimise questions asked of participants at T2.

At T2, consent forms were signed (see Appendix 1.4), and the researcher conducted a semi structured interview to clarify information regarding the injury. Information was also obtained regarding employment and relationship history. The interview was carried out in the presence of a significant other to help confirm details. Neuropsychological assessment was then carried out. Finally, the researcher explained that he would leave the set of questionnaires to be completed by the participant at a convenient time then mailed to the researcher in an envelope provided. However, it was necessary for the researcher to give some details regarding the questionnaires to both participants and significant others. It was explained that certain questionnaires were to be completed in relation to the time when the injury was sustained. These particular questionnaires were highlighted as such. Questionnaires allocated for a significant other were completed whilst the participants were being assessed. Therefore, the researcher was able to take these completed measures after the assessment. Finally, participants were requested to contact the researcher in any circumstance where they had any query or problem associated with the study. In cases where questionnaires had not been received by the researcher after a period of 3-4 weeks, the participants were contacted by telephone as a reminder. A second telephone reminder was made after a further period of 3-4 weeks, after which no further reminders were given, and unreturned questionnaires were treated as missing.

6.5 Materials

6.5.1 Neuropsychological Tests at Time 1

Intelligence

Intellectual functioning at T1 was assessed by administration of subtests from the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955) or the Wechsler Adult Intelligence Scale – Revised (WAIS-R) (Wechsler, 1981). The instruments as a whole provide a measure of intellectual functioning and consist of eleven subtests divided into two intelligence subscales, verbal and performance. In this study, five subtests were found to have been consistently administered. From the verbal scale: Digit Span, Vocabulary and Similarities; from the performance scale: Block Design and Digit Symbol (many IQ scores had been calculated on a pro-rated basis). Each of the five subtests provides a measure of a specific function as follows:

Digit Span:	span of immediate verbal recall.
Vocabulary:	knowledge of vocabulary.

Similarities: verbal concept formation / reasoning.

Block Design: visuospatial organization / reasoning.

Digit Symbol: complex visual attention / mental speed.

Memory

A test of auditory recall memory (Story A of the Logical Memory subtest from the Wechsler Memory Scale – Revised (Wechsler, 1987)) was consistently administered at T1. The test comprises the oral presentation of a story, at the end of which participants have to recall as many details as they can. After a delay of approximately 30 minutes, participants are once again asked to recall what they can of the story.

The Recognition Memory Test (Warrington, 1984) assessed recognition of words and faces. The former involves presenting 50 stimulus words (one every three seconds) to participants in a test booklet. Participants are told to say ‘yes’ or ‘no’ depending on whether they find the word ‘pleasant’. The retention of words is assessed immediately by presenting 50 pairs of words, one of which was a stimulus word, and participants have to choose the word they think is the stimulus word. The recognition of faces test has the same procedure, substituting words with photographs of faces.

The Rey Auditory Verbal Learning Test (Rey, 1964) provides a test of various components of memory, including immediate memory span, learning curve, interference tendencies, and learning strategies. The test consists of five presentations of a fifteen word list. After each presentation, participants are asked to recall as many words as they can. A second list of 15 words is then presented and the participant asked to recall this new list. Finally, the participant is asked to recall the original list of words. Trials 6 and 7 were not administered to all participants, therefore, the total score used in this study was calculated by summing words recalled from the first five presentations, to provide a measure of word learning ability.

6.5.2 Neuropsychological Tests at Time 2

The selected battery of tests that were administered at T2 reflected both the need to remain consistent with tests at T1, but also the modernisation of tests since T1. Therefore, a larger number of tests were chosen that assessed a broader range of cognitive functions. For instance, although tests of attention and information processing speed had very rarely been completed at T1, they could be consistently administered at T2. Tests are also currently available that assess aspects of executive functioning, whereas at T1 these tests had not been introduced. Where possible, modern versions of those tests administered at T1 were selected, to enable some comparison to be made regarding cognitive change over time. This approach also ensured that up to date norms were used in establishing an accurate cognitive profile of participants at both T1 and T2.

Intelligence

The National Adult Reading Test - Revised (NART)(Nelson & Willison, 1991) provided an estimate of PI intellectual functioning. It comprises of 50 words that are presented in order of increasing difficulty. Each word is an 'irregular' word, in terms of adherence to normal grapheme-phoneme pronunciation rules. Therefore each word can only be read correctly if respondents are familiar with its correct pronunciation. The test score is the number of words incorrectly read. This is converted to equivalent WAIS-R IQ scores as indicated in the manual. High levels of split half reliability (0.93), inter-rater reliability (0.96-0.98) and test-retest reliability (0.98) have been reported (Crawford, Parker, Stewart, Besson, & De Lacey, 1989; O'Carroll, 1987; Schlosser & Ivison, 1989). Crawford, Stewart, Cochrane, Parker and Besson (1989) demonstrated good construct validity of the NART. They found it loaded highly (0.85) on the general factor of intelligence that emerges from factor analysis of the Wechsler subtests. In a further paper Crawford, Deary, Starr and Whalley (2001) found evidence to support using the NART many years post injury as an index of prior intellectual functioning.

Intellectual functioning at T2 was assessed using selected subtests from the Wechsler Adult Intelligence Scale – Third Edition (WAIS-III) (Wechsler, 1997a). Just like earlier versions of the same test (see section 6.5.1), the instrument as a whole provides a measure of intellectual functioning and consists of two intelligence subscales, verbal and performance. Individual subtests produce measures in more specific areas of intelligence. Six subtests were selected to be carried out at T2, due to time restraints: Vocabulary, Similarities, Digit Span, Block Design, Digit Symbol and Matrix Reasoning. These particular subtests were selected because they include the five subtests consistently administered at T1, along with Matrix Reasoning, a new subtest for the Wechsler Adult

Intelligence Scale – Third Edition, which is a test of visual information processing and abstract reasoning. The six subtests also represent three subtests from each of the verbal and performance subscales, and each subtest forms a part of the core set of subtests that provide both IQ and index scores. As such they provide an assessment of a broad range of functions. IQ scores reported were pro-rated based on data obtained from the selected subtests.

Memory

A comprehensive assessment of memory was obtained by administration of the Wechsler Memory Scale – Third Edition (WMS-III) (Wechsler, 1997b). Individual subtests produce measures of more specific areas of memory. All ten primary subtests were administered, and details of their specific function are as follows:

Logical Memory I and II:	auditory recall memory.
Verbal Paired Associates I and II:	auditory association learning ability.
Faces I and II:	facial recognition.
Family Pictures I and II:	visual recall memory.
Letter-Number Sequencing:	auditory working memory.
Spatial Span:	visuospatial working memory.

Reliability coefficients for the subtests range from 0.74 to 0.93. Concurrent validity has been shown as the WMS-III (Wechsler, 1997b) correlates with the WMS-R (Wechsler, 1987). However, the visually presented material show lower correlations than auditory presented material because greater differences exist between the versions of these tests (Wechsler, 1997c).

Information Processing Speed

The Trail Making Test provided a test of speed of attention, sequencing, mental flexibility, visual search and motor function (Lezak, 1995). Two parts make up the test. Part A consists of encircled numbers, randomly arranged on a page, ranging from 1-25. Participants are asked to join up the numbers with a continuous line in the proper order as quickly as they can. Part B is similar, but encircled numbers and letters are randomly presented on a page. Participants have to join the numbers and letters, with a continuous line, alternately (1-A-2-B-3-C etc.). Again participants are asked to do this as quickly as possible. The test score is time taken in seconds for each part to be completed. Reliability has been reported as 0.98 for Part A and 0.67 for Part B (Lezak, 1995).

The Speed of Comprehension Test (SCOLP) (Baddeley, Emslie, & Nimmo Smith, 1992) assessed rate of information processing, specifically slow processing in comprehension. It consists of 100 statements about the world that require little knowledge base in order to verify. However, half of the statements are false. A false statement has been achieved by combining the incorrect subject and predicate of two true sentences. Respondents are given two minutes to work through as many sentences as they can by placing a tick at the end of true ones, and a cross at the end of false ones. The test score is number of statements correctly verified. Reliability of the SCOLP is good with a coefficient of 0.93 having been reported (Baddeley et al., 1992).

Executive Function

Deficits that are commonly seen in people with dysexecutive syndrome were tested using the Hayling and Brixton Tests (Burgess & Shallice, 1997). The Hayling Test is a measure of basic task initiation speed as well as response suppression. It incorporates two sections that have 15 sentences with the last word missing, which are read aloud to participants. The first section requires participants to complete each sentence as quickly as possible with a word that makes sense. The second section requires participants to provide a word that is completely unconnected to the rest of each sentence in every way. The two sections yield different scores distinguishing latency of response and ability to inhibit a response. Furthermore, a third score is obtained from section two, indicating errors made. All three scores were combined to produce an overall score. Test-retest reliability of the overall score on the Hayling test has been reported as 0.76 (Burgess & Shallice, 1997).

The Brixton Test is a rule detection and rule following task. It involves participants having to identify a pattern and then use this knowledge to inform their decision making on further aspects of the test. 56 pages have the same arrangement of ten circles. On each page, one circle is coloured blue. This coloured circle is in a different position on every page, but is positioned according to a pattern. Participants are shown one page at a time and are asked to predict the position of the coloured circle on the following page, having seen its position on previous pages. The test score is number of errors made on the test, except for the first page, as this response is a guess. Burgess and Shallice (1997) report a test-retest reliability coefficient of 0.71 for the Brixton test.

6.5.3 *Outcome Measures*

Independent Living

The Supervision Rating Scale (SRS) (Boake, 1996) (see Appendix 2.1) was used as a measure of independent living. It is based on a thirteen-point ordinal scale which corresponds to degrees of supervision received by a patient, ranked in order of both intensity and duration. A lower score indicates greater independence. The clinician/researcher rates the appropriate ordinal point corresponding to the supervision actually received, rather than what the patient is judged to need. Good criterion validity is reported by Boake. The SRS is strongly associated with the Disability Rating Scale (Rappaport, et al., 1982) and Glasgow Outcome Scale (Jennett & Bond, 1975).

Community Integration

The Community Integration Questionnaire (CIQ) (Willer, Linn et al., 1993) (see Appendix 2.2) comprises three scales: home integration, social integration and productive activity. The first two scales consist of five and six items respectively, with responses on each item ranging from 0-2. Productive activity is a composite score devised from the weighting of four items ranging from 0-7. The three scales are totalled to produce an overall score. A higher score indicates greater degree of integration. A second copy of the questionnaire was completed by participants in relation to the time when the injury was sustained, to estimate their community integration at this time (see Appendix 2.3). Internal consistency of the scale has been reported by various authors (Corrigan & Deming, 1995; Heinemann & Whiteneck, 1995; Willer, Linn et al., 1993; Willer et al., 1994). Three out of the four studies report Cronbach's alpha values for the CIQ total score of above 0.80. However, lower values are reported for each subscale, particularly the productive activity subscale. Concurrent validity has been established resulting in expected correlations with several appropriate measures of community integration, also impairment, disability and QoL (Heinemann & Whiteneck, 1995).

Life Satisfaction

A measure of overall subjective well-being was obtained using the Satisfaction With Life Scale (SWLS) (Diener et al., 1985) (see Appendix 2.4). This measure consists of five items with a seven-point Likert rating scale (range 1-7), whereby respondents indicate their level of agreement with each item. A higher score indicates a greater satisfaction with life. Norms used to interpret this measure were reported by Pavot and Diener (1993). Internal consistency of the scale has been reported by Diener et al., with a Cronbach's alpha value of 0.87. Concurrent validity has been established resulting in expected correlations with several appropriate measures of subjective well-being (Larson, Diener, & Emmons, 1985).

Emotion

Anxiety and depression were assessed using the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) (see Appendix 2.5), which uses seven items for each emotion to measure emotional state. Respondents choose from four responses to each item to reflect their feelings in the past week. The total score for each emotion is obtained by totalling each of the ratings on relevant items. A higher score indicates a more intense emotional state. Norms used to interpret this measure were reported by Zigmond and Snaith. Internal consistency of the two subscales has been reported by Moorey et al. (1991). Cronbach's alpha for the anxiety scale was 0.93 and the depression scale was 0.90. Construct validity was confirmed in a factor analysis by Moorey et al. (1991), with the two factors accounting for 53% of the variance.

Employment Status

Employment status was categorised at both PI and T2 as follows: full-time employed, part-time employed, unemployed, student and retired. The outcome variable at T2 was converted to a dichotomy by assessing whether participants had managed to return to their PI employment status as categorised above. Assessing employment in this way accounts for the pre-injury level of employment achieved by participants, and therefore does not penalise participants if they were not able to obtain full-time employment prior to injury.

Quality of Life

An indication of participant's perceived QoL was obtained from a rating on a single measure asking respondents to describe their overall QoL as 'poor, fair, good, very good or excellent' (see Appendix 2.6). This measure has been employed with a traumatic brain injury population by Dawson et al. (2000), who also found it to have a high correlation (r = 0.8) with another QoL measure, the Reintegration to Normal Living Index (Wood-Dauphinee, Opzoomer, Williams, Marchand, & Spitzer, 1988) in controls. The variable was converted to a dichotomy by distinguishing between participants who gave a rating of 'poor' or 'fair', and participants who gave a rating of 'good' or better.

6.5.4 Predictor Measures

Demographic Variables

Injury severity, gender and years of education were all recorded for inclusion in the analysis. Age, employment status and relationship status were also documented for the three time points: PI, T1 and T2. Relationship status was categorised as a dichotomous variable distinguishing between participants who were and were not in a relationship. Employment status was also categorised as a dichotomous variable distinguishing between participants who were and were not in paid work. This variable will be referred to as 'Paid Work' from this point forward to distinguish it from the outcome variable of 'Employment Status'.

Self-Concept and Personality

The Head Injury Semantic Differential Scale (HISDS) (Tyerman & Humphrey, 1984) (see Appendix 2.7) was used as a measure of self-concept. Twenty adjective pairs, relevant to severe head injury, are rated on a seven-point scale (range 1-7). The total score ranges from 20-140, with a higher score reflecting more positive characteristics.

Personality was profiled using the Eysenck Personality Questionnaire – Revised (EPQ-R) (Eysenck & Eysenck, 1991) (see Appendix 2.8). The measure includes 100 items, to which respondents indicate a 'Yes' or 'No' response. Each of the items is associated with one of three dimensions of personality: Psychoticism, Neuroticism and Extraversion. A further 'Lie' dimension is produced and was originally included in the measure as an assessment of dissimulation. Eysenck and Eysenck suggested this could actually be measuring conformity. However, due to uncertainty regarding this domain it was not included in the analysis of this study. A score is calculated for each dimension by totalling all items marked that correspond to the direction as indicated in the manual. A higher score indicates a stronger endorsement of that personality type. Internal consistency of the scale has been reported by Eysenck & Eysenck, with a mean Cronbach's alpha of 0.77 for Psychoticism, 0.88 for Extraversion, and 0.87 for Neuroticism.

Life Events and Social Support

The Recent Life Changes Questionnaire (RLCQ) (Miller & Rahe, 1997) (see Appendix 2.9) provided a measure of stressful life events during a two year period prior to assessment at T2. Respondents were asked to indicate which of the listed life events they have experienced, along with the frequency of each event. Events are coded using life change units suggested by Miller and Rahe. The sum of life change units is then calculated. A higher score indicates a higher degree of life stress. Norms used to interpret this measure were reported by Miller and Rahe.

The Significant Others Scale – Short Form (SOS-SF) (Milne, 1992) (see Appendix 2.10) provided information on perceived type of social support and its function within a person's social network. The scale is derived from The Significant Others Scale (SOS) (Power, Champion, & Aris, 1988), and assesses actual and ideal levels of both emotional and practical support, for a number of significant relations. The scale is in a questionnaire format, with four items for each significant relation. Two items are each associated with emotional and practical support. In addition, a question relating to each item, asks respondents to indicate their ideal level of that particular kind of support. Ratings are made on a seven-point Likert scale (range 1-7). A mean rating is calculated to account for the number of significant relations each participant has. A higher score indicates a greater degree of actual or ideal support. Concurrent validity of the SOS has been demonstrated because the scale was used to successfully discriminate between a depressed and non-depressed group in the predicted direction (Power et al., 1988).

The Dysexecutive Questionnaire – Other Scale (DEX-O) (Wilson et al., 1996) (see Appendix 2.11) was used to assess any evidence of symptoms that make up the dysexecutive syndrome, such as personality changes, motivation, behaviour and cognition. The measure consists of 20 questions that are rated by a significant other, using a five-point Likert scale (range 0-4). All items are totalled to provide an overall score. A higher score indicates a greater degree of dysexecutive problems.

Awareness was assessed by comparing responses of participants and relative/significant others on appropriately worded versions of the Patient Competency Rating Scale (PCRS) (Prigatano & Altman, 1990) (see Appendices 2.12 and 2.13). The measure has 30 items falling within four areas of competency as suggested by Leathem, Murphy and Flett (1998): activities of daily living, interpersonal behaviour, cognition and emotional behaviour. Respondents are asked to rate the ease or difficulty in performing each item on a five-point Likert scale (range 1-5). A mean item score for each subscale and the overall scale are calculated. A higher score indicates a greater degree of competency. The measure of awareness is computed by subtracting participant's scores from the relative/significant other's scores. The scale was originally devised for measuring awareness as described. It has not been validated as a measure of functional competency, however it has very good face validity and assesses a comprehensive number of areas. Furthermore, a study by Hall et al. (2001) found it to be the measure that correlated with most other functional outcome measures, showing a greater sensitivity across subjects than most measures. Leathem et al. also described it as a useful measure for determining current functioning after traumatic brain injury Therefore, the PCRS was also used to assess functional competency. Internal consistency of the scale has been reported by Fleming (1998), with a Cronbach's alpha reported of 0.91 for patient ratings and 0.93 for relative ratings.

6.5.5 Appraisal and Coping Mediators

Causal Attribution

Causal beliefs were assessed with the Revised Causal Dimension Scale (CDS II) (McAuley et al., 1992) (see Appendix 2.14). The beliefs related to the specific event that resulted in each participant sustaining their head injury. The measure asks respondents to write the cause of their injury and to rate 12 items on a nine-point scale (range 1-9) according to their opinions of the noted cause. Each item is associated with one of four subscales within the measure, and appropriate items are totalled to provide a score for each. The subscales refer to Locus of Causality, Stability, Personal Control and External Control. High scores indicate that the cause is perceived as being internal, stable, of greater personal control, and of greater external control, respectively. Internal consistency of the four subscales has been reported by McAuley et al.. Cronbach's alpha for the subscales were as follows: Locus of Causality = 0.67, Stability = 0.67, Personal Control = 0.79, External Control = 0.82. Construct validity was confirmed in a factor analysis by McAuley et al..

Self-Efficacy

The Generalized Self-Efficacy Scale (GSES) (Schwarzer, 1993) (see Appendix 2.15) was used to provide information of a participant's generalized beliefs that they can effectively respond to, and control, demands and challenges of the environment. A four-point Likert scale (range 1-4) is used to indicate agreement with each item. The rating of each item is summed for the total score. A higher score indicates a stronger generalised self-efficacy belief. Schwarzer (1993) reported norms and internal consistency of the scale, finding Cronbach's alpha values of between 0.82 and 0.93 across five 'normal' samples. Concurrent validity has been established resulting in expected correlations with several appropriate measures. For example, the GSES correlated with generalised anxiety as measured by the State-Trait Anxiety Inventory (Spielberger, 1983) ($r = -0.54$), and self-esteem as measured by the Rosenberg Self-Esteem Scale (Rosenberg, 1989) ($r = 0.52$).

Coping

An abbreviated version of the COPE Inventory (Carver, Scheier, & Weintraub, 1989), the Brief COPE (Carver, 1997) (see Appendix 2.16) was employed to measure coping styles of participants in response to stress. The scale consists of 14 strategies made up of two items each. Each item relates to either a specific behavioural or cognitive activity associated with a particular coping strategy. Respondents choose from a four-point Likert scale (range 1-4) relating to their frequency in using each specific activity. Items that make up each strategy are summed to provide a score for each. A higher score indicates more use of the corresponding strategy. Internal consistency of the scale has been reported by Carver, with Cronbach's alpha values across all strategies between 0.50 and 0.90. However, all but three strategies exceeded 0.60.

6.5.6 Reliability

Tables 6.2 and 6.3 show Cronbach's alpha values for all measures as completed by the sample from this study. Generally, internal consistency was moderate to good across all scales. However, it should be noted that the Self-Distraction and Planning subscales of the Brief COPE; the Stability subscale of the CDSII; the Productive Activity subscale of the CIQ at both PI and T2; and the Social Integration subscale of the CIQ at PI, all had a value below 0.5. Nunnally (1978) suggested this cut off is the minimum Cronbach's alpha value that is acceptable. However, the total score of the CIQ was used in the analysis, not the subscales. Therefore, three variables with poor internal consistency were included in the analysis (see Table 6.3).

Table 6.2 Internal consistency of outcome and psychosocial measures completed in this study

Measure	Cronbach's Alpha
Community Integration Questionnaire – PI	
Home Integration	0.92
Social Integration	0.46*
Productive Activity	0.23*
Total Score	0.68
Community Integration Questionnaire – T2	
Home Integration	0.88
Social Integration	0.61
Productive Activity	0.39*
Total Score	0.77
Satisfaction With Life Scale	0.90
Hospital Anxiety and Depression Scale	
Anxiety	0.81
Depression	0.82
Head Injury Semantic Differential	0.95
Eysenck Personality Questionnaire - Revised	
Psychoticism	0.69
Neuroticism	0.84
Extraversion	0.83
Recent Life Changes Questionnaire	0.76
Significant Others Scale – Short Form	
Total Actual Support	0.92
Total Ideal Support	0.90

*Indicates Cronbach's alpha value below 0.5.

The Productive Activity subscale of the Community Integration Questionnaire is calculated from 2 items.

Table 6.3 Internal consistency of psychosocial measures completed in this study (continued)

Measure	Cronbach's Alpha
Dysexecutive Questionnaire – Other	0.95
Patient Competency Rating Scale - Patient	
Activities of Daily Living	0.84
Cognition	0.91
Interpersonal Behaviour	0.82
Emotional Behaviour	0.87
Total Score	0.94
Patient Competency Rating Scale - Relative	
Activities of Daily Living	0.88
Cognition	0.91
Interpersonal Behaviour	0.87
Emotional Behaviour	0.57
Total Score	0.92
Generalized Self-Efficacy Scale	0.94
Causal Dimensions Scale II	
Locus of Causality	0.81
External Control	0.88
Stability	0.44*
Personal Control	0.78
Brief COPE	
Self-Distraction	0.30*
Active Coping	0.66
Denial	0.53
Substance Use	0.92
Use of Emotional Support	0.79
Use of Instrumental Support	0.82
Behavioural Disengagement	0.77
Venting	0.58
Positive Reframing	0.58
Planning	0.20*
Humour	0.80
Acceptance	0.57
Religion	0.89
Self-Blame	0.68

*Indicates Cronbach's alpha value below 0.5.

All subscales of the Brief COPE are calculated from 2 items.

6.6 Data Screening and Analysis

Data was analysed using the Statistical Package for the Social Sciences – SPSS for Windows version 12.0.1 (SPSS Inc., 2003). Accuracy of entry, missing data, homogeneity of variance, and normality were checked prior to analyses.

6.6.1 Missing Value Analysis

Neuropsychological tests consistently administered at T1 were completed by participants to varying degrees, as can be seen in Table 6.4. The number of the sample that completed each test ranged from 54 (41.2%) for Vocabulary to 122 (92.1%) for Digit Span.

Administration of all cognitive tests at T2 was attempted, however, a small minority of participants did not complete some of them because they were either unwilling, or had physical disabilities preventing them from responding in the prescribed manner. Only the National Adult Reading Test (N=12, 9.2%), the Hayling Sentence Completion test (N=8, 6.1%) and the Trails Making Test Part B (N=10, 7.6%) had missing values.

Table 6.4 Number (percentage) of participants that completed each cognitive test at T1.

Cognitive Test	N	%
Vocabulary	54	41.2
Similarities	116	88.5
Digit Span	122	92.1
Digit Symbol	72	55.0
Block Design	82	62.6
Rey Auditory Verbal Learning Test	68	51.9
Recognition Memory Test – Words	60	45.7
Recognition Memory Test – Faces	63	48.1
WMS-R – Logical Memory Story A - Immediate	111	84.7
WMS-R – Logical Memory Story A - Delayed	99	75.6

WMS-R – Wechsler Memory Scale-Revised

Table 6.5 shows the completion rate of all psychosocial questionnaires completed at T2. Overall, the number of participants that completed the measures ranged from a minimum of 87 (66.4%), for the Causal Dimensions Scale II, up to 104 (79.4%), for the Hospital Anxiety and Depression Scale.

Table 6.5 Completion rate of psychosocial measures

Measure	N	%
Dysexecutive Questionnaire – Other	103	78.6
Satisfaction With Life Scale	102	77.9
Generalized Self-Efficacy Scale	103	78.6
Causal Dimensions Scale II	87	66.4
Recent Life Changes Questionnaire	90	68.7
Significant Others Scale	95	72.5
Community Integration Questionnaire – PI	101	77.1
Community Integration Questionnaire – T2	101	77.1
Head Injury Semantic Differential – PI	103	78.6
Head Injury Semantic Differential – T2	103	78.6
Head Injury Semantic Differential – Other	103	78.6
Eysenck Personality Questionnaire	98	74.8
Patient Competency Rating Scale - Patient	101	77.1
Patient Competency Rating Scale - Relative	98	74.8
Hospital Anxiety and Depression Scale	104	79.4
Brief COPE	99	75.6

Conducting analyses using only those cases with complete datasets would have reduced the sample size, and markedly reduced the statistical power and reliability of statistical models. The reason for much of the missing data was not known, and measures not completed varied between participants. Therefore a missing value analysis was performed to identify any patterns within the missing data. Little's Missing Completely at Random Test (1988) was calculated for the complete set of variables. The test showed no significant deviation from a pattern of values that are missing completely at random (Chi-squared = 4324.122, df = 4273, p = 0.288). Instead of filling in missing values with constants, such as medians or means, the Expectation-Maximisation method of imputation was employed to substitute values for missing data for all variables (Little & Rubin, 1987). This process involves forming a missing data correlation matrix for partially missing data, finding the conditional expectation of missing data, and substituting these expectations for missing values. The maximisation step performs maximum likelihood estimation to generate imputed values (Schafer & Graham, 2002; Tabachnick & Fidell, 2001).

6.6.2 Normality

Variables that did not conform to the criteria for normality were transformed using formulas from Tabachnick and Fidell (2001). 14 (17.5%) variables required transformation, however, the normality of 12 (85.7%) of these variables was not improved.

Both parametric and non-parametric correlation analyses were performed on data for transformed and untransformed variables. The associations that were significant did not differ between both forms of data and both types of analyses. Therefore parametric correlation analyses are reported and original, untransformed variables are used in regression analyses.

6.6.3 *Profile Analysis*

Z-scores were calculated for all cognitive tests and subtests as reported by Hinkebein, Martin, Callahan and Johnstone (2003), ensuring all test scores were on the same scale, and therefore easily comparable. The formula used to compute z scores was as follows:

$$z = \frac{\text{participant's score on test} \quad - \quad \text{mean of the standardization sample}}{\text{standard deviation of the standardization sample}}$$

For subtests of the WAIS/WAIS-R and WMS-R z-scores were determined using a mean of 10 and standard deviation of 3. Age is controlled for because scaled scores were age corrected. For the Hayling and Brixton tests, scaled scores were converted to equivalent z-scores, as estimated by Lezak (1995), because means and standard deviations for raw data was not available from the manual. For the Rey Auditory Verbal Learning Test and Trail Making Test, age was controlled for by using age-related normative data reported by Geffen, Hoar, O'Hanlon, Clark and Geffen (1990) and Fromm-Auch and Yuedall (1983) respectively. The Trail Making Test z-scores, for individuals older than 64, were calculated using normative data for the 41-64 year-old age group. The Logical Memory raw scores could not be converted to z-scores because norms for Story A were not reported in the WMS-R manual.

6.6.4 Multicollinearity

Cognitive tests were grouped into domains for the purpose of analysis, increasing the ease with which analyses could be interpreted. Each domain score was computed by calculating the mean z-score of tests within the domain.

The domains consisted of the following tests:

Time 1:-

Verbal Ability – Vocabulary, Similarities

Information Processing Speed – Digit Symbol, Digit Span

Visuospatial Reasoning – Block Design

Memory – Rey Auditory Verbal Learning Test, Recognition Memory Test of Words and Faces

Time 2:-

Verbal Ability – Vocabulary, Similarities

Information Processing Speed – Digit Symbol, Trail Making Test Parts A and B, Speed of Comprehension Test

Visuospatial Reasoning – Block Design, Matrix Reasoning

Executive Function – Hayling Sentence Completion Test, Brixton Spatial Anticipation Test

Visual Memory – Family Pictures I and II, Faces I and II

Auditory Memory – Logical Memory I and II, Verbal Paired Associates I and II, and Delayed Auditory Recognition

Working Memory – Digit Span, Spatial Span, Letter-Number Sequencing

Multicollinearity was not found to be present between any of the cognitive domain scores. However it was present between several of the psychosocial measures as follows:

Dysexecutive Questionnaire and each of Cognition (r = -0.80), Interpersonal Behaviour (r = -0.77), and Emotional Behaviour (r = -0.70) subscales of the Patient Competency Rating Scale.

Interpersonal Behaviour and Cognition subscales of the Patient Competency Rating Scale (r = 0.83).

To address the issue of multicollinearity between the independent variables above, the following variables were omitted from the analyses:

Dysexecutive Questionnaire - Other

Patient Competency Rating Scale subscales (they were replaced by the total score)

6.6.5 Principal Components Analysis

Subscales of the Brief COPE and psychosocial predictor variables were subjected to principal components analysis (PCA). PCA was selected instead of factor analysis because the aim was to identify those components that were empirically associated, rather than confirming a hypothetical factor structure (Tabachnick & Fidell, 2001). Two separate sets of analyses were conducted because the Brief COPE measures coping style, a variable depicted as a mediator in Kendall and Terry's model (1996). Therefore it was not appropriate to include the Brief COPE along with other psychosocial predictor variables.

The Brief COPE has 14 subscales. Therefore, in order to include scores from this questionnaire in a regression along with other psychosocial measures, as was required to test for evidence of mediation, a reduction in subscales was desirable. This would reduce the variable to case ratio, and ease the interpretation of regression analyses.

Previous factor analyses have been conducted on the COPE (Carver et al., 1989), the measure from which the Brief COPE was derived. However, although differing factor analyses broadly agree with each other, translating factors to the Brief COPE is not ideal for two reasons. Firstly, although the Brief COPE was derived from the COPE, a few changes were made in terms of additional scales and items. Secondly, each sample differs, producing different factors. A brain injury sample has not been used in factor analysis of either the COPE or Brief COPE.

Prior to performing PCA the suitability of the data for analysis was assessed. Inspection of the correlation matrix revealed the presence of several coefficients of 0.3 and above (see Appendix 3.1). The Kaiser-Meyer-Oklin value was 0.658, exceeding the recommended value of 0.6 (Kaiser, 1970, 1974). Also, Bartlett's Test of Sphericity (Bartlett, 1954) reached statistical significance, supporting the factorability of the correlation matrix.

Principal component analysis revealed the presence of five components with eigenvalues exceeding 1, explaining 24.14%, 19.72%, 9.29%, 8.55%, 8.17% of the variance respectively. An inspection of the screeplot revealed a clear break after the fifth component. It was decided to retain five components for further investigation. To aid interpretation of these five components, varimax rotation was performed. The rotated solution is presented in Table 6.6, showing loadings of 0.4 or above.

The five component solution explained a total of 69.87% of the variance. The components can be interpreted as follows:

Component 1 – Avoidance

Positive scores regarding denial, substance use, behavioural disengagement, venting and self-blame reflect an approach to coping that involves denying the reality of an event; reducing effort spent on dealing with the stressor; expressing feelings that are a result of the stressor; blaming themselves; and using substances to deal with feelings that result from the stressor.

Component 2 - Problem-Focused Cognitions

Positive scores in planning and acceptance reflect an approach to coping that involves accepting the reality of the situation and thinking about strategies to accommodate the stressor.

Table 6.6. Varimax rotated loadings for principal components analysis of the Brief COPE

Brief COPE Subscales	Avoidance	PFC	PFB	PI	Religion
Denial	0.603				
Substance Use	0.692				
Behavioural Disengagement	0.585				
Venting	0.702				
Self-Blame	0.743				
Planning		0.809			
Acceptance		0.802			
Active Coping			0.493		
Use of Emotional Support			0.672		
Use of Instrumental Support			0.877		
Self-Distraction				0.584	
Positive Reframing				0.584	
Humour				0.831	
Religion					0.864
Variance %	24.14	19.72	9.29	8.55	8.17

Loadings less than 0.40 are not listed

PFC – Problem Focused Cognitions; PFB – Problem Focused Behaviour; PI – Positive Interpretation

Component 3 – Problem-Focused Behaviour

Use of emotional and instrumental support, reflect a coping approach of actively seeking support from others.

Component 4 – Positive Interpretation

Positive reframing and humour involve construing a stressful transaction in positive terms.

Component 5 – Religion

This single subscale factor refers to the use of religious beliefs to cope with a stressor.

A second principal components analysis was carried out to reduce the nine psychosocial predictor variables included in the study (see Table 6.7). When assessing the suitability of data for analysis the correlation matrix revealed several coefficients of 0.3 and above (see Appendix 3.2). The Kaiser-Meyer-Oklin value was 0.624, exceeding the recommended value of 0.6 (Kaiser, 1970, 1974) and the Bartlett's Test of Sphericity (Bartlett, 1954) reached statistical significance, supporting the factorability of the correlation matrix.

Principal component analysis revealed the presence of four components with eigenvalues exceeding 1, explaining 29.02%, 17.77%, 16.72%, 12.48% of the variance respectively. An inspection of the screeplot revealed a clear break after the fourth component. It was decided to retain four components for further investigation. To aid interpretation of these four components, varimax rotation was performed. The rotated solution is presented in Table 6.7, showing loadings of 0.4 or above.

Table 6.7 Varimax rotated loadings for principal components analysis of psychosocial predictor variables

Predictor Variables	Personality	Social Support	Competency	Life Stress
Self-Concept	0.856			
Neuroticism	-0.703			
Extraversion	0.705			
Actual Social Support		0.872		
Ideal Social Support		0.892		
Competency			0.783	
Awareness			0.895	
Psychoticism				0.728
Life Events				0.853
Variance %	29.02	17.77	16.72	12.48

Loadings less than 0.40 are not listed

The four component solution explained a total of 75.99% of the variance. The components can be interpreted as follows:

Component 1 – Personality

Measures of self-concept and extraversion loaded positively, and neuroticism loaded negatively. These scales all reflect aspects of personality.

Component 2 – Social Support

Having a good amount of actual social support, and high perceptions of ideal social support were reflected in this factor.

Component 3 – Competency

The total score from the Patient Competency Rating Scale loaded on this component, along with having good awareness of competency in performing tasks.

Component 4 – Life Stress

The measure of recent life events loaded on this component, along with the psychoticism scale of personality. This could imply that a psychotic personality is associated with experiencing stressful life events.

6.6.6 Correlation and Regression Analysis

The predictor variables were grouped to distinguish demographic, cognitive and psychosocial measures. This meant that the areas of Kendall and Terry's (1996) model labelled 'Pre-Injury Functioning' and 'Neurological Factors' were combined as demographic variables. The areas of the model labelled 'Personal Resources', 'Environmental Factors', and 'Situational Factors' were combined as psychosocial variables. This grouping ensured the maximum number of predictor variables could be considered

Throughout the analyses, Pearson's correlations were performed between each predictor variable and each continuous outcome variable: community integration, satisfaction with life, anxiety and depression. Point biserial correlations were conducted between each predictor variable and the dichotomous outcome variables of employment status and QoL. Although the significance of each correlation is indicated, the emphasis of interpretation of the correlations is on the size of the coefficient (Pallant, 2001). Cohen (1988) suggested that the following criteria be applied when interpreting the strength of correlation coefficients:

$r = \pm 0.10$ to 0.29 - small

$r = \pm 0.30$ to 0.49 - medium

$r = \pm 0.50$ to 1.00 - large

Therefore, throughout Chapter 7, correlations are only commented on if the coefficient is at least of medium strength (i.e. ≥ 0.30).

The predictive associations between predictor variables and continuous outcome variables were investigated using multiple regression analyses. Logistic regression analyses were performed for dichotomous outcome variables. The enter regression method was used. When reporting findings of logistic regression analyses, the Nagelkerke R square value is presented as this accounts for sample size and is also adjusted to achieve a maximum value of 1 (Tabachnick & Fidell, 2001). Only those predictor variables that significantly contribute to predictive models are presented in tables that show results of regression analyses (see Chapter 7).

The process described by Baron and Kenny (1986) was used to assess the hypotheses that appraisal and coping will mediate the influence of predictor variables on outcome. Firstly, the relationship between predictor variables and mediators needed to be identified. A regression was conducted with each of the mediators acting as a dependent variable, and predictor variables as independent variables. Only those mediators that were significantly predicted were carried forward for further analyses. Secondly, a regression was conducted with each outcome variable as a dependent variable, and predictor variables as independent variables. Only those predictor variables that significantly contributed to models were carried forward for further analyses. Thirdly, each outcome variable was regressed on those mediators that had significant relationships with predictor variables, identified from the first step. Fourth, predictor variables that significantly contributed to each outcome variable in the second step were added to the regression of the third step, and if they no longer had a significant effect, mediators were judged to have mediated the association between predictor variables and outcomes (Baron & Kenny, 1986). The tables presenting findings of the third and fourth steps (see section 7) only present those mediators that significantly contribute to the model, whereas the predictor variables are always presented because their significance determines whether their relationship with outcome variables was mediated by appraisal and coping variables.

Chapter 7: Results

7.1 Aim 1 - Outcome Descriptives

7.1.1 Independent Living

The mean rating of the researcher on the Supervision Rating Scale was 1.63 (range = 1-10, SD = 1.95). 119 (90.8%) participants were rated in the top two classifications of the scale, within Level 1, and therefore were considered to be 'independent'. Ratings from the Supervision Rating Scale were not used in any further analyses due to the apparent ceiling effect.

7.1.2 Community Integration

Total and subscale community integration scores relating to PI and T2 are shown in Table 7.1. All scales, except home integration, showed a significant reduction at T2 when analysed using paired samples t-tests.

7.1.3 Life Satisfaction

The mean rating on the Satisfaction With Life Scale was 20.49 (range = 5-35, SD = 7.41), which according to Pavot and Diener (1993), falls exactly at the 'neutral' point of the scale. However, a wide range of ratings were evident within the sample from 'extremely dissatisfied' to 'extremely satisfied'.

Table 7.1 Difference between community integration scores at PI and T2

CIQ Score	PI Mean (SD) (range)	T2 Mean (SD) (range)	t-value (df = 130)
Home Integration	4.68 (3.51) (0-10)	5.06 (2.73) (0-10)	1.358
Social Integration	8.80 (2.18) (3-12)	7.65 (2.40) (0-12)	-3.879**
Productive Activity	5.51 (1.19) (1-7)	4.40 (1.73) (0-6)	-5.440**
Total Score	18.98 (4.54) (9-28)	17.06 (5.03) (1-28)	-2.906**

** $p<0.01$ using Bonferroni corrected alpha level of 0.0025

7.1.4 Anxiety and Depression

Anxiety and depression were rated on the Hospital Anxiety and Depression Scale. The mean rating of anxiety at T2 was 7.97 (range = 0-19, SD = 3.96) which falls within the 'mild' classification (Zigmond and Snaith, 1983). The mean rating of depression at T2 was 5.62 (range = 0-16, SD = 3.78) falling within the 'normal' range (Zigmond and Snaith, 1983). Table 7.2 shows the proportion of the cohort according to severity of both anxiety and depression. The majority (79.4%) of participant's anxiety ratings were either 'normal' or 'mild', whereas the majority (74.8%) of depression ratings were 'normal'.

Table 7.2 Anxiety and Depression ratings at T2

	Anxiety	Depression
Classification	N (%)	N (%)
Normal	46 (35.1)	98 (74.8)
Mild	58 (44.3)	18 (13.7)
Moderate	20 (15.3)	12 (9.2)
Severe	7 (3.8)	3 (2.3)

7.1.5 Employment Status

The proportion of the cohort categorised by employment status at PI, T1 and T2 are shown in Table 7.3. The number of people employed on a full time basis decreased markedly after injury, but improved slightly at T2. This finding is reflected by the opposite pattern in the unemployed category, which suggests that those who were no longer full time employed at T2 were unemployed and not in work in a lesser capacity.

When considering PI employment status in evaluating employment outcome, it was found that 60 (45.8%) participants were able to return to either the same or better employment status at T1. This number had decreased to 54 (41.2%) at T2. If the participant was retired at T2, their employment status just before retirement was considered. This accounted for the expected change in employment status i.e. taking retirement, with increased age over time. Furthermore, those that were classified as students at PI or T1 (who would therefore be expected to obtain full-time employment on completion of their studies), but were in full-time employment at T2 were judged to have returned to their PI employment status.

Table 7.3 Employment status at PI, T1 and T2

	PI	T1	T2
Employment Status	N (%)	N (%)	N (%)
Full Time	101 (77.1)	38 (29.0)	48 (36.6)
Part Time	9 (6.9)	7 (5.3)	13 (9.9)
Unemployed	7 (5.3)	75 (57.3)	56 (42.7)
Student	14 (10.7)	11 (8.4)	0 (0)
Retired	0 (0)	0 (0)	14 (10.7)

7.1.6 Quality of Life

Ratings given by the cohort regarding their QoL on the five-point likert scale are shown in Table 7.4. Only 22.5% perceived their QoL at T2 as being less than good. The majority (64.3%) rated their QoL as being either ‘good’ or ‘very good’.

Table 7.4 QoL ratings at T2

	T2
QoL Rating	N (%)
Poor	8 (6.2)
Fair	21 (16.3)
Good	44 (34.1)
Very Good	39 (30.2)
Excellent	17 (13.2)

7.2 Aim 2 – Psychosocial Outcome Correlations

As can be seen from Table 7.5 the majority of psychosocial outcome variables were significantly associated with one another. Employment status had the weakest correlations with all other variables, with no coefficient of medium strength. Associations between employment status and anxiety, depression and QoL were not significant. Anxiety and depression had the strongest association (0.608) of any pair of variables.

Table 7.5 Intercorrelations between outcomes

	CIQ	SWLS	Anxiety	Depression	Emp Status
SWLS	0.450**				
Anxiety	-0.268**	-0.450**			
Depression	-0.552**	-0.585**	0.608**		
Emp Status	0.252**	0.192*	-0.141	-0.116	
QoL	0.424**	0.343**	-0.434**	-0.281**	0.110

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* p<0.05 ** p<0.01

7.3 Aim 3 - Neuropsychological Profile Analysis

Overall cognitive abilities of the cohort at both T1 and T2 were investigated using z-score profiles. To make interpretation of profiles easier, z-scores of the Trail Making Test Parts A and B were inverted because on these tests a high score reflects a poor performance. Means and standard deviations of all cognitive tests administered (see Table 7.6), and the cognitive profiles (see Figures 7.1 and 7.2) show that no test performance was above the average range. Greatest impairments at T1 were for recognition of words (RMT Words) and learning capacity (RAVLT). At T2, the cognitive profile shows performances below average on tests of visual memory (Family Pictures I and II) and speed of information processing (Trail Making Test Parts A and B).

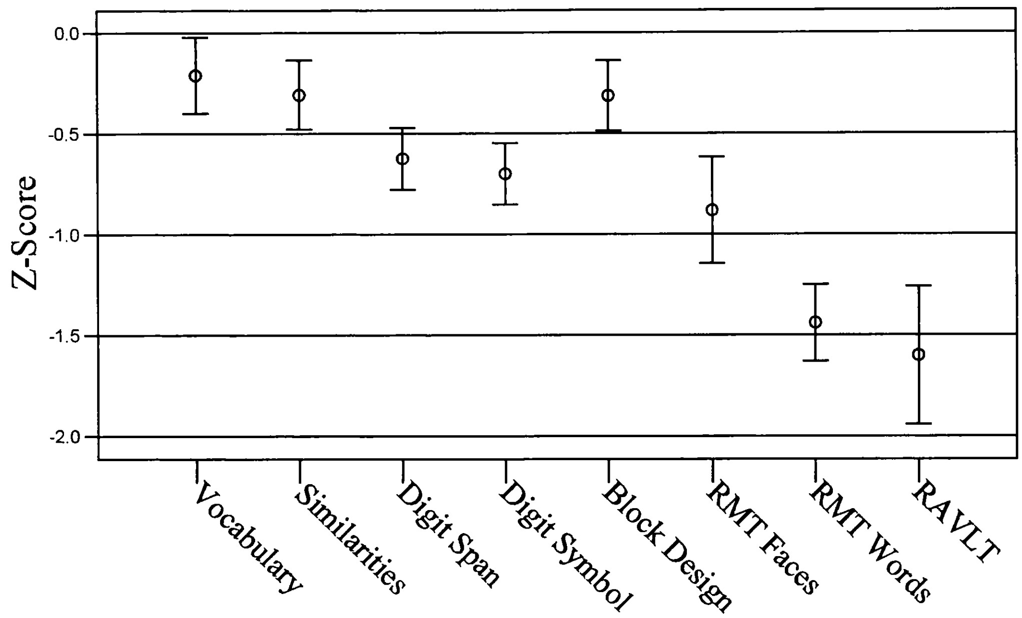
Table 7.6 Cognitive test scores at T1 and T2

Test	N	T1 Mean (SD)	N	T2 Mean (SD)
NART (PI FSIQ estimate)			119	102.78 (13.29)
WAIS/R/III				
Full Scale IQ (pro-rated)	131	94.62 (13.99)	131	95.01 (16.34)
Verbal IQ (pro-rated)	131	94.97 (13.52)	131	93.67 (15.01)
Performance IQ (pro-rated)	131	95.57 (16.93)	131	97.67 (19.22)
Vocabulary	54	9.56 (2.44)	131	9.04 (2.98)
Similarities	116	9.09 (2.88)	131	8.90 (3.05)
Digit Span	122	8.24 (2.51)	131	9.59 (2.99)**
Digit Symbol	72	7.91 (2.35)	131	8.30 (3.24)
Block Design	82	8.95 (2.68)	131	10.16 (3.55)**
Matrix Reasoning			131	10.31 (2.82)
WMS-R			131	
Story A Immediate Recall (raw score)	111	10.44 (3.98)		
Story A Delayed Recall (raw score)	99	7.81 (4.14)	131	
WMS-III			131	
Logical Memory I				7.98 (3.63)
Faces I			131	8.80 (2.58)
Verbal Paired Associates I			131	8.86 (3.20)
Family Pictures I			131	6.54 (2.71)
Letter-Number Sequencing			131	9.29 (3.92)
Spatial Span			131	9.87 (3.05)
Logical Memory II			131	8.81 (3.69)
Faces II			131	9.13 (3.01)
Verbal Paired Associates II			131	8.93 (3.20)
Family Pictures II			131	6.42 (2.98)
Delayed Auditory Recognition			131	9.39 (3.83)
RMT Words (raw score)	60	39.96 (4.90)	131	
RMT Faces (raw score)	63	39.57 (4.91)	131	
Rey Auditory Verbal Learning Test (raw score)	68	42.63 (8.73)	131	
Trail Making Test Part A (raw score)			131	56.44 (28.52)
Trail Making Test Part B (raw score)			121	100.61 (66.83)
Speed of Comprehension Test			131	9.26 (3.52)
Hayling Test (scaled score, range 1-10)			123	5.18 (1.89)
Brixton Test (scaled score, range 1-10)			131	5.34 (2.10)

NART – National Adult Reading Test; WAIS – Wechsler Adult Intelligence Scale; WAIS-R - Wechsler Adult Intelligence Scale-Revised; WAIS-III – Wechsler Adult Intelligence Scale-Third Edition; WMS-R – Wechsler Memory Scale-Revised; WMS-III – Wechsler Memory Scale-Third Edition; RMT – Recognition Memory Test

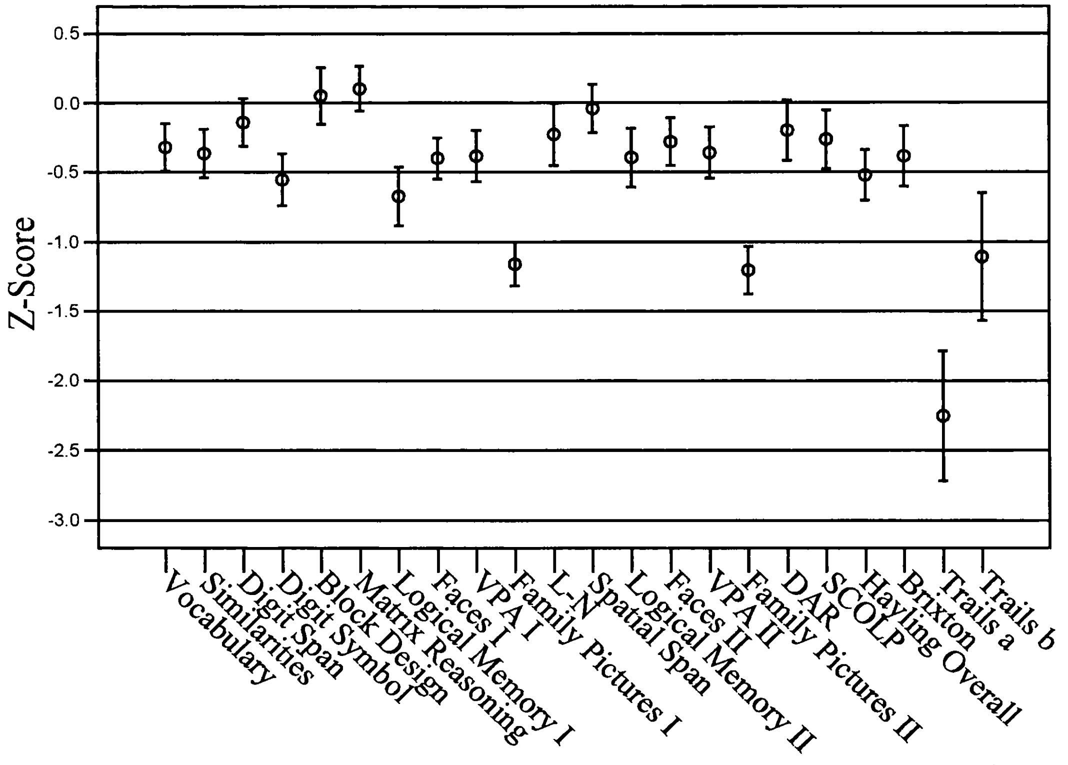
**p<0.01 when comparing tests at T1 and T2

Figure 7.1 Cognitive profile at T1



RMT - Recognition Memory Test; RAVLT - Rey Auditory Verbal Learning Test

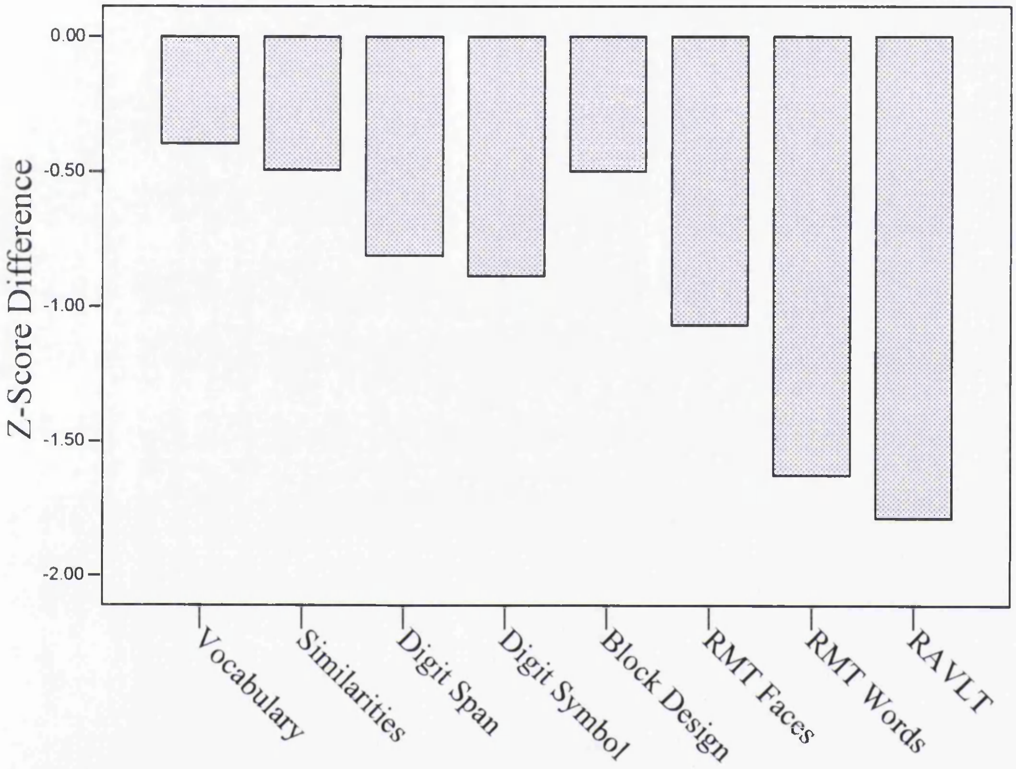
Figure 7.2 Cognitive profile at T2



VPA - Verbal Paired Associates; L-N - Letter-Number Sequencing; DAR - Delayed Auditory Recognition; SCOLP - Speed of Comprehension test

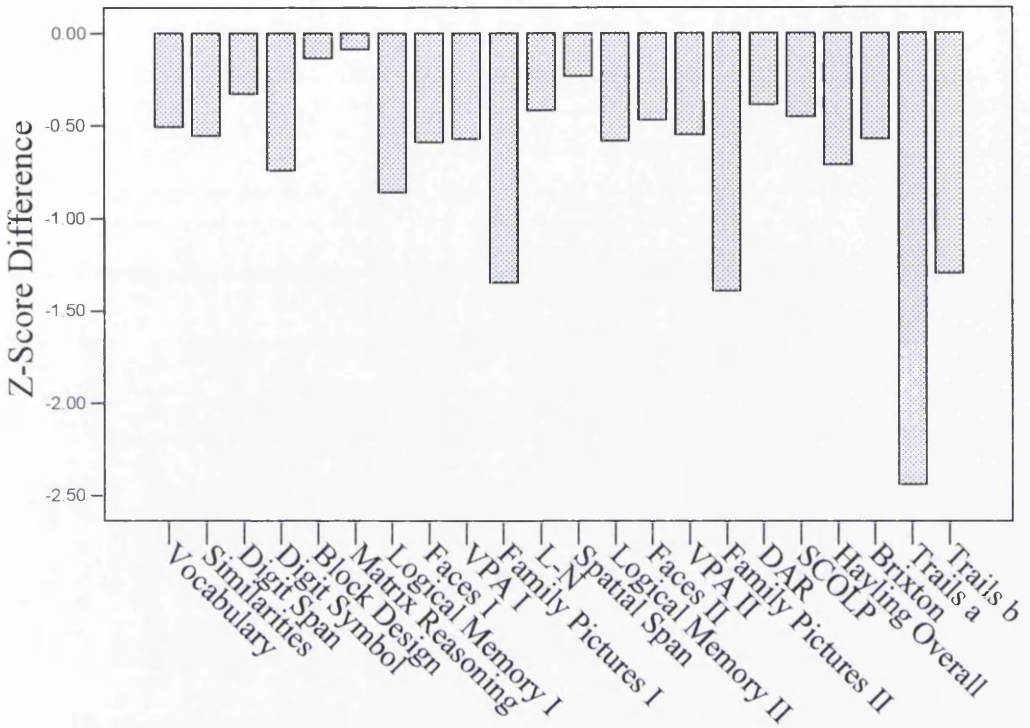
To assess cognitive decline between PI levels of functioning and post injury cognitive functioning, z-scores for each cognitive test were subtracted from the NART z-score. Johnstone and colleagues (1998; 1995) used this methodology when employing the Wide Ranging Achievement Test-Revised (Jastak & Wilkenson, 1984) as an estimate of PI functioning. Figure 7.3 shows the deficit profile at T1. The pattern of differences was similar to the cognitive profile at T1 because the largest deficits were present for recognition of words (RMT Words) and faces (RMT Faces), and learning capacity (RAVLT). The cognitive deficit profile between PI functioning and T2 shows a similar pattern of deficits as the cognitive profile at T2 (see Figure 7.4). Deficits were evident regarding visual memory (Family Picture I and II) and speed of information processing (Trail Making Test Parts A and B). Cognitive deficits between those tests common to both assessments, were calculated by subtracting T1 cognitive z-scores from T2 cognitive z-scores. These deficits provide a measure of cognitive decline during time post injury. Figure 7.5 presents the cognitive deficit profile between T1 and T2. Interestingly the difference on the Digit Span test reflected an improvement over time, as did performance on Digit Symbol and Block Design tests. Performance on Vocabulary and Similarities tests showed a decrease over time. The largest difference was on performance on the Digit Span test, but even this difference was not great enough to warrant a change in clinical classification, i.e. both performances were within the average range. However, to further assess the difference in test performance between T1 and T2, a repeated-measures MANOVA was conducted, and a significant effect for time was evident on the Digit Span ($F(1,260)=17.036$, $p=0.0005$) and Block Design ($F(1,260)=7.230$, p=0.008) tests. However, no significant effect for time was found on the Vocabulary (F(1,260)=0.753, p=0.386), Similarities (F(1,260)=0.233, p=0.630) and Digit Symbol (F(1,260)=1.375, p=0.242) tests.

Figure 7.3 Cognitive deficit profile between PI and T1



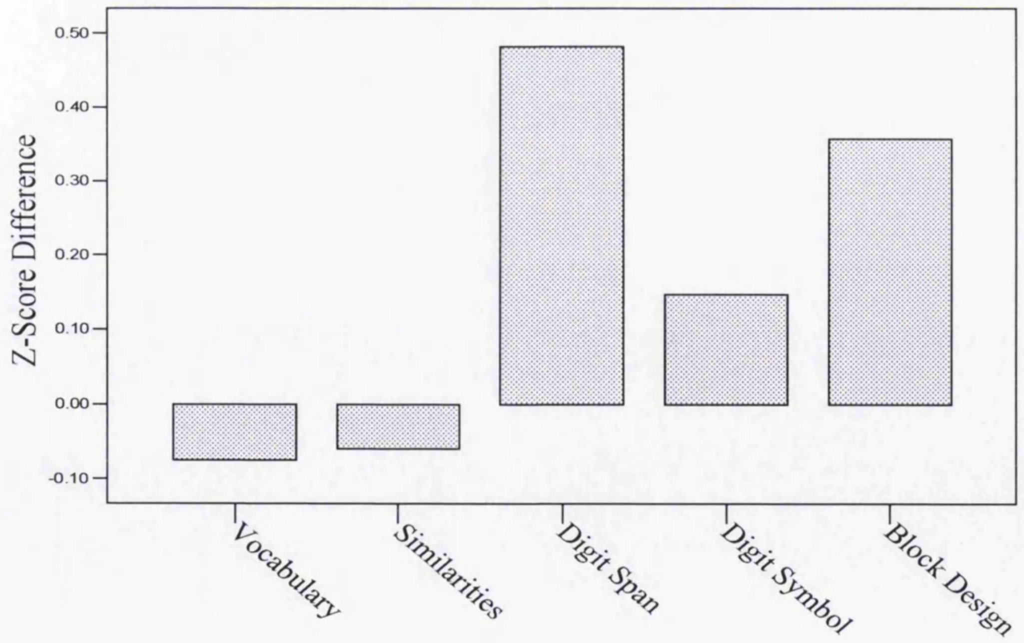
RMT - Recognition Memory Test; RAVLT - Rey Auditory Verbal Learning Test

Figure 7.4 Cognitive deficit profile between PI and T2



VPA - Verbal Paired Associates; L-N - Letter-Number Sequencing; DAR - Delayed Auditory Recognition; SCOLP - Speed of Comprehension test

Figure 7.5 Cognitive deficit profile between T1 and T2



7.4 Aim 4 - Demographic Variable Correlations

The correlation matrix presented in Table 7.7 shows the relationship between demographic variables and outcome variables. Only two associations were evident. Gender was associated with community integration, with the direction of the association implying females were more integrated. Age at T2 was negatively associated with employment status, suggesting that younger participants were more likely to have returned to PI employment status.

Table 7.7 Correlations between demographic variables and outcomes

	CIQ	SWLS	Anxiety	Depression	Emp Status	QoL
Gender	0.353*	-0.021	0.019	-0.154	-0.096	-0.031
Years Educ	0.296**	0.148	-0.093	-0.203*	0.178*	0.209*
Severity (PTA)	-0.079	-0.291**	0.024	0.032	-0.113	0.036
Age - Injury	-0.153	-0.076	-0.020	0.033	-0.265**	-0.169
Age - T1	-0.171	-0.103	-0.026	0.049	-0.296**	-0.166
Age - T2	-0.184*	-0.132	0.000	0.090	-0.331**	-0.138
TSI - T1	0.075	-0.061	-0.081	0.049	-0.129	0.073
TSI - T2	-0.063	-0.149	0.052	0.143	-0.163	0.113

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Years Educ – years of education; PTA – Post Traumatic Amnesia; TSI – Time Since Injury

* $p<0.05$ ** $p<0.01$

7.5 Aim 5 - Demographic Variable Regressions

The degree to which demographic variables (IVs) predicted each of the outcome variables (DVs) was assessed. Demographic variables were considered separately according to time i.e. PI, T1 and T2. However, injury severity, gender and years of education were included in all regressions, as these factors are stable at all times after injury.

Pre-Injury

Demographic variables entered into the regression were: injury severity, gender, years of education, age at injury, being in paid work at PI, PI relationship status. Results presented in Table 7.8 and 7.9 are of the overall models. Community integration, satisfaction with life and employment status were significantly predicted by PI demographic variables. The predictive model of community integration accounted for 24% of the variance, with years of education, relationship status and gender having made significant contributions. The predictors explained 9% of the variance in satisfaction with life but only severity made a significant contribution, whereas 19% of the variance in employment status was explained, and age was the only significant contributor. However, the odds ratio shows little change in the likelihood of returning to PI employment status on the basis of being older by one year.

Table 7.8 Summary of multiple regression analyses for PI demographic variables predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.1 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.238	7.777**		
Years of education			0.174	2.106*
Relationship Status			-0.238	-2.290*
Gender			0.289	3.539**
SWLS	0.085	3.020**		
Severity			-0.316	-3.595**
Anxiety	-0.001	0.974		
Depression	0.029	1.645		

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* p<0.05 ** p<0.01

Table 7.9 Summary of logistic regression analyses for PI demographic variables predicting employment status and QoL (see appendix 4.2 for full version)

	Chi Square	Nagelkerke R squared	Classification (%)	Wald Statistic	Odds Ratio
Emp Status	18.998**	0.182	65.6		
Age				4.835*	1.051
QoL	11.092	0.124	77.1		

* p<0.05 ** p<0.01

Time 1

Variables entered into the regressions were: injury severity, gender, years of education, age at T1, being in paid work at T1, relationship status at T1, and time since injury at T1. Results presented in Table 7.10 and 7.11 are of the overall models. Community integration, satisfaction with life and returning to PI employment status were again significantly predicted by demographic variables. The predictive model of the former accounted for 25% of the variance, with just age and gender having made significant contributions. The predictors explained 12% of the variance in satisfaction with life, with severity and being in paid work both having made significant contributions to the model. Age, time since injury and being in paid work made significant contributions in accounting for 44% of the variance in returning to PI employment status. The predictor with the greatest odds ratio implies that returning to PI employment status is over 11 times more likely if the person was in paid work at T1.

Table 7.10 Summary of multiple regression analyses for T1 demographic variables predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.3 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.254	7.320**		
Age			-0.214	-2.100*
Gender			0.325	4.057**
SWLS	0.121	3.554**		
Severity			-0.295	-3.469**
Paid Work			0.237	2.737**
Anxiety	0.011	1.201		
Depression	0.034	1.647		

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* p<0.05 ** p<0.01

Table 7.11 Summary of logistic regression analyses for T1 demographic variables predicting employment status and QoL (see appendix 4.4 for full version)

	Chi Square	Nagelkerke R squared	Classification (%)	Wald Statistic	Odds Ratio
Emp Status	51.305**	0.437	74.8		
Age				11.205**	1.092
TSI				3.924*	1.004
Paid Work				21.439**	11.346
QoL	11.883	0.133	76.3		

* p<0.05 ** p<0.01

Time 2

Variables entered into the regression were: injury severity, gender, years of education, age at T2, being in paid work at T2, relationship status at T2, and time since injury at T2. Results presented in Table 7.12 and 7.13 are of the overall models. Just as when assessed at PI and T1, demographic variables at T2 significantly predicted community integration, satisfaction with life and returning to PI employment status. The predictive model of the former accounted for 27% of the variance. Years of education, being in paid work, relationship status and gender made significant contributions. Satisfaction with life was significantly predicted with 14% of the variability explained. Severity and relationship status made significant contributions to the model. Being in paid work was the sole significant contributor, explaining 80% of the variance in returning to PI employment status. On the basis of being in paid work at T2, the large odds ratio suggests that a person is nearly 225 times more likely to have returned to PI employment status at T2.

Table 7.12 Summary of multiple regression analyses for T2 demographic variables predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.5 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.265	7.698**		
Years of education			0.163	2.008*
Paid Work			0.253	3.029**
Relationship Status			-0.196	-2.322*
Gender			0.279	3.440**
SWLS	0.140	4.030**		
Severity			-0.214	-2.417*
Relationship Status			0.254	2.778**
Anxiety	0.017	1.316		
Depression	0.007	1.136		

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* $p<0.05$ ** $p<0.01$

Table 7.13 Summary of logistic regression analyses for T2 demographic variables predicting employment status and QoL (see appendix 4.6 for full version)

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	117.268**	0.797	91.6		
Paid Work				36.047**	224.965
QoL	11.694	0.131	76.3		

Class. – Classification

* $p<0.05$ ** $p<0.01$

7.6 Aim 6 - Cognitive Domain Correlations

Table 7.14 presents all correlations between cognitive domain scores and dependent variables. Many cognitive domains have a significant correlation with outcome variables. However, at T1 there was only three associations of medium strength: verbal ability, and visuospatial reasoning with satisfaction with life; information processing speed with depression. At T2, 10 associations were of medium strength. The majority of these involved the cognitive domains of information processing speed and working memory, with the strongest association between working memory and depression.

Table 7.14 Correlations between cognitive domains and outcomes

	CIQ	SWLS	Anxiety	Depression	Emp Status	QoL
T1						
Memory	0.015	0.181*	0.036	-0.031	0.112	-0.015
Verb Ab	0.241**	0.334**	-0.150	-0.226**	0.139	0.190*
Info Pro	0.277**	0.262**	-0.147	-0.307**	0.201*	0.118
Vis Reas	0.240**	0.328**	-0.278**	-0.295**	0.182*	0.156
T2						
Info Pro	0.368**	0.261**	-0.162	-0.322**	0.305**	0.110
Verb Ab	0.307**	0.261**	-0.197*	-0.242**	0.205*	0.233**
Vis Reas	0.273**	0.286**	-0.241**	-0.263**	0.238**	0.163
Aud Mem	0.334**	0.277**	-0.192*	-0.272**	0.137	0.161
Work Mem	0.397**	0.386**	-0.307**	-0.445**	0.252**	0.214*
Vis Mem	0.166	0.234**	-0.200*	-0.305**	0.189*	0.137
Exec Func	0.258**	0.183*	-0.189*	-0.261**	0.282**	0.103

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Verb Ab – Verbal Ability; Info Pro – Information Processing Speed; Vis Reas – Visuospatial Reasoning; Aud Mem – Auditory Memory; Work Mem – Working Memory; Vis Mem – Visual Memory; Exec Func – Executive Functioning

* $p<0.05$ ** $p<0.01$

7.7 Aim 7 - Cognitive Domain Regressions

The following analyses considered the possibility that cognitive domains (IVs) directly predicted outcome variables (DVs). Cognitive domains were considered separately according to the time point they related to.

Pre-Injury

The cognitive variable entered into the regression was the NART. Although only one IV was included in these regressions, they were conducted to investigate the direct link between PI functioning and outcomes as depicted by Kendall and Terry (1996), from a cognitive functioning perspective. Results are presented in Table 7.15 and 7.16. All psychosocial outcome variables, with the exception of returning to PI levels of employment, were significantly predicted by PI intellectual functioning. However, only small amounts of the variance were explained in each of community integration (9%), satisfaction with life (5%), anxiety (4%), depression (6%) and QoL (2%).

Table 7.15 Summary of multiple regression analyses for PI cognitive functioning predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.092	14.235**		
NART			0.315	3.773**
SWLS	0.048	7.485**		
NART			0.234	2.736**
Anxiety	0.035	5.764*		
NART			-0.207	-2.401*
Depression	0.060	9.254**		
NART			-0.259	-3.042**

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* p<0.05 ** p<0.01

Table 7.16 Summary of logistic regression analyses for PI cognitive functioning predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Classification (%)	Wald Statistic	Odds Ratio
Emp Status	2.076	0.021	58.8		
NART				2.026	0.981
QoL	6.609*	0.075	76.3		
NART				6.284*	1.042

* p<0.05 ** p<0.01

Time 1

Variables entered into the regressions were the four cognitive domains: verbal ability, information processing speed, visuospatial reasoning, and memory. Results presented in Table 7.17 and 7.18 are of the overall models. Community integration, satisfaction with life and depression were all significantly predicted by cognitive domains assessed at T1. Only information processing speed made a significant contribution to predicting community integration, accounting for 8% of the variance, and 9% of the variance in satisfaction with life was explained, with only visuospatial reasoning having made a significant contribution. Information processing speed was again the sole significant contributor to the model that explained 7% of the variance in depression.

Table 7.17 Summary of multiple regression analyses for T1 cognitive domains predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.7 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.083	3.924**		
Info Pro			0.225	2.254*
SWLS	0.088	4.151**		
Vis Reas			0.214	2.192*
Anxiety	0.032	2.068		
Depression	0.071	3.492*		
Info Pro			-0.231	-2.298*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Info Pro – Information Processing Speed; Vis Reas – Visuospatial Reasoning

* p<0.05 ** p<0.01

Table 7.18 Summary of logistic regression analyses for T1 cognitive domains predicting employment status and QoL (see appendix 4.8 for full version)

	Chi Square	Nagelkerke R squared	Classification (%)
Emp Status	7.454	0.075	63.4
QoL	6.826	0.078	77.1

Time 2

Variables entered into the regressions were the T2 cognitive domains: verbal ability, information processing speed, visuospatial reasoning, executive functioning, visual memory, auditory memory, and working memory. Results presented in Table 7.19 and 7.20 are of the overall models. Community integration, satisfaction with life, depression and employment status were significantly predicted by cognitive domains at T2. The variance accounted for by each model was 15%, 7% and 13% respectively. Working memory was the sole significant contributor to each of these models. The predictors explained 19% of the variance in employment status but no individual cognitive domains made a significant contribution.

Table 7.19 Summary of multiple regression analyses for T2 cognitive domains predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.9 for full version)

	Adjusted R squared	F-values	Beta	t-value
CIQ	0.146	4.173**		
Working Memory			0.310	2.278*
SWLS	0.067	2.326*		
Working Memory			0.320	2.245*
Anxiety	0.048	1.934		
Depression	0.129	3.747**		
Working Memory			-0.460	-3.344**

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* $p<0.05$ ** $p<0.01$

Table 7.20 Summary of logistic regression analyses for T2 cognitive domains predicting employment status and QoL (see appendix 4.10 for full version)

	Chi Square	Nagelkerke R squared	Classification (%)
Emp Status	19.392*	0.185	69.5
No Significant Contributors			
QoL	10.325	0.116	74.8

* p<0.05 ** p<0.01

7.8 Aim 8 – Cognitive Domain Mediation Tests

The indirect relationships between cognitive domains and outcome variables, via the mediation of appraisal and coping variables were investigated. Once again, the cognitive domains were considered separately according to the time points they relate to.

Time 1

Associations were identified between T1 cognitive domains (IVs), and the appraisal and coping mediating factors of self-efficacy, causal attribution subscales and coping style components (DVs). Results presented in Table 7.21 are of each model. Five of the appraisal and coping mediators were significantly predicted by the independent variables. None of the causal attribution subscales were related to cognitive domains, but all of the coping components were, with the exception of positive interpretation. Self-efficacy was the mediator that had the largest amount of explained variance. The cognitive domains accounted for 12% of the variance, with information processing speed and visuospatial reasoning having made significant contributions.

The relationship between cognitive domains and outcome variables has previously been identified (see Tables 7.17 and 7.18). Therefore, having also established those mediators that were predicted by cognitive domains, outcome variables (DVs) were regressed on both mediators and cognitive domains (IVs) using the hierarchical method. Results presented in Table 7.22 are of each model.

In the first part of the analyses, when community integration was the dependent variable, mediators combined to act as reliable predictors, accounting for 21% of the variance, with self-efficacy having made a significant contribution. The relationship between information processing speed and community integration was no longer significant when the predictor variable was added to the regression. Therefore, the relationship between information processing speed and community integration was found to be mediated by self-efficacy.

When satisfaction with life was the dependent variable, mediators were again found to have a significant relationship, accounting for 35% of the variance. Problem focused behaviour – coping, problem focused cognitions – coping, and self-efficacy all made significant contributions. The relationship between visuospatial reasoning and satisfaction with life was no longer significant when predictor variables were added to the regression. Therefore, the relationship between visuospatial reasoning and satisfaction with life was found to be mediated by the appraisal and coping variables of problem focused behaviour – coping , problem focused cognitions – coping, and self-efficacy.

Mediators reliably predicted 31% of the variance when the dependent variable was depression, with problem focused behaviour - coping and self-efficacy making significant contributions. The independent variable of information processing speed no longer made a significant contribution to depression when added to the regression. Therefore, the association between information processing speed and depression was found to be mediated by problem focused behaviour – coping and self-efficacy.

Tests of mediation could not be performed when anxiety, employment status, or QoL, were dependent variables because cognitive domains were not significantly associated with them (see Tables 7.17 and 7.18).

Table 7.21 Summary of multiple regression analyses for T1 cognitive domains predicting appraisal and coping mediators (see appendix 4.11 for full version)

	Adjusted R squared	F-value	Beta	t-value
Self- Efficacy	0.121	5.461**		
Information Processing Speed			0.221	2.263*
Visuospatial Reasoning			0.191	1.994*
Avoidance - Coping	0.066	3.282*		
Verbal Ability			-0.267	-2.552*
PFB – Coping	0.047	2.618*		
Verbal Ability			0.239	2.257*
PFC – Coping	0.052	2.789*		
Information Processing Speed			0.301	2.964**
Religion – Coping	0.064	3.211*		
Memory			0.220	2.340*
Visuospatial Reasoning			-0.204	-2.068*
PI – Coping	0.018	1.603		
Stability – Causal Attribution	0.005	1.169		
PC – Causal Attribution	-0.016	0.493		
EC – Causal Attribution	-0.012	0.608		
LoC – Causal Attribution	-0.016	0.481		

PFB – Problem Focused Behaviour; PFC – Problem Focused Cognitions; PI – Positive Interpretation; PC – Personal Control; EC – External Control; LoC – Locus of Causality

* $p<0.05$ ** $p<0.01$

Table 7.22 Summary of hierarchical regression analyses testing for mediation between T1 cognitive domains and community integration, satisfaction with life, and depression (see appendix 4.12 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ – Block One	0.207	7.768**		
Self-Efficacy			0.458	5.001**
CIQ - Block Two	0.215	6.919**		
Information Processing Speed			0.129	1.509
SWLS – Block One	0.351	15.031**		
Self-Efficacy			0.460	5.548**
PFB - Coping			0.156	2.205*
Religion			-0.153	-2.149*
SWLS - Block Two	0.357	13.038**		
Visuospatial Reasoning			0.113	1.514
Depression – Block One	0.313	12.866**		
Self-Efficacy			-0.449	-5.265**
PFB - Coping			-0.153	-2.109*
Depression - Block Two	0.310	10.738**		
Information Processing Speed			-0.051	-0.634

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PFB – Problem Focused Behaviour

* $p<0.05$ ** $p<0.01$

Time 2

Predictive associations between T2 cognitive domains (IVs) and appraisal and coping mediating factors (DVs) were investigated. Results presented in Table 7.23 are of each model. Only three of the appraisal and coping mediators were significantly predicted by independent variables. None of the causal attribution scales were related to cognitive domains, and only the avoidance - coping and positive interpretation - coping components were related to independent variables. Self-efficacy was the mediator that had the largest amount of explained variance, with the cognitive domains accounting for 18% of the variance, however no individual domain made a significant contribution.

Mediators that were predicted by cognitive domains and those cognitive domains that were previously found to predict each outcome variable (see Table 7.19 and 7.20) were entered into a hierarchical regression. Results presented in Table 7.24 are of each model. The first part of the analyses when community integration was the dependent variable was very similar to the equivalent regression when testing for mediation using T1 cognitive domains. Mediators combined to act as reliable predictors, accounting for 20% of the variance, with self-efficacy having made a significant contribution. The second part of the analyses found that working memory still made a significant contribution to community integration. Therefore, the association between working memory and community integration was not found to be mediated by self-efficacy, avoidance – coping and positive interpretation - coping.

Table 7.23 Summary of multiple regression analyses for T2 cognitive domains predicting appraisal and coping mediators (see appendix 4.13 for full version)

	Adjusted R squared	F-value	Beta	t-value
Self-Efficacy	0.182	5.140**		
No Significant Contributors				
Avoidance - Coping	0.088	2.784*		
Verbal Ability			-0.246	-1.987*
Working Memory			-0.334	-2.375*
PI – Coping	0.106	3.203**		
Visuospatial Reasoning			-0.351	-2.631*
Information Processing Speed			0.476	3.800**
Stability – Causal Attribution	0.038	1.733		
PC – Causal Attribution	0.025	1.485		
EC – Causal Attribution	-0.003	0.953		
LoC – Causal Attribution	0.028	1.525		
PFB – Coping	-0.012	0.776		
PFC - Coping	0.003	1.049		
Religion - Coping	-0.012	0.778		

PI – Positive Interpretation; PC – Personal Control; EC – External Control; LoC – Locus of Causality; PFB – Problem Focused Behaviour; PFC – Problem Focused Cognitions

* $p<0.05$ ** $p<0.01$

When satisfaction with life was the dependent variable, again mediators were found to have a significant relationship, accounting for 31% of the variance, and once more self-efficacy made a significant contribution. The relationship between working memory and satisfaction with life, though, was no longer significant when the predictor variables were added to the regression. Therefore, the relationship between working memory and satisfaction with life was found to be mediated by self-efficacy.

Mediators reliably predicted 30% of the variance when the dependent variable was depression, with self-efficacy the sole significant contributor. The independent variable of working memory no longer made a significant contribution to depression when added to the regression. Therefore, the association between working memory and depression was found to be mediated by self-efficacy.

Tests of mediation could not be performed when anxiety and QoL were dependent variables because cognitive domains were not significantly associated with them (see Tables 7.19 and 7.20). Cognitive domains did significantly predict employment status, however a test of mediation could not be performed because no individual cognitive domain was found to contribute significantly to the prediction of the outcome (see Table 7.20).

Table 7.24 Summary of hierarchical regression analyses testing for mediation between T2 cognitive domains and community integration, satisfaction with life, and depression (see appendix 4.14 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ – Block One	0.203	12.027**		
Self-Efficacy			0.444	4.891**
CIQ - Block Two	0.243	11.445**		
Working Memory			0.239	2.788**
SWLS – Block One	0.307	20.236**		
Self-Efficacy			0.496	5.866**
SWLS - Block Two	0.310	15.587**		
Working Memory			0.098	1.197
Depression – Block One	0.303	19.881**		
Self-Efficacy			-0.457	-5.381**
Depression - Block Two	0.317	16.097**		
Working Memory			-0.154	-1.884

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* $p<0.05$ ** $p<0.01$

7.9 Aim 9 - Psychosocial Variable Correlations

As can be seen from Table 7.25, several psychosocial variables were associated with outcome variables. Self-efficacy was associated with all but QoL, and employment status. None of the causal attribution subscales were associated with psychosocial outcomes. Of the coping components, only avoidance - coping was associated with any of the psychosocial outcomes. In this case, anxiety, depression and satisfaction with life were the outcome variables. Personality was associated with all outcome variables, with employment status as an exception. However, no other psychosocial components had associations with any outcome variables.

Table 7.25 Correlations between psychosocial variables, mediators and outcomes

	CIQ	SWLS	Anxiety	Depression	Emp Status	QoL
Self-Efficacy	0.466**	0.570**	-0.602**	-0.592**	0.229**	0.279**
EC – CA	-0.148	-0.181*	0.210*	0.188*	-0.172*	-0.137
Stability – CA	-0.127	-0.013	-0.033	0.064	-0.078	0.019
PC – CA	-0.035	0.111	-0.053	0.018	-0.103	-0.073
LoC – CA	0.079	0.047	-0.182*	-0.069	0.092	0.063
Avoidance - Coping	-0.254**	-0.431**	0.492**	0.475**	-0.164	-0.134
PFC - Coping	0.132	0.130	-0.225**	-0.111	-0.001	0.092
PFB - Coping	0.293**	0.209*	-0.026	-0.202*	-0.112	0.237**
PI - Coping	0.193*	0.209*	-0.048	-0.216*	0.054	-0.051
Religion - Coping	-0.102	-0.195*	0.251**	0.087	0.007	-0.152
Personality	0.591**	0.664**	-0.653**	-0.763**	0.250**	0.393**
Social Support	0.067	0.091	-0.025	-0.192	0.072	0.002
Competency	0.132	-0.027	-0.006	-0.080	0.091	0.046
Life Stress	0.140	-0.018	0.255**	0.127	-0.013	-0.008

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; EC – CA - External Control – Causal Attribution; Stability – CA – Stability – Causal Attribution; PC – CA - Personal Control - Causal Attribution; LoC – CA - Locus of Causality - Causal Attribution; PFC – Problem Focused Cognitions; PFB – Problem Focused Behaviour; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

7.10 Aim 10 - Psychosocial Variable Mediation Tests

The indirect relationship between psychosocial predictors and outcome variables via the mediation of appraisal and coping variables, was considered. Firstly, associations were identified between psychosocial components (IVs), and the appraisal and coping mediating factors of self-efficacy, causal attribution subscales and coping style components (DVs). Results presented in Table 7.26 are of each model. The majority of appraisal and coping mediators were significantly predicted by independent variables. Only the personal control - causal attribution, external control – causal attribution, locus of causality - causal attribution scales, and the religion - coping component were not related to independent variables. Self-efficacy explained the largest amount of variance, accounting for 41% of the variance, with personality having made a significant contribution.

Table 7.26 Summary of multiple regression analyses for psychosocial components predicting appraisal and coping mediators (see appendix 4.15 for full version)

	Adjusted R squared	F-value	Beta	t-value
Self-Efficacy	0.409	23.494**		
Personality			0.649	9.633**
Stability – Causal Attribution	0.093	4.350**		
Personality			-0.228	-2.730**
Competency			-0.209	-2.505*
Avoidance - Coping	0.296	14.670**		
Personality			-0.512	-6.958**
Life Stress			0.208	2.824**
PFC - Coping	0.106	4.870**		
Personality			0.215	2.594*
Social Support			-0.232	-2.802**
PFB – Coping	0.133	5.996**		
Social Support			0.383	4.696**
PI – Coping	0.179	8.092**		
Personality			0.248	3.119**
Social Support			-0.167	-2.104*
Life Stress			0.324	4.081**
PC –Causal Attribution	0.023	1.749		
EC – Causal Attribution	0.010	1.324		
LoC – Causal Attribution	0.029	1.972		
Religion - Coping	-0.010	0.691		

PFC – Problem Focused Cognitions; PFB – Problem Focused Behaviour; PI – Positive Interpretation; PC – Personal Control; EC – External Control; LoC – Locus of Causality

* $p<0.05$ ** $p<0.01$

Secondly, associations between psychosocial components (IVs), and outcome variables (DVs) were identified. Results presented in Table 7.27 and 7.28 are of each model. Psychosocial components had a significant overall predictive effect on all outcome variables. However, various combinations of independent variables made significant contributions to each outcome. The prediction of community integration was significantly contributed to by personality and competency, with 26% of the variance explained. Personality also made a significant contribution to predicting satisfaction with life, accounting for 35% of the variance. Anxiety and depression were significantly predicted by personality and life stress, with 38% and 45% of the variance explained respectively, whilst personality was the sole significant contributor to both employment status, and QoL. The variance explained in these cases, were 10% and 24% respectively.

Table 7.27 Summary of multiple regression analyses for psychosocial components predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.16 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.262	12.516**		
Personality			0.477	6.330**
Competency			0.194	2.580*
SWLS	0.345	18.092**		
Personality			0.600	8.446**
Anxiety	0.375	20.469**		
Personality			-0.574	-8.237**
Life Stress			0.247	3.568**
Depression	0.452	27.811**		
Personality			-0.661	-10.177**
Life Stress			0.143	2.199*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* $p<0.05$ ** $p<0.01$

Table 7.28 Summary of logistic regression analyses for psychosocial components predicting employment status and QoL (see appendix 4.17 for full version)

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	10.279*	0.102	64.1		
Personality				7.883**	0.582
QoL	22.134**	0.238	83.2		
Personality				17.048**	3.058

Class. – Classification

* $p<0.05$ ** $p<0.01$

Thirdly, mediators that were predicted by psychosocial components (see Table 7.26), and those psychosocial components that contributed to the prediction of each outcome variable (see Tables 7.27 and 7.28), were entered into hierarchical regressions. Results presented in Table 7.29 and 7.30 are of each model. In the first part of the analyses, when community integration was the dependent variable, mediators combined to act as reliable predictors, accounting for 23% of the variance, with self-efficacy, stability – causal attribution and problem focused behaviour - coping having made significant contributions. In the second part of the analyses, personality and competency still made significant contributions to community integration. Therefore, associations between each of personality, and competency with community integration were not found to be mediated by appraisal and coping variables.

Table 7.29 Summary of hierarchical regression analyses testing for mediation between psychosocial components and community integration, satisfaction with life, anxiety and depression (see appendix 4.18 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ - Block One	0.234	7.618**		
Self-Efficacy			-0.403	4.394**
Stab – Causal Attribution			-0.163	-2.019*
PFB – Coping			0.165	2.138*
CIQ - Block Two	0.299	7.922**		
Personality			0.321	3.014**
Competency			0.165	2.136*
SWLS - Block One	0.325	11.426**		
Self-Efficacy			0.475	5.505**
PFB – Coping			0.154	2.135*
SWLS - Block Two	0.401	13.424**		
Personality			0.402	4.089**
Anxiety – Block One	0.345	12.394**		
Self-Efficacy			-0.445	-5.239**
Avoidance – Coping			0.242	2.934**
PFB – Coping			-0.164	-2.261*
Anxiety - Block Two	0.433	13.399**		
Personality			-0.372	-3.885**
Life Stress			0.190	2.534*
Depression – Block One	0.319	11.161**		
Self-Efficacy			-0.427	-4.929**
PFB – Coping			0.152	-2.156*
Depression - Block Two	0.473	15.577**		
Personality			-0.524	-5.681**
Life Stress			0.180	2.493*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Stab – Stability; PFB – Problem Focused Behaviour; PFC – Problem Focused Cognitions

* $p<0.05$ ** $p<0.01$

Table 7.30 Summary of hierarchical logistic regression analyses testing for mediation between psychosocial components and employment status and QoL (see appendix 4.19 for full version)

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status- Block One	8.415	0.084	62.6		
QoL - Block One	17.763**	0.194	77.1		
Self-Efficacy				5.674*	1.051
PFB - Coping				6.925**	1.973
QoL - Block Two	36.224**	0.370	80.9		
Personality				14.411**	4.720

Class. – Classification; PFB – Problem Focused Behaviour

* $p<0.05$ ** $p<0.01$

When satisfaction with life was the dependent variable, mediators were again found to have a significant relationship, this time accounting for 33% of the variance. Self-efficacy and problem focused behaviour - coping made significant contributions. The relationship between personality and satisfaction with life was still significant when the predictor variable was added to the regression. Therefore, the relationship between personality and satisfaction with life was not found to be mediated by appraisal and coping variables.

Several mediators made significant contributions when accounting for 35% of the variance of anxiety. Self-efficacy, avoidance – coping and problem focused cognitions - coping had significant effects. When independent variables were added to the regression, personality and life stress still made significant contributions. Therefore, relationships between each of personality, and life stress with anxiety were not found to be mediated by appraisal and coping variables.

Mediators reliably predicted 32% of the variance when the dependent variable was depression, with self-efficacy and problem focused behaviour - coping both having made significant contributions. Independent variables of personality and life stress also still made significant contributions to depression when added to the regression. Therefore, associations between personality and social support with depression were not found to be mediated by appraisal and coping variables.

Mediators did not significantly predict employment status in the first block of the regression. This relationship has to be present when testing for mediation (Baron & Kenny, 1986), and therefore further analyses were discontinued.

Mediators reliably predicted 19% of the variance in QoL. Self-efficacy and problem focused behaviour – coping both made a significant contribution. However, when the independent variable of personality was added to the regression it still significantly contributed to its predictive nature. Therefore, the association between personality and QoL was not found to be mediated by appraisal and coping variables.

7.11 Psychosocial Variable Moderation Tests

The lack of mediation effects found implied that the relationship between psychosocial components and outcome was not indirect via appraisal and coping variables. However, appraisal and coping could influence the relationship by acting as moderators. The process described by Baron and Kenny (1986) was used to test for evidence of moderation effects by appraisal and coping, in the relationship between psychosocial components and outcome. All scores were centred before calculating interaction terms, avoiding problems of multicollinearity when conducting regression analyses using higher order terms (Aiken & West, 1991).

A hierarchical regression was performed, entering variables in the following order:

Block One – Independent variables not included in the relationship of interest.
Block Two – Independent variable that is part of the relationship of interest.
Block Three – Moderator of interest.
Block Four – Interaction term of independent variable and moderator.

When testing for moderating effects only those appraisal and coping variables that were previously found to be significantly predicted by each psychosocial variable were considered (see Table 7.26). Likewise, only those psychosocial variables that were previously found to have contributed to each outcome were considered (see Tables 7.27 and 7.28). Results presented in Tables 7.31 to 7.36 are of the final step of each regression. Psychosocial components/moderators presented are those that significantly contribute to each of the regression models. The interaction term is presented throughout because its significance determines whether a moderation effect is identified (Baron and Kenny, 1986).

It is clear from Table 7.31 and 7.32 that none of the interaction terms made a unique contribution to the prediction of community integration or satisfaction with life once other variables had been entered. Table 7.33 shows only the interaction term of personality*avoidance – coping uniquely contributed to the prediction of anxiety. This implies that the influence of personality on anxiety is affected by use of an avoidance coping style. When predicting the remaining outcomes of depression, employment status, and QoL, no interaction terms contributed significantly to the regressions (see Tables 7.34. to 7.36).

Table 7.31 Summary of multiple regression analyses testing for moderation between psychosocial components and community integration

	Adjusted R squared	F-value	Beta	t-value
Overall Regression	0.263	8.742**		
Competency			0.174	2.192*
Personality			0.498	2.398*
Personality*Stability – CA			-0.052	-0.251
Overall Regression	0.290	9.837**		
Competency			0.190	2.535*
Personality			0.672	2.071*
Self-Efficacy			0.218	2.216*
Personality*Self-Efficacy			-0.347	-1.120
Overall Regression	0.268	8.939**		
Competency			0.187	2.453*
Personality			0.475	6.257**
Personality*PFB – Coping			0.015	0.195
Overall Regression	0.273	9.130**		
Personality			0.417	5.153**
Competency*Stability – CA			0.291	1.304
Overall Regression	0.283	9.538**		
Personality			0.326	3.326**
Self-Efficacy			0.230	2.295*
Competency*Self-Efficacy			0.036	0.154
Overall Regression	0.277	9.321**		
Personality			0.449	5.834**
Competency			0.220	2.803**
Competency*PFB - Coping			0.104	1.279

CA – Causal Attribution; PFB – Problem Focused Behaviour

* $p<0.05$ ** $p<0.01$

Table 7.32 Summary of multiple regression analyses testing for moderation between psychosocial components and satisfaction with life

	Adjusted R squared	F-value	Beta	t-value
Overall Regression	0.387	14.693**		
Self-Efficacy			0.300	3.278**
Personality*Self-Efficacy			0.160	0.555
Overall Regression	0.358	13.092**		
Personality			0.589	8.236**
PFA - Coping			0.169	2.153*
Personality*PFB - Coping			-0.044	-0.593

PFB – Problem Focused Behaviour

* p<0.05 ** p<0.01

Table 7.33 Summary of multiple regression analyses testing for moderation psychosocial components and anxiety

	Adjusted R squared	F-value	Beta	t-value
Overall Regression	0.422	16.827**		
Life Stress			0.254	3.794**
Self-Efficacy			-0.313	-3.514**
Personality*Self-Efficacy			-0.164	-0.589
Overall Regression	0.369	13.650**		
Life Stress			0.240	3.361**
Personality			-0.558	-7.765**
Personality*PFC – Coping			0.020	0.283
Overall Regression	0.397	15.272**		
Life Stress			0.215	3.059**
Personality			-0.505	-6.305**
Personality*Avoidance – Coping			0.145	2.123*
Overall Regression	0.426	17.051**		
Personality			-0.378	-4.316**
Self-Efficacy			-0.312	-3.545**
Life Stress*Self-Efficacy			-0.374	-1.044
Overall Regression	0.369	13.684**		
Personality			-0.557	-7.758**
Life Stress			0.234	3.294**
Life Stress*PFC – Coping			0.034	0.452
Overall Regression	0.379	14.209**		
Personality			-0.506	-6.201**
Life Stress			0.232	3.209**
Life Stress*Avoidance - Coping			-0.061	-0.839

PFC – Problem Focused Cognitions

* $p<0.05$ ** $p<0.01$

Table 7.34 Summary of multiple regression analyses testing for moderation between psychosocial components and depression

	Adjusted R squared	F-value	Beta	t-value
Overall Regression	0.469	20.129**		
Life Stress			0.152	2.368*
Personality			-0.699	-2.491*
Self-Efficacy			-0.193	-2.259*
Personality*Self-Efficacy			0.168	0.627
Overall Regression	0.463	19.703**		
Personality			-0.643	-9.898**
Personality*PFB - Coping			1.534	1.534
Overall Regression	0.469	20.143**		
Life Stress			0.146	2.271*
Personality			-0.537	-6.338**
Self-Efficacy			-0.192	-2.248*
Social Support*Self-Efficacy			0.165	0.661
Overall Regression	0.456	19.128**		
Personality			-0.655	-10.100**
Social Support*PFB - Coping			-0.050	-0.745

PFB – Problem Focused Behaviour

*p<0.05 ** p<0.01

Table 7.35 Summary of logistic regression analyses testing for moderation between psychosocial components and employment status

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Overall Regression	12.946*	0.127	63.4		
Personality				4.098*	0.150
Personality*Self-Efficacy				2.429	1.028
Overall Regression	10.717	0.106	64.1		
Personality				8.137**	0.564
Personality*PFC – Coping				0.249	0.919
Overall Regression	10.759	0.106	63.4		
Personality				4.981*	0.605
Personality*Avoidance – Coping				0.384	1.122
Overall Regression	14.987*	0.146	64.9		
Personality				8.879**	0.546
PFA - Coping				4.322*	1.582
Personality*PFB – Coping				0.860	0.854
Overall Regression	11.888	0.117	60.3		
Personality				6.739**	0.591
Personality*PI – Coping				1.520	1.279
Overall Regression	13.753*	0.134	64.9		
Personality*Stability – Causal Attribution				2.614	0.945

Class. – Classification; PFC – Problem Focused Cognitions; PFB – Problem Focused Behaviour; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

Table 7.36 Summary of logistic regression analyses testing for moderation between psychosocial components and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Overall Regression	23.393**	0.251	79.4		
Personality				4.004*	9.984
Personality*Self-Efficacy				1.281	0.975
Overall Regression	24.508**	0.261	80.2		
Personality				16.450**	3.506
Personality*PFC – Coping				2.486	1.545
Overall Regression	25.505**	0.271	83.2		
Personality				16.171**	3.821
Personality*Avoidance – Coping				2.523	1.435
Overall Regression	27.939**	0.294	80.9		
Personality				18.667**	3.796
Personality*PI – Coping				1.768	1.466
Overall Regression	33.024**	0.341	83.2		
Personality				12.623**	2.823
PFA - Coping				5.607*	2.325
Personality*PFB – Coping				0.984	0.736
Overall Regression	27.024**	0.286	80.2		
Personality				8.962**	14.240
Personality*Stability – Causal Attribution				3.551	0.910

Class. – Classification; PFC – Problem Focused Cognitions; PI – Positive Interpretation; PFB – Problem Focused Behaviour

* $p<0.05$ ** $p<0.01$

7.12 Psychosocial Variable, Appraisal and Coping Regressions

The analyses have shown that appraisal and coping variables were not acting as mediators. Only avoidance - coping was shown to have a moderating influence on the relationship between psychosocial components and outcome (in this case anxiety). Therefore, appraisal and coping predictors appeared to be acting independently of other psychosocial variables. Consequently, the degree to which appraisal and coping variables, together with other psychosocial components (IVs) predicted each outcome, (DVs) was investigated. Results presented in Tables 7.37 and 7.38 are of each model.

Table 7.37 Summary of multiple regression analyses for psychosocial components, appraisal and coping predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.20 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.309	5.156**		
Personality			0.325	2.903**
Competency			0.165	2.103*
Self-Efficacy			0.258	2.526*
PC – Causal Attribution			-0.218	-2.233*
SWLS	0.423	7.821**		
Personality			0.388	3.796**
PFB – Coping			0.181	2.438*
Self-Efficacy			0.271	2.904**
PC – Causal Attribution			0.218	2.450*
Anxiety	0.450	8.595**		
Personality			-0.285	-2.850**
Life Stress			0.200	2.611*
Religion - Coping			0.164	2.361*
Self-Efficacy			-0.313	-3.435**
LoC – Causal Attribution			-0.233	-2.262*
Depression	0.463	9.009**		
Personality			-0.177	-4.900**
Life Stress			0.236	2.343*
Self-Efficacy			-0.128	-2.622*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PC – Personal Control; LoC – Locus of Causality

* $p<0.05$** $p<0.01$

Table 7.38 Summary of logistic regression analyses for psychosocial components, appraisal and coping, predicting employment status and QoL (see appendix 4.21 for full version)

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	19.453	0.186	63.4		
QoL	43.715**	0.435	84.7		
Personality				12.910**	4.990
PFB - Coping				7.627**	2.918

Class. – Classification; PFB – Problem Focused Behaviour

* p<0.05 ** p<0.01

Independent variables had a significant overall predictive effect on all outcome variables except employment status. However, various combinations of independent variables made significant contributions to each outcome. The predictive model of community integration was significantly contributed to by personality, competency, self-efficacy and personal control – causal attribution, with 31% of the variance explained. Personality, problem focused behaviour – coping, self-efficacy and personal control – causal attribution all made significant contributions to predicting satisfaction with life, accounting for 42% of the variance. Personality, life stress, religion – coping, self-efficacy and locus of causality – causal attribution significantly predicted 45% of the variance in anxiety. Personality, life stress and self-efficacy showed significant effects with depression, explaining 46% of the variance. Personality also had a significant effect, along with problem focused behaviour – coping, when predicting QoL, with 44% of the variance explained. The odds ratio implies that on the basis of a one unit change in the personality component, a person is almost five times more likely to rate their QoL as good or better, whereas with a one unit increase in problem focused behaviour – coping, a person is nearly three times more likely to rate their QoL as good or better.

7.13 Combining Variables to Form Models

Variables that appeared to be important, as a result of the preceding analyses, in predicting each outcome variable, are presented in this section. Predictors that significantly contributed to each outcome from each of the demographic, neuropsychological and psychosocial categories are presented together. This approach enables the complete set of predictors for each dimension of outcome to be evaluated.

Evidence of mediation or moderation effects was inconsistent when considering the relationship between cognitive domains, particularly at T2, and psychosocial variables, with outcome. Therefore, Figures 7.6 to 7.11 only present the direct relationships between predictors and each outcome as identified by the standard regression analyses. In the case of the continuous outcomes, standardised beta coefficients for each predictor are presented. For the dichotomous outcome variables, odds ratios for each predictor are presented.

When predicting community integration using PI demographic variables, Figure 7.6 shows the important variables were gender, years of education and relationship status. Furthermore, PI cognitive functioning also accounted for some variance in community integration. At T1, gender and age contributed to the prediction of community integration, whereas information processing speed was the most important cognitive variable. At T2, community integration was again influenced by gender, with years of education, relationship status, and being in paid work making further contributions. At this stage, working memory was the important cognitive function. Personality, competency, self-efficacy and personal control – causal attribution influenced community integration from the psychosocial perspective.

At least one demographic, cognitive and psychosocial variable also contributed to the prediction of satisfaction with life. However, the important demographic variable across all time points was injury severity. Being in paid work at T1 was also found to be of importance, as was relationship status at T2. PI cognitive functioning once again accounted for some variance, whereas visuospatial reasoning was the most significant cognitive domain at T1, and working memory was again important in relation to cognitive functioning at T2. Personality, self-efficacy, personal control – causal attribution and problem focused behaviour – coping were identified as significant contributors from the psychosocial group of variables.

Very few variables were found to influence levels of anxiety. No demographic variables and only PI levels of cognitive functioning were identified as influential outside of psychosocial variables. Once again personality and self-efficacy were significant contributors, as were life stress, locus of causality – causal attribution and religion – coping.

A similar situation was found regarding depression. Once again no demographic variables were important. However, as well as PI cognitive functioning, information processing speed at T1 and working memory at T2 were also influential. Consistent with previous outcome variables, personality and self-efficacy were again identified as being the most important psychosocial variables, with life stress also contributing in this instance.

Only demographic variables were important in determining whether a participant returned to PI employment status. Age was more important than any other PI demographic variables. It also contributed with time since injury and being in paid work at T1. At T2, only being in paid work was important.

In contrast, no demographic variables helped to determine whether a participant rated their QoL as good or better. PI cognitive functioning accounted for some variance, but personality and problem focused behaviour – coping were also found to significantly contribute to the model.

Figure 7.6 Predictors of community integration

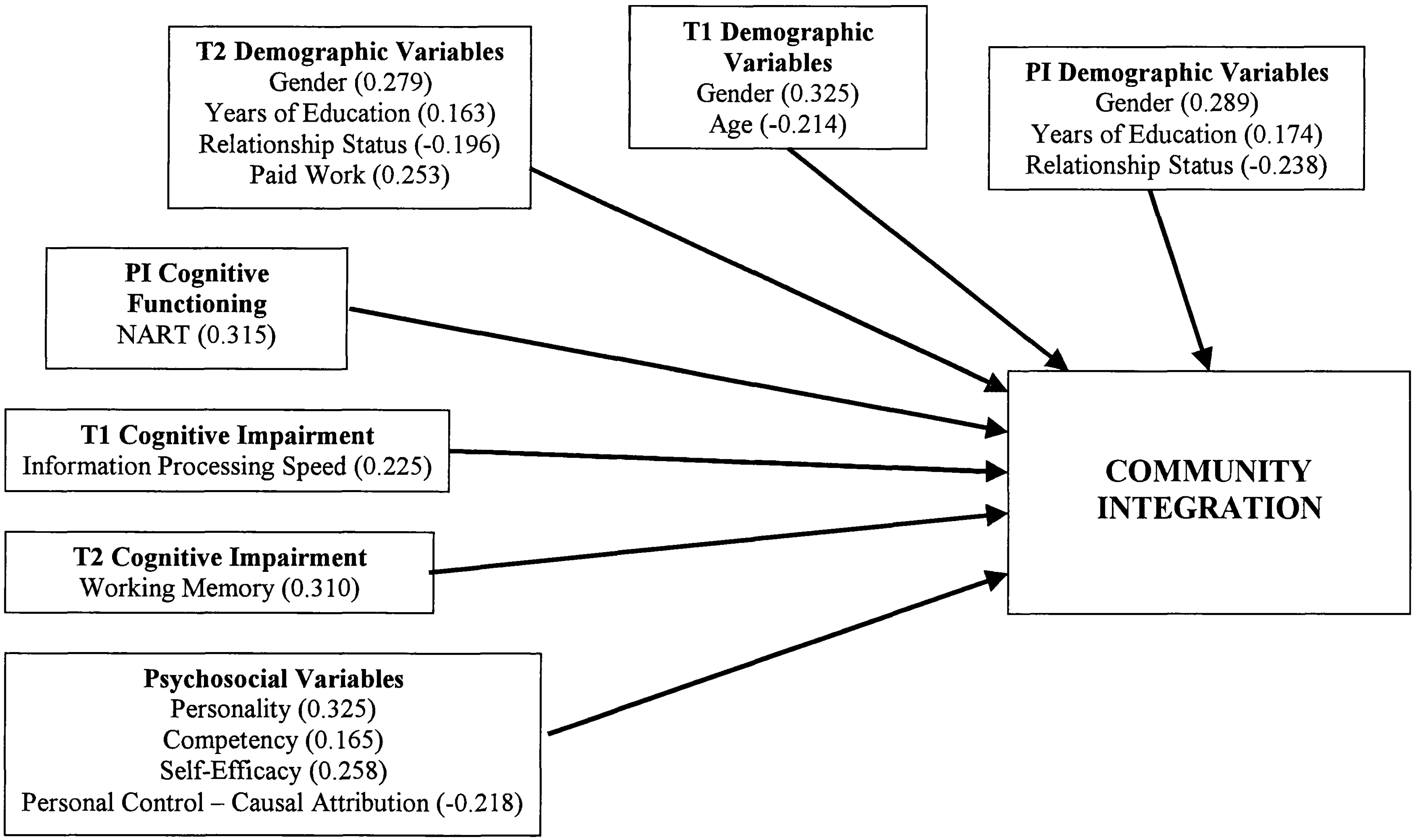


Figure 7.7 Predictors of satisfaction with life

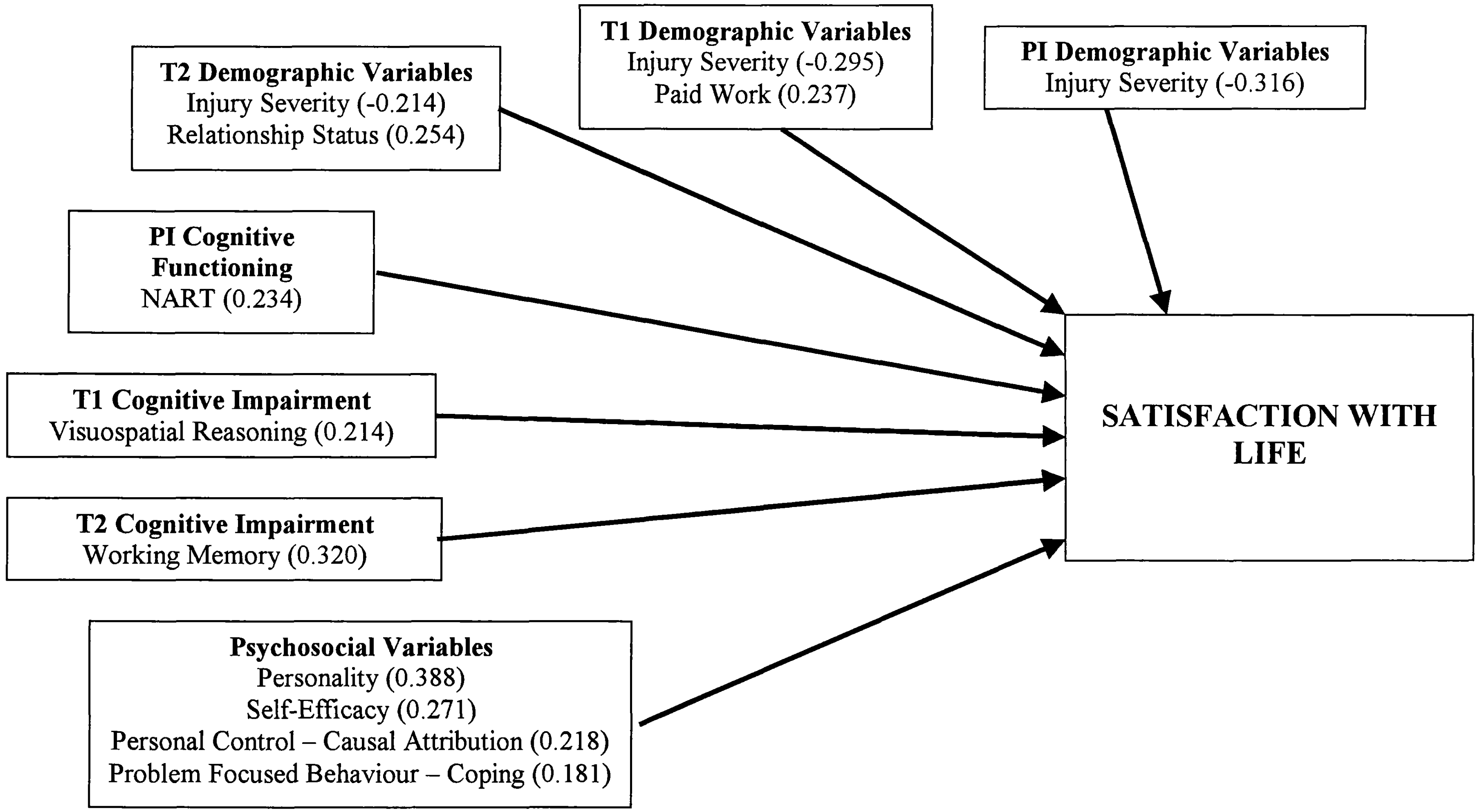


Figure 7.8 Predictors of anxiety

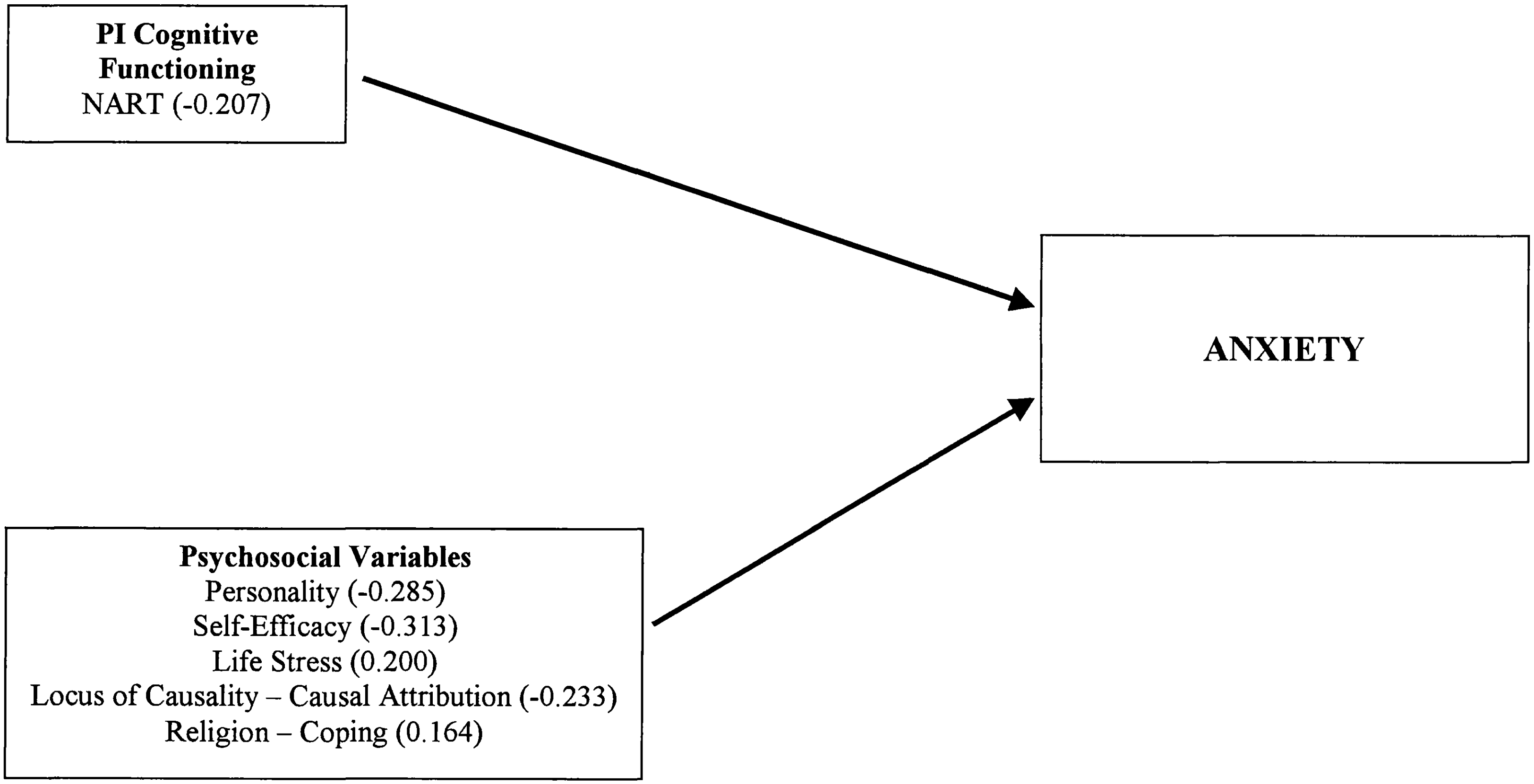


Figure 7.9 Predictors of depression

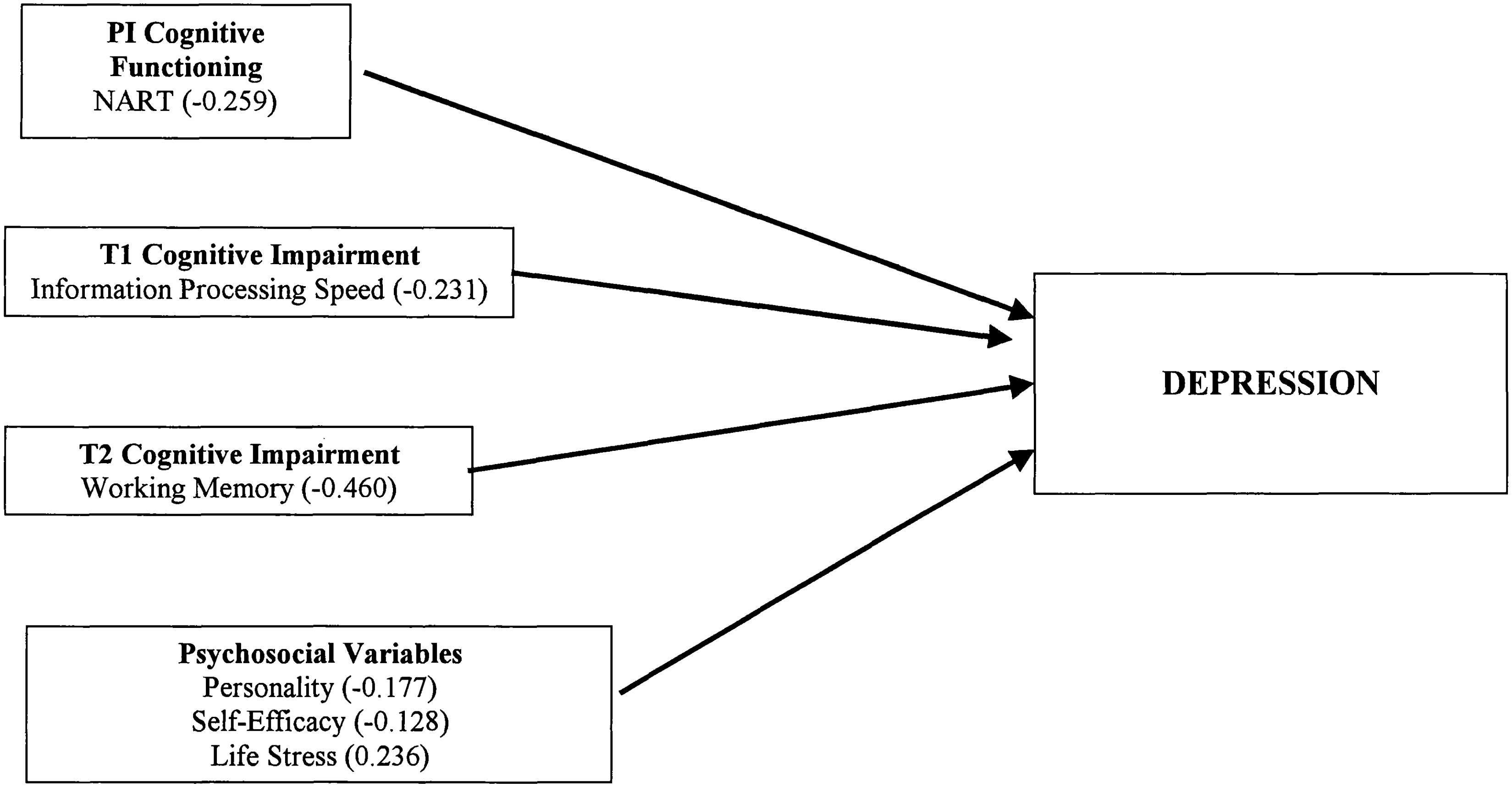


Figure 7.10 Predictors of returning to PI employment status

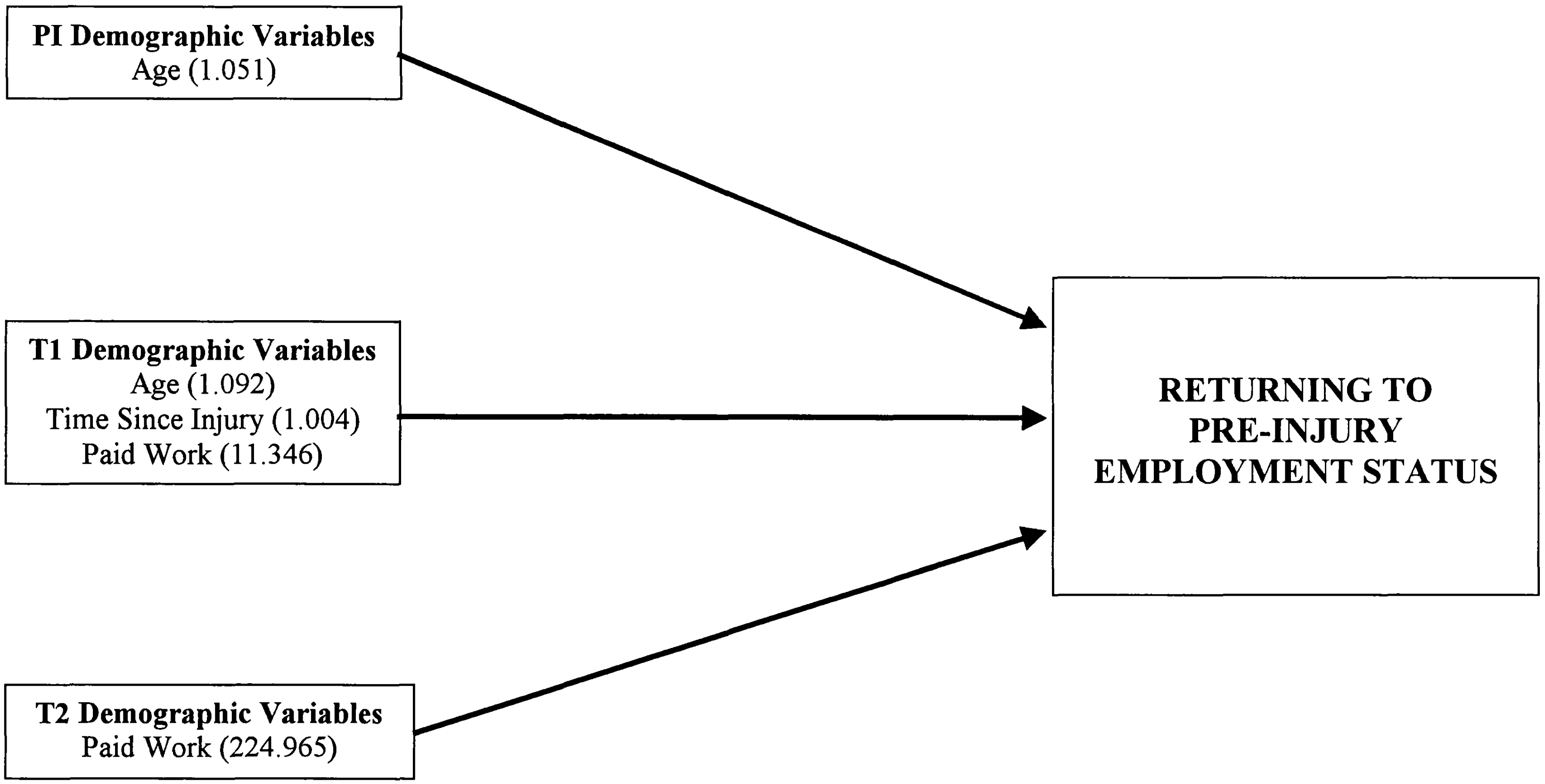
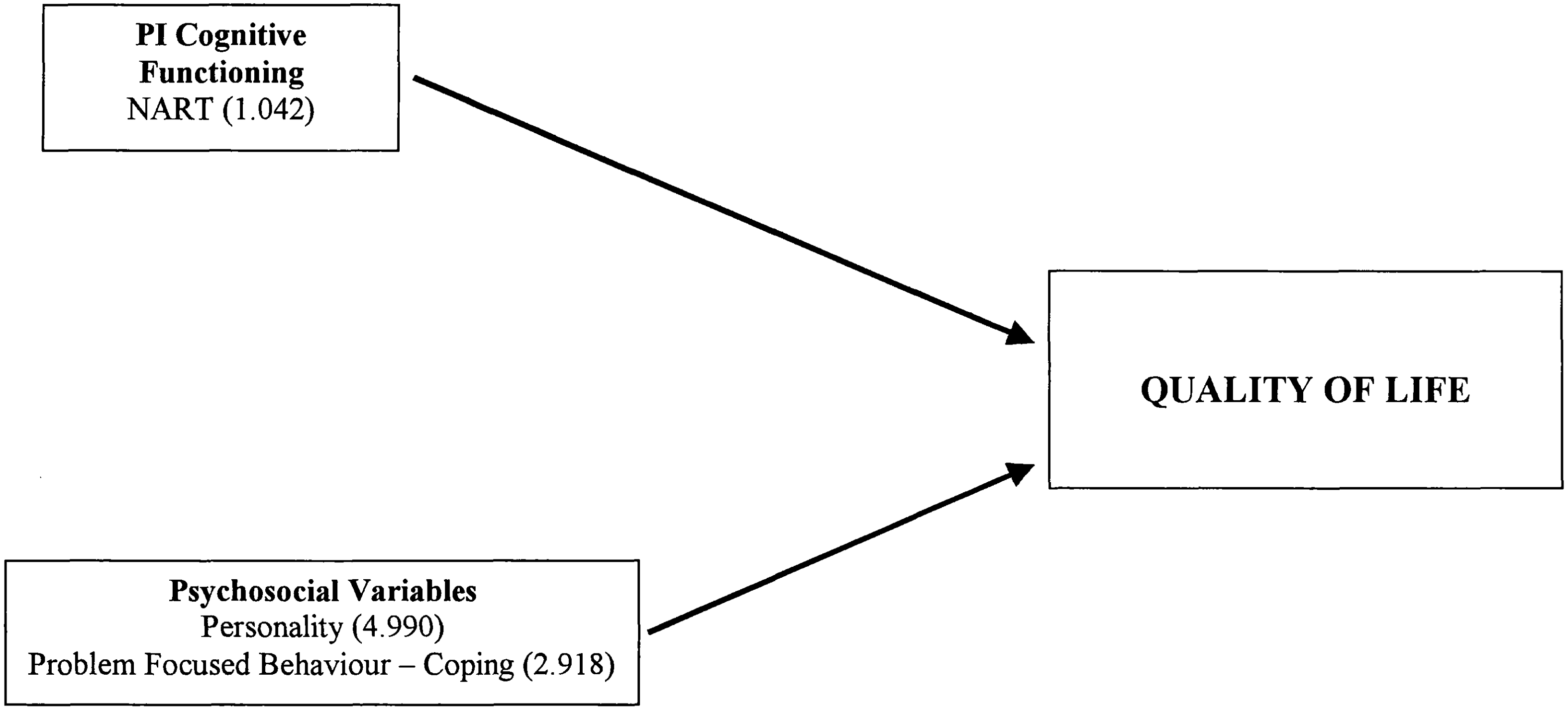


Figure 7.11 Predictors of QoL



7.14 Significant Predictors of Outcome

Models shown in the previous section depict all variables that were found to significantly contribute to each of the regressions after grouping variables into demographic, neuropsychological and psychosocial categories, and by time in terms of whether variables were in relation to PI, T1 or T2. However, the following analyses identifies which of these variables (IVs) are most important, for each outcome (DVs), when considered together. Results presented in Tables 7.39 and 7.40 are of each model. As would be expected, the independent variables had a significant overall predictive effect on all outcome variables. However, several independent variables no longer made significant contributions to each outcome.

Variables that significantly contributed to community integration were gender, relationship status at T2, personality, competency, self-efficacy and personal control – causal attribution. Together these variables accounted for 48% of the variance in community integration. Evaluation of standardised coefficients suggests that gender and personality make the largest contribution to the predictive model.

Relationship status at T2, personality, problem focused behaviour – coping, self-efficacy and personal control – causal attribution were all found to be important when predicting the variance of satisfaction with life. These significant contributors accounted for 51% of the variance, and personality contributed to the greatest degree.

Anxiety was significantly predicted by personality, self-efficacy, life stress, and religion – coping, with 44% of the variance explained. Personality and self-efficacy contributed the most to the regression. Personality, self-efficacy and life stress were once again found to be important, this time when predicting depression. They explained 46% of the variance, and personality again made the largest contribution to the model.

Being in paid work at T2 understandably contributed to the prediction of returning to PI employment status, and accounted for 76% of the variance. No other variables added significantly to the model. Personality and problem focused behaviour – coping were the important predictors in explaining 32% of the variance in QoL.

It is clear that important variables are of a psychosocial nature when determining the majority of outcomes. Neuropsychological variables do not feature as significant contributors in any model, and although some demographic variables made significant contributions, psychosocial variables made larger contributions. Personality and self-efficacy are present in the majority of models predicting the different dimensions of outcome, and they also appear to exert the strongest influence out of all predictors.

Table 7.39 Summary of multiple regression analyses for the significant demographic variables, cognitive domains and psychosocial components predicting community integration, satisfaction with life, anxiety and depression (see appendix 4.22 for full version)

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.479	10.197**		
Gender			0.269	3.866**
Relationship Status at T2			-0.167	-2.295*
Personality			0.266	2.947**
Competency			0.140	2.111*
Self-Efficacy			0.198	2.278*
PC – Causal Attribution			-0.133	-2.020*
SWLS	0.510	14.509**		
Relationship Status at T2			0.219	3.205**
Personality			0.356	4.136**
PFB – Coping			0.187	2.990**
Self-Efficacy			0.281	3.343**
PC – Causal Attribution			0.163	2.595*
Anxiety	0.443	18.226**		
Personality			-0.334	-3.775**
Life Stress			0.272	3.992**
Religion - Coping			0.132	1.979*
Self-Efficacy			-0.312	-3.468**
Depression	0.460	19.448**		
Personality			-0.514	-5.732**
Life Stress			0.162	2.418*
Self-Efficacy			-0.185	-2.112*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PC – Personal Control; PFB – Problem Focused Behaviour
*p<0.05 ** p<0.01

Table 7.40 Summary of logistic regression analyses for the significant demographic variables, cognitive domains and psychosocial components predicting employment status and QoL (see appendix 4.23 for full version)

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	109.223**	0.762	91.6		
Paid Work at T2				29.202**	127.743
QoL	30.771**	0.321	80.9		
Personality				13.426**	2.834
PFB - Coping				7.034**	2.069

Class. – Classification; PFB – Problem Focused Behaviour

* $p<0.05$ ** $p<0.01$

Chapter 8: General Discussion

8.1 Research Aims

An aim of this research was to evaluate long term multidimensional outcome after brain injury, and to examine possible relationships between each outcome dimension. Assessments of neuropsychological functioning at early and late stages post injury were evaluated to investigate change in cognitive impairment over time, and cognitive abilities were compared to PI estimates to examine the impact of injury. It was hoped to identify the most significant variables that influence long term outcome after brain injury, and to establish the nature of the relationship between significant predictor variables. The theoretical model proposed by Kendall and Terry (1996) was used as a framework. It depicts appraisal and coping as mediating relationships between cognitive functioning, personal resources, environmental factors, and situational factors, with multidimensional psychosocial adjustment. Kendall and Terry also suggested that neurological factors, PI functioning and cognitive functioning will have a direct association with psychosocial adjustment. These theoretical relationships were evaluated to determine their influence over psychosocial adjustment at late stages post brain injury.

8.2 Summary of Findings

Aim 1: The findings indicated that long term outcome after brain injury, in the current sample, was not as poor as hypothesised. The two outcome variables that showed greatest impairment of function were community integration and returning to PI employment status. These were the only two outcome measures that were compared to PI measures, the former case rated by the participant at T2. This finding confirmed the hypothesis. However, other hypotheses were rejected because outcome measures of independent living, QoL, satisfaction with life, and emotion were not found to be reduced.

Aim 2: The majority of the six outcomes were significantly correlated, supporting the hypotheses. However, only three associations had coefficients above the 0.5 cut off recommended by Cohen (1988) to indicate a large correlation. Therefore, constructs assessed by the outcome measures appeared to be distinct enough from one another to imply that each construct should be measured when evaluating multidimensional outcome after brain injury.

Aim 3: Impairments were evident when considering the neuropsychological profile of the group, as predicted in the hypotheses. This was true at both T1 and T2, even though the mean PI estimate of intellectual functioning was no higher than average. At T1, performance on a test of recognition memory of words, and a test of learning capacity were below the average range, whereas at T2 deficits were evident on tests of visual recall memory and information processing speed.

This pattern of performance was substantiated when comparing scores with PI levels of intellectual functioning. When comparing performance between assessments, a difference was evident on tests of working memory and visuospatial reasoning, with both tests showing an improvement over time, a finding which was contrary to the direction of the difference expected in the hypotheses.

Aim 4: The hypothesis predicting that time since injury would be associated with all outcomes was rejected. However, as hypothesised, length of time spent in education was positively associated with both community integration and employment status. Furthermore, greater education was also associated with lower levels of depression and better QoL. Age at all time points was negatively correlated with employment status, and age at T2 with community integration. Therefore, findings only partially supported the hypotheses that age would be correlated with all outcomes. The prediction that gender would not have an association with any outcome was not supported because it was found that being female correlated with better community integration. All associations summarised were found to be significant, but weak.

Aim 5: As hypothesised, demographic variables had a direct predictive effect on community integration, and returning to PI levels of employment. Demographic variables also reliably predicted satisfaction with life. Predictive relationships with all three outcomes were consistent, regardless of the time point at which variables were measured, i.e. relationship status at PI, T1 or T2. The particular variables that contributed to predictive models, and strength of prediction was dependent on the specific outcome variable. Gender was a consistent predictor of community integration, whilst years of education was predictive when demographic variables measured at PI and T2 were included. Relationship and employment status were significant predictors except for PI employment status, and relationship status at T1. When including variables at T1 the only other predictor of community integration was age.

Injury severity was a consistent predictor of satisfaction with life, contributing to variables at all time points. However, employment status at T1 also made a significant contribution, as did relationship status at T2. Returning to PI employment status did not have a predictor that was present throughout all time points. Interestingly, PI employment status was not a predictor. However, employment status was a predictor at T1 and more reliably at T2. Age was predictive of returning to PI employment status when considered at PI and T1. The only other predictor was length of time since injury at T1.

As would be expected, predictors accounted for greater amounts of variance in all outcomes as the time since injury when they were assessed increased i.e. the inclusion of demographic variables assessed at T2 accounted for more variance than demographic variables at PI and T1. The outcome variable that was predicted most accurately was returning to PI employment status. The high predictability of this measure was understandable since one of the demographic predictor variables was employment status and therefore, highly related to this particular outcome. Of the other two outcomes, prediction of community integration from demographic variables was more reliable than prediction of satisfaction with life.

Aim 6: All correlations between cognitive variables and outcomes were generally weak with only a few of moderate strength. However, in contrast to the hypotheses, significant associations were evident between some cognitive variables and the outcomes of anxiety and depression.

Aim 7: Cognitive functioning was predictive of some outcomes, but was dependent on time of assessment. Pre-injury intellectual functioning was predictive of all outcomes except for employment status. However, only small amounts of the variance in each outcome were accounted for. The most reliably predicted outcome was community integration, with just 9% of the variance explained, whereas only 3.5% of the variance was accounted for in anxiety, the least reliably predicted outcome. Although PI intellectual functioning was predictive of all outcomes, cognitive functioning at T1 was only directly predictive of community integration, satisfaction with life and depression. Information processing speed was the sole significant predictor in the former and latter outcome variables, whereas visuospatial reasoning was predictive of satisfaction with life. Once again, small amounts of variability were explained. The same three outcome variables of community integration, satisfaction with life and depression were again significantly predicted by cognitive functioning at T2. Working memory was the sole predictor of each outcome, but greater degrees of variability were explained here than by cognitive functioning at T1. Employment status was also directly predicted by cognitive functioning at T2, however, no individual aspect of cognition contributed significantly. Both anxiety and depression were accounted for by cognitive functioning at some time point, so hypotheses that suggested otherwise were rejected. Furthermore, QoL was not predicted by cognitive functioning at any time point, once again contrary to the hypotheses.

Aim 8: Evidence was found of appraisal and coping variables acting as mediators between cognitive functioning at T1 and outcome variables. Self-efficacy was particularly important because it acted as a mediator in all three outcomes of community integration, satisfaction with life and depression. In the former case, it was the sole mediator, however, the coping strategies of problem focused behaviour and problem focused cognitions were additional mediators between visuospatial reasoning and satisfaction with life. Using problem focused behaviour as a coping strategy also acted as a mediator between information processing speed and depression. An indirect relationship was evident between working memory at T2 and the outcome variables of satisfaction with life and depression with self-efficacy acting as a mediator. However, a mediation effect was not found between working memory and community integration.

Aim 9: As hypothesised, personality was significantly correlated with all outcomes, suggesting that a better self-concept and low neuroticism related to a more positive outcome. All associations were strong, with the exception of employment status and QoL. Another variable identified as being associated with all outcomes was self-efficacy, with a more positive self-efficacy rating reflecting a better outcome. Use of an avoidance coping strategy was also found to be positively related to anxiety and depression, but negatively related to satisfaction with life. However, the hypothesis that predicted an association between social support and outcome was not supported.

Aim 10: Evidence that appraisal and coping factors mediated the relationship between predictor variables and psychosocial outcome was not found, meaning the hypothesis was rejected. Furthermore, a consistent moderating effect was not apparent because only use of an avoidance coping style acted as a moderator, in this case between personality and anxiety. However, when appraisal and coping were considered along with other psychosocial variables, as direct predictors of outcome, every outcome measured was reliably predicted, accounting for large amounts of the variance.

Further Analyses: When all variables that had significantly contributed to each outcome were combined (regardless of whether they were demographic, neuropsychological or psychosocial variables), the variables found to be most important were those of personality and self-efficacy. These two variables consistently contributed strongly to the prediction of most outcomes, with the exception of employment status and, in the case of self-efficacy, QoL.

8.3 *Discussion of Results*

8.3.1 *Outcomes*

Independent Living

The high proportion of participants found to be living independently was consistent with the reports of Dikmen et al. (2003) and Hoofien et al. (2001). Participants did not seem to require supervision when going about their daily routines, implying that those who had physical disabilities, or experienced neurobehavioural deficits, had been able to accommodate them and manage them sufficiently well, to the point that care support was not required. However, caution is needed when interpreting data from the Supervision Rating Scale, as the apparent good recovery of the cohort may just reflect insensitivity of the measure to distinguish between subtle changes of independent living. This ceiling effect has also been reported by others (Hall et al., 2001). However, when publishing the scale, Boake (1996) reported a broad range of supervision levels required by his cohort. Furthermore, the measure itself specifically assesses levels of supervision needed and does not account for quality of independent living. For example, a person may be capable of living alone, but levels of domesticity, such as hygiene and cooking, may be far reduced from what they achieved prior to injury.

Community Integration

Levels of community integration were not so promising. A significant reduction was exhibited by participants compared to PI injury levels. Interestingly, home integration was not reduced and, although not significant, an increase in ratings was found. This finding may reflect greater time spent in the home as a result of disability, a view supported by the high number of unemployed participants, allowing them to carry out more jobs around the house. The work of participants is accounted for in the productive activity subscale of the CIQ and employment status is therefore also reflected in this measure.

Although retrospective ratings have been suggested as a useful method of obtaining control data (Corrigan & Deming, 1995; Dijkers, 1997), these recommendations were made in the context of far shorter follow-up periods than the one employed in this study. Therefore, retrospective ratings in this study should be considered with caution. However, PI ratings reported by this cohort were comparable to those from a sample reported by Corrigan and Deming less than 12 months post injury. The ability to obtain retrospective ratings using the CIQ is further supported by the fact that the measure asks for ratings regarding factual aspects of the respondent's living situation, minimising the degree of interpretation required when responding to an item, e.g. *Who usually prepares meals in your household?* When making their ratings, the participant had to consider present levels of community integration in comparison to those estimated prior to injury, which produced interesting findings. Participants perceived themselves as having less involvement in the community, even 10 years after injury, information consistent with levels of community integration reported by other studies after brain injury (Colantonio et al., 2004; Dijkers, 1997; Willer et al., 1994). Yet, when compared to scores reported by control participants, the brain injured participant's level of community integration appears to be compromised (Willer et al., 1994). Other reports suggested that increases in levels of community integration can be experienced in early years post injury (Corrigan et al., 1998; Seale et al., 2002). If this was experienced by the cohort in this study, the early gains must have plateaued and may even have receded, or at the very least did not continue into the later stages of recovery, suggesting that the negative impact of brain injury on community integration was long lasting.

Life Satisfaction

Based on the SWLS mean rating, the participants appeared to be neither satisfied nor dissatisfied with their lives. As with community integration, scores reported in this study were comparable to other brain injured cohorts (Brzuzy & Speziale, 1997; Corrigan et al., 2001; Heinemann & Whiteneck, 1995). However, if ratings are compared with those of non-injured samples, level of life satisfaction seems to be lower (Dijkers, 2004). At first this does not seem surprising. It would be astonishing to think that the experience of having the injury did not negatively affect participant's perceptions of, and satisfaction with, their lives. Yet, it was a surprise to find that participants were not more dissatisfied with their lives. The SWLS specifically asks the respondent to think about whether they would have changed anything in their life. The traumatic event of sustaining a brain injury would appear to be an obvious life event that would be considered when responding to this item. However, perhaps the lack of dissatisfaction with life is influenced by length of time that has passed since injury, allowing for a degree of psychological adjustment to take place, and resulting in the event being perceived more positively than at a shorter time after injury. Any financial compensation received as a result of the injury might also reduce negative feelings about how the injury was sustained, a particular issue for the sample in this study, which contained a high number of litigants. Participants will also have had time to adapt to the change in lifestyle imposed by injury, thus their expectations about the impact of injury will have been modified. This explanation was also suggested by Hoofien et al. (2001) when they interpreted positive ratings made by relative's regarding their injured partner's family functioning.

Emotion

Despite many studies having reported a high prevalence of anxiety and depression in samples with traumatic brain injury, the cohort in this study did not report any serious emotional disorders. Only seven participants were suffering from severe anxiety and only three participants from severe depression. Information regarding the prevalence of emotional dysfunction at earlier stages post injury was not available for this study, but literature suggests some participants will have experienced feelings of anxiety and depression (McKinlay et al., 1981). Therefore, it would appear that emotional symptoms of this kind are largely resolved at late stages after injury, a finding contrary to Fordyce et al. (1983), who concluded that after head trauma, anxiety and depression become worse over time. It is clear that the nature and course taken by emotional symptoms after head injury needs further investigation. An assessment at just one time point, as in this study, is not sufficient to elucidate the patterns of emotional disorder that may exist. For example, if assessed in a further years time, the anxiety and depression experienced by the few participants at T2, may have resolved, or indeed their symptoms may have become more chronic. In addition, the apparent positive finding of this study may be influenced by several issues. For example it is possible the participants completed the questionnaires while they were having a 'good' day, and as such their responses may not accurately reflect their actual day-to-day level of mood. The participants who did not respond to the original letter requesting their participation may experience mood disorders, which negatively influenced their decision to reply. The HADS is a fairly superficial measure more suited for use as a screening tool, and therefore it may not have been sensitive enough to subtle mood symptoms.

Employment Status

Data from this study is consistent with others that show high levels of unemployment after traumatic brain injury. The large decrease in employment status, between T1 and T2, is similar to reports of employment at earlier stages post injury (Brooks et al., 1987). Participant's employment status at T2 was also comparable to the cohort in Colantonio et al.'s (2004) study at a similar follow-up time (mean 14.2 years). They reported 29.1% in full-time employment and 52.4% unemployed, compared to 36.6% and 42.7% in this study. These data support Oddy's (2003) conclusion that most people who return to work do so by 2 years post injury. Only a further 10 participants had obtained full-time employment between T1 and T2 and less than half of participants had managed to return to PI employment status at T2. It is clear that the impact of brain injury on employment status forces a long term change in social role, the effects of which have been touched upon in other areas of outcome, such as community integration. However, it must be remembered that a high proportion of the sample were involved in litigation after injury, and therefore may well have received some compensation as a result. Although, not accounted for in this study, any financial compensation would go towards alleviating the need to return to work after injury. Furthermore, participants might also feel justified in not seeking work if the settlement went in their favour. As a consequence, the high number of litigants recruited for this study may have resulted in an under-estimate those who return to employment at late stages after brain injury.

Quality of Life

A more subjective measure of outcome after brain injury is how people perceive their current QoL. The majority of participants made a rating that was good, very good or excellent, a pattern of results that was very similar to that found by Dawson et al. (2000) using an identical scale. However, their cohort was only four years post injury, which implies that QoL, as viewed by a brain injured person, may remain stable over many years post injury. It is possible that many different conceptualisations of the term 'quality of life' were employed by participants because when rating QoL, people tend to compare their actual situation to expectations of what they perceive their situation should be, or would like to be. These expectations are continuously being modified in response to circumstances (Brown et al., 2000; Dijkers, 2003). Therefore, the fact that participants perceived their QoL as good (or better) suggests that, with time, they have accepted their situation, and made necessary adjustments to accommodate it.

Multidimensional Outcome

Most outcome measures did not result in such negative findings as predicted by hypotheses, with the exception of employment status, and the social integration and productive activity subscales of the CIQ. This pattern is reflected in associations between outcome dimensions. Employment status had no associations with any outcome, except for a weak correlation with community integration, a finding contrary to other reports that have found employment to be associated with outcomes such as life satisfaction (Corrigan et al., 2001; Mailhan et al., 2005). As already mentioned, the concept of community integration partly incorporates employment, therefore evidence of this relationship was not surprising. However, the lack of associations involving employment status suggested that this outcome dimension is distinct from others, implying that returning to PI employment was not an important factor when determining QoL, life satisfaction, anxiety or depression. As mentioned earlier, the majority of those unemployed at T2 were also out of work at T1. Therefore, these participants will have had a long time to adjust to this negative outcome of their injury, perhaps enabling them to come to terms with their different social role. Consequently, employment status was less associated with other dimensions of outcome at late stages post injury.

Strongest associations included the variable of depression with community integration and satisfaction with life, as well as the obvious relationship with anxiety. The correlation between depression and community integration may reflect the social isolation experienced by many people who survive brain injury. It has been well documented that a reduced social network is common after brain injury (Oddy et al., 1985), and greater social isolation may lead to lower mood. However, the strong influence of personality across all outcomes found in this study suggested that this was a more significant factor influencing depression. Depressed individuals are likely to withdraw from their usual activities resulting in less community integration (Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2003). In turn the subjective life satisfaction of the individual may be affected, as reported by Mailhan et al. (2005), because they do not experience many positive, enjoyable aspects to life as once they might have done.

In this study, outcomes were generally not as well correlated as reported elsewhere (Hall et al., 2001), suggesting that notions of outcome, when applied long term after brain injury, consists of several dimensions, as indicated by Boake and High (1996) in their discussion of outcome measures. However, no one measure is capable of accounting for all dimensions of outcome, consequently, data from this study suggested that a comprehensive assessment of long-term outcome, needs to include a number of scales relating to areas of functional and emotional outcome, as well as QoL.

8.3.2 Neuropsychological Profile

Reduced cognitive functioning, in comparison to PI estimates, was found at both T1 and T2, supporting findings of others (Johnstone et al., 1998; Millar, Nicoll, Thornhill, Murray, & Teasdale, 2003). Therefore, cognitive abilities should not be expected to return to pre-injury levels, even at very late stages after injury, a finding that does not support Lewin et al. (1979) who argued that even after very severe injury, persisting mental disability is likely to be uncommon.

An important finding of this study was that there appeared to be no deterioration of intellectual ability over time after injury, between T1 and T2. Indeed, in tests of visuospatial reasoning and working memory, an improvement was identified. The lack of evidence suggesting progressive cognitive decline supports the findings of Newcombe (1996). It also bodes well when considering the potential, after brain injury, for accelerated cognitive ageing. However, studies that have reported early cognitive ageing (Walker and Blumer, 1989; Corkin et al., 1989; Plassman et al., 2000) involved older participants than were included in this study (many of the current cohort were in middle or late-middle age, possibly still too early to reveal signs of premature cognitive ageing). Studies by Walker and Blumer (1989) and Corkin et al. (1989) also incorporated longer follow-ups than this study (45 years and 40 years respectively), suggesting that 10-30 years after injury may not be long enough to sufficiently assess the impact of injury on long term cognitive abilities. However, these studies were able to achieve such long follow-ups because, unlike this study, the cohorts consisted of ex-servicemen. The fact that these individuals had experienced the effects of first hand combat, in addition to predominantly suffering a penetrating head injury, set this population apart from individuals suffering closed head injuries. Therefore, evidence of cognitive ageing in studies that include ex-servicemen may not provide an accurate representation of participants such as those in this study. It should also be noted the length of time post injury at T1 and T2 varied for each participant in this study. Indeed T1 for some participants was very similar to T2 for others (e.g. 10 years post injury). Therefore, the distinction between time points in this study may not be clear enough to sufficiently determine any real change over time. Furthermore, it was only possible to directly compare a few tests between T1 and T2 in this study. This was due to the lack of tests administered at T1 and the construction of modern tests differing from those used in earlier assessments. However, other published studies include a variable range of tests, many of which involve a superficial form of cognitive assessment (for example, Plassman et al., 2000). Therefore, a study incorporating a more comprehensive assessment, using a test-retest design, will produce more reliable findings.

8.3.3 Demographic Variables

Age, at all time points, was found to have significant associations with the outcome variable of employment status, supporting previous findings (Lewin et al., 1979; Ruff et al., 1993). The finding that younger individuals were more likely to return to PI employment status after brain injury also lends general support to Groswasser et al.'s (1999) conclusion that an upper age limit of 45 years determines the likelihood of getting back to work. As would be expected from the associations, age also contributed to the prediction of employment status. However, its importance at PI and T1 was not translated to T2. The inclusion of the predictor variable that indicated whether the participant was in work at T2 may have lessened the influence of the participant's age at this time. The finding that gender strongly influenced community integration has been reported by other users of the CIQ (Dijkers, 1997). Females were better integrated into the community, which may be due to the home integration subscale of the measure being biased towards the stereotypical role of the housewife, or those who were not in work.

Injury severity was only associated with life satisfaction. Those with less severe injuries were more satisfied with their lives. However, it is interesting to note that this was the only dimension of outcome to be influenced by injury severity, confirming the impression that its importance as an outcome variable reduces over time (Brooks et al., 1986; Groswasser et al., 1999). A sense of life satisfaction is something that may be influenced by injury severity at later stages of recovery because the concept requires an evaluation of life over a period of time, including the time between injury and follow-up. Individuals who experience a large number of problems post injury (and more severely injured people would be expected to have more problems at the acute stage of recovery) may reflect on these problems and express less satisfaction with their life. All other outcome measures included in this study only relate to present (long term) circumstances of the individual and thus were less susceptible to the influence of factors, such as injury severity, that might have a greater impact during the intervening period between injury and assessment.

Demographic variables were only predictive of satisfaction with life, community integration and returning to PI employment status. Variables that were consistently found to be important across all these outcomes consisted of demographic information that would not change (e.g. injury severity, age, gender and years of education) regardless of the time point they were assessed (i.e. T1 or T2). Therefore, it appears that demographic information regarding the participant, at the time of injury, plays a more consistent role in accounting for some outcome dimensions, than demographic information that may change throughout the course of time post injury. However, the transient variable of relationship status was only identified as a significant variable predicting community integration at PI and T2. The implication is that being in a relationship at these times reduces a person's level of community integration. One explanation for this finding is that a healthy partner would provide support and carry out tasks that otherwise would be performed by the brain injured person, thereby reducing the chance of integration. Being in a relationship at T2 is also an important demographic variable when predicting life satisfaction. However, in this case, having a partner improves the outcome, a finding consistent with previous research (Warren et al., 1996), and therefore does not support the idea that the benefit of being married during early recovery diminishes over time (Corrigan et al., 2001). Being in paid work at both T1 and T2 was, not surprisingly, found to be important regarding the chances of returning to PI employment status in the long term. Therefore, as mentioned earlier, it would seem that efforts to get the participant back to work as soon as possible after injury are worthwhile because employment status does not appear to change greatly over time (Oddy, 2003).

It has previously been suggested that being in work prior to injury is an important factor predicting outcomes (Felmingham et al., 2001), but this suggestion was not supported in this study. This finding might reflect the longer follow-up incorporated in this study, in comparison to many other studies. However, the large proportion of the cohort that were in full-time employment prior to injury, and the consequent limited variability within the data, may also have restricted the extent to which PI employment status could impact on outcome (Brooks et al., 1987). Literature also suggests that outcome measures specifically reflecting employment would be particularly affected by PI employment status. However, the outcome measure used in this study identified whether participants had managed to return to PI levels of employment. Therefore, the measure accounted for the pre-injury work status of individuals, and was selected because it would be unrealistic to expect participants who were not able to obtain work before injury to have gained employment after injury. However, by using such a measure, the influence of being in work prior to injury is diminished when considering employment outcome at T2.

8.3.4 Cognitive Variables

Estimates of PI intellectual functioning influenced all outcomes, except employment status. The importance of PI cognitive ability to early adjustment was reported by Hanks et al. (1999), in the context of a more general rehabilitation sample that included orthopaedic and spinal injury patients, as well as those who were brain injured. However, cognitive ability at T1 was not found to reliably predict all outcomes, but only community integration, life satisfaction and depression. Interestingly, employment status was not accounted for, which is contrary to reports of early cognitive assessment being a predictor of later employment (Sherer, Novack et al., 2002; Sherer, Sander et al., 2002). This could be due to the high proportion of the cohort who were not in work at T2, but may also reflect a waning influence of cognitive impairment as time post injury increases. Particular cognitive functions that were found to be important were information processing speed and visuospatial reasoning, supporting the findings of others (Klonoff et al., 1986; Ross et al., 1997).

Working memory was the main neuropsychological factor at T2 that was predictive of community integration, satisfaction with life and depression. This finding supports the usefulness of performing cognitive assessments in relation to well-being (Klonoff et al., 1986) and community integration (Ross et al., 1997). The relationship between working memory and depression could exist because those who still experience problems due to poor working memory at later stages of recovery have not been able to adjust to persisting difficulties, and therefore become more susceptible to experiencing low mood. This view was supported by the finding that self-efficacy acted as a mediator between impairment in working memory and both depression and satisfaction with life. Inability to adjust to cognitive difficulties could lead to participants having a low perception of their ability to deal with situations effectively, which in turn might lead to low mood and dissatisfaction with life.

8.3.5 Psychosocial Variables

The major psychosocial component that was associated with all outcomes was personality. A good self-concept and few neurotic traits were related to better outcomes of all dimensions. This predicted finding supported other reports, suggesting that the personality trait of neuroticism is a potential risk factor of poor outcome after brain injury (Malec et al., 2004; Schretlen, 2000). A further variable consistently associated with all outcomes was self-efficacy. Perceiving oneself as capable of dealing with problems and situations appears important to achieving good outcome. Interestingly those variables that did not show associations with any outcomes included social support and functional competency. The former variable has often been documented as essential to improving the chance of good recovery (Oddy et al., 1985; Thomsen, 1984; Webb et al., 1995), but at later stages post injury, the influence of social support appears to reduce.

The finding that ability to perform functional tasks is not associated with outcome is also contrary to that implied by literature at earlier stages post injury (Doig et al., 2001; Greenspan et al., 1996). A possible explanation for the discrepancy is that compensatory strategies, such as external aids, might be more efficiently employed at later stages in recovery to help overcome difficulties performing functional tasks, whereas at earlier stages of recovery, individuals might not be able or willing to use strategies, or strategies might not yet be in place. Coping styles, generally, were not found to be strongly associated with outcomes. However, the avoidance coping component was the exception. This included denial, self-blame, avoiding the issue by performing other tasks, taking out frustration on others, and turning to drugs and alcohol (see section 6.6.5). Not surprisingly, use of these negative approaches in coping, were related to poorer community integration, life satisfaction, greater anxiety and depression. These findings were similar to those documented by others (Malia et al., 1995; Moore & Stambrook, 1994).

8.3.6 The Multivariate Model

Aspects of the model proposed by Kendall and Terry (1996) that are specific to brain injury have already been touched upon when discussing the results. Only the working memory factor of cognitive impairment was found to have both a direct and indirect predictive relationship with any outcome variables. Demographic variables including the neurological factor of injury severity, and measures of PI functioning, such as being in paid work, were shown to reliably predict only the outcomes of community integration, life satisfaction and depression.

The cognitive-phenomenological theory of stress and adjustment proposed by Lazarus and Folkman (1984) forms the theoretical basis for the model proposed by Kendall and Terry (1996). However, there was no support for the theory that psychosocial variables, such as personal and environmental resources and situational factors, predict psychosocial adjustment through the mediation of appraisal and coping variables. When proposing the model to account for individual differences in outcome after brain injury, Kendall and Terry did not specify a time frame whereby the model could be most appropriately applied, something which is also true of the theory of stress and adjustment. However, it is fair to assume that the impact of an event is at its greatest (and resources needed to adjust are at their most limited) soon after the event. Therefore, the ability of the model to explain psychosocial adjustment achieved at very late stages after brain injury may be limited. At late stages, the impact of brain injury sequelae will have decreased, and experiential learning during the time since injury could enable individuals to increase their levels of awareness (Powell, Machamer, Temkin, & Dikmen, 2001) and adjust to their situation and circumstances in a way they would not have done at an earlier stage of recovery. In other words the injury itself is of less importance than its psychological and social consequences. These determine whether injured people can resume work, or re-integrate into the community, or be free of emotional disorders.

One explanation for not finding that appraisal and coping acted as mediators between predictors and outcomes could be that the power of the analyses was low. However, principal components analyses reduced the number of predictor variables that were included, and the final regression, when testing for mediation, included a maximum of eight predictor variables for each outcome measure. According to the formula given by Tabachnick and Fidell (2001): $N > 50 + 8m$ (where m = number of independent variables), the sample size, in the case of eight predictor variables, would need to be 114. Our sample of 131 exceeds this number and therefore suggests that the results can be reliably generalised.

A further possibility could be that relationships between variables represented in the theory are not accurate. Holmbeck (1997) evaluated much literature that tests for, or proposes mediation and moderation effects, and concluded that great inconsistency exists. Furthermore, Holmbeck cites Lazarus and Folkman's (1984) theory as a prime example whereby the distinction between moderators and mediators is confused, and suggests that although the diagram of the model shows a mediational effect, when Lazarus and Folkman describe the theory, a moderational process is suggested. If this is so, appraisal and coping variables are not determined by psychosocial factors, before they in turn influence outcome. Instead appraisal and coping variables influence the ability of psychosocial variables to determine outcome. This rationale might explain the absence of a mediation effect, however in this study, there was also no evidence of a moderation effect. Therefore, it would appear that appraisal and coping variables do not significantly influence the extent of relationships between psychosocial predictors, such as environmental and personal resources and situational factors, with long term outcome. However, when appraisal and coping variables were added to psychosocial variables to predict outcomes, self-efficacy was found to play an additional important part in accounting for community integration, life satisfaction, anxiety and depression.

Making a distinction between demographic, cognitive and psychosocial variables obviously results in components of each being identified as predictors of outcome. It may not always be possible for an assessment to be made that incorporates measures from each of the variable categories, therefore, carrying out the analyses in this way is useful. Identifying whether a person is likely to achieve a good outcome, based on just their demographic information, may be helpful before going on to perform a neuropsychological assessment, or administering psychosocial measures. However, when combining important predictors from each of the categories, some predictors no longer made significant contributions. This was the case for all cognitive variables that had previously been shown to account for some part of the outcomes. Variation existed between groups of remaining variables that reliably predicted each outcome. Often, the variation reflected particular idiosyncrasies of outcomes that were identified in earlier prediction analyses. For example, gender was found to be most important concerning community integration, while being in paid work was important at T2, when trying to predict whether a person will return to PI employment status. Interestingly, recent life events that have been experienced also added to the possibility of experiencing emotional symptoms. However, consistent across all outcomes was the influence of personality and self-efficacy. A good self-concept, few neurotic personality traits, and a good self-efficacy, predicted most outcomes reasonably well.

The findings of this study also suggested that the time when predictor variables were assessed was important. A comparison can be made between the predictability of demographic and cognitive variables at PI, T1 and T2. On all outcome dimensions that were significantly predicted at all time points, an increasing trend was present in the amount of variance explained by the predictors as time progressed. The one exception to this pattern involves cognitive variables predicting satisfaction with life. The variance explained at T1 was greater than at both PI and T2. However, the variance at all three times was low, below 9%. Of course, the same comparison cannot be made when considering psychosocial variables, because these were only assessed at T2. This area needs to be explored to identify when these variables become more important than cognitive and demographic variables when predicting long term outcome.

When predictors were combined, the variance explained by regression models ranged between 32% for QoL and 76% for employment status. These levels of predictability compare well with other studies. For example, the amount of variance in community integration explained in this study (48%) was greater than other studies. In a severely brain injured cohort, Doninger et al. (2003) only explained 14% of the variance in community integration, including cognitive and health measures as predictors. Ross et al. (1997) found that age, the Rey Auditory Verbal Learning Test (Lezak, 1995) and the Trail Making Test were able to account for just 33% of the variance in community integration at one year post-injury. However, Corrigan et al. (1998) included a range of demographic and functional predictor measures, which explained 45% of the variance in community integration up to 5 years post injury.

In the same study, predictors were found to account for only 5% of the variance in satisfaction with life, far less than the 51% explained variance in this study. However, Smith et al. (1998) found that measures of social support, health and community integration predicted 35% of the variance in life satisfaction (measured by the Life Satisfaction Index-A (Adams, 1969)) in a predominantly severely injured cohort at least one year post injury. Corrigan et al. (2001, p.553) stated that *"In the general population, as much as half of the variance in subjective well-being may be determined by individual personality or socioeconomic factors…".*

This observation may explain why the predictors in this study (including measures of personality) were able to account for larger amounts of variance than in other literature.

Anxiety and depression are rarely used as outcome measures in prediction studies, but more commonly as predictors themselves. However, Williams et al. (1998) reported that anxiety and depression in participants between 9 months and 5 years post injury, were predicted by locus of control, in terms of causal attribution of the injury, accounting for 29% and 23% of the variance respectively. Of course more predictors were investigated in this study, which may explain the greater variance explained in both anxiety (44%) and depression (46%).

In this study the high amount of variance explained when predicting whether participants had returned to pre-injury levels of employment (76%), appeared to be predominantly influenced by inclusion of the variable indicating whether participants were in paid work at T2. Felmingham et al. (2001) reported a higher degree of predictability (89%) of employment status at 2 years post discharge from rehabilitation, when including premorbid and injury-related variables, but also psychosocial variables, such as community integration and employment status on discharge from rehabilitation. However, Dawson and Chipman (1995) only managed to account for 16% of the variance in working handicap at 13 years post injury, with age and presence of physical environmental barriers making significant contributions. No aspect of employment was included as a predictor in

Dawson and Chipman's study, perhaps explaining the discrepancy between their model's predictive ability, and the models in this study.

Quality of life was the outcome dimension that had the lowest variance explained by the predictors in this study (32%). However, Steadman-Pare, Colantonio, Ratcliff, Chase and Vernich (2001) were able to explain 55% of the variance in the QoL of participants ranging from 8 to 24 years post injury, by including measures of health, gender, emotional support, and work and leisure in their model. Despite the predictors included in this study not appearing to predict QoL as well as other studies, the ability of the predictor variables to account for outcome dimensions was generally good. It should be particularly noted that the high level of predictability was achieved with only a relatively small number of variables making significant contributions (the maximum number of significant predictors was six), suggesting that the importance lies in the nature of the variables that were included, rather than the number of variables included.

8.4 Limitations

Several issues need to be considered when interpreting findings of this study. The approach that was used to gather participants inherently introduced the possibility of responder bias. Those individuals located had retained the same address for a long period of time, implying a stable lifestyle and opportunity for good community support. Respondents might also have been those who made the best personal adjustment after injury and therefore, were more willing to take part in the study. However, this may have been counteracted by some participants, who perhaps were not so well adjusted, believing they would benefit from being involved.

The make up of the final cohort in the study needs consideration. The sample was not representative of the population with traumatic brain injury both in terms of proportional distribution of injury severity and in terms of the proportion involved in litigation after injury. These factors have important implications regarding the extent to which findings can be generalised. The combination of injury severities within the sample restricts the ability to infer similar findings for the population as a whole because there is an over-representation of severe injuries in the cohort of this study. Likewise, because the cohort did not exclusively consist of those with severe injuries, results cannot be generalised to this group either. In the light of these issues the findings may be influenced by such artefacts of the study, which therefore go some way to explaining discrepancies with existing literature.

The high proportion of participants that were involved in litigation at T1 could well be a confounding variable that influenced outcome findings. At T1, the concern is that litigants may be exaggerating negative aspects of their situation. In contrast, at T2 the compensation that litigants may have received on completion of the litigation process may have influenced their situations in a positive respect. Both instances would result in the findings not being an accurate reflection of the population with traumatic brain injury.

The use of modern versions of neuropsychological tests in the study resulted in a major drawback. The ability to make inferences about cognitive change between T1 and T2 was limited because tests were not exactly the same at both time points, the procedure did not reflect a test-retest design. Therefore, the difficulty of tests administered at each time differed. Although selected tests ensured up to date norms were used in interpreting test performance, an alternative approach would have been to employ a test-retest approach and make a correction for scores obtained at T2 to compensate for the use of out dated norms.

When selecting each of the questionnaires, primary importance was given to the ease with which they could be understood and completed, because the inability of participants to understand measures could lead to low completion rates. Furthermore, because participants were asked to complete a high number of measures, each measure had to be reasonably concise. As a result, the shortened versions of several measures were included. Although these precautionary measures were taken, the completion rate of between 66-80% was disappointing, and may have reflected the time needed to complete a large number of measures. A further limitation was that some measures did not show good internal consistency. This was particularly the case regarding the measure of coping styles (the Brief COPE), possibly due to each subscale consisting of only two items.

Having collected data, the missing values needed to be addressed. The majority of missing values were related to the cognitive assessment data obtained at T1. However, a thorough missing value analysis was conducted and data was found to be missing completely at random, suggesting that any bias due to missing data was minimised. Despite this assurance, having missing data was not ideal, and therefore the possibility that this influenced the findings cannot be ruled out.

An additional problem when using self-report questionnaires concerns the accuracy of responses, because many brain injured participants potentially lack insight (Prigatano & Altman, 1990; Prigatano & Klonoff, 1998). However, this study attempted to circumvent this problem, by requesting proxy ratings on some questionnaires, and by having a significant other present during interview. In fact, the participants over-stated their problems in comparison to ratings given by significant others on the Patient Competency Rating Scale (Prigatano & Altman, 1990), the measure of awareness used in this study. Whatever the level of insight demonstrated by the cohort, the fact that questionnaires were left with participants to complete meant the reliability of responses could not be ensured, and as a result, findings should be interpreted with caution. A related issue to awareness is the way executive dysfunction was accounted for within the study. The Dysexecutive Questionnaire – Other Scale (Wilson et al., 1996) was originally selected as a measure of dysexecutive behaviour problems. However, the score from this measure was found to be highly correlated with that of the Patient Competency Rating Scale, and consequently had to be omitted from analyses. This process limited the ability to account for the ways in which executive problems could have influenced findings. For example, it is not known how many participants were unable to return to pre-injury levels of employment because of difficulties with planning and organising their behaviour. Impairment of executive functioning may also have led participants to have difficulty in maintaining relationships due to disorganised behaviour.

The final limitations to be mentioned concern the design of the study. Findings that involve comparing data between T1 and T2 could be influenced by the fact that the actual time since injury of T1 and T2 varied for each participant. It was not possible to have a consistent time since injury for each participant at both T1 and T2, resulting in a wide range in time since injury at both times. However, possibly of more importance was the maximum limit at T1 and the minimum limit at T2, both being 10 years post injury. This design meant that data would have been collected at similar times since injury for different participants, but classified differently as either T1 or T2. As such, when interpreting the comparisons of data between T1 and T2, consideration must be given to the fact that findings might not accurately reflect differences between specified times since injury, but rather change over variable amounts of time for each participant.

The design of the study was such that some of the predictor variables were assessed at the same time as outcome variables. Therefore, some of the predictor variables could also be construed as assessing other aspects of long term outcome after brain injury. However, of primary importance to this study was investigating the way variables interact with one another before influencing multidimensional outcome. The nature of the relationship between variables that might predict outcome was consequently hypothesised, with Kendall and Terry's (1996) model forming the conceptual basis of the analyses. This along with the ICIDH-2 model

(WHO, 2001), determined those variables that were deemed predictors and outcomes. Furthermore, no mention is made of the time when predictor variables should be assessed in either model, so the theoretical basis of each was deemed to apply when all components of the models were assessed concurrently.

The study is limited in its ability to predict long term outcome at early stages after brain injury because psychosocial predictor variables were assessed at T2, the same time as the outcomes were assessed. However, the findings do provide details regarding characteristics of individuals at late stages after injury, and their relation to outcome. Consequently, the information provides an understanding of the possible risk factors at late stages of outcome, which can be used to direct rehabilitation goals at earlier times post injury. However, the findings need to be treated as exploratory until such time as they can be confirmed in a prospective study.

8.5 Implications for Rehabilitation

An implication of this study is that the findings provide a focus for rehabilitation interventions at early stages after brain injury. Of importance at this stage is the re-introduction of the participant to some form of employment. It would appear that if this is not achieved early then the likelihood of individuals obtaining employment at a later date is greatly reduced. Vocational rehabilitation programmes have been found to be successful (Wall, Rosenthal, & Niemczura, 1998; Wehman et al., 1993; Wehman, Kreutzer, West, & al, 1990), and McMillan and Oddy (2001) stated that in the UK supported employment schemes are increasingly being developed in the independent sector, although they acknowledge these are rarely found in the NHS. Interventions may need to address cognitive impairments in order to resume employment, (McMillan & Greenwood, 2003; McMillan & Oddy, 2001), but in the long term it does not appear that cognitive ability contributes to the chance of achieving good outcomes. However, it is not clear whether returning to work has any influence concerning outcomes other than employment status. It does not appear that being in work is related to QoL, whereas an association with relationship status does appear to exist. Therefore, the partner of the brain injured person should be educated about the consequences of the injury, which is done in many rehabilitation programmes (Prigatano, 1986a), and given support whilst trying to cope (Oddy, 2003), increasing the likelihood of the relationship surviving. Furthermore, efforts should be made to improve social skills of brain injured participants and to increase their social network. Experiencing life stressors leads to a greater possibility of emotional disorder, and thus training participants to use coping techniques other than avoidance strategies could be beneficial. However, some variables do impact on the majority of outcomes and thus targeting these during rehabilitation may demonstrate a generic improvement in outcome. For example, improving the person's perception of themselves in terms of their self-efficacy and self-concept is particularly important according to the results of this study and therefore, should be a focus of post acute rehabilitation. Oddy comments that psychotherapy should form part of any comprehensive rehabilitation service and evidence suggests that it can improve feelings of self-value (Prigatano, 1986a; Thompson, Sobolew-

Shubin, Grahan, & Janigian, 1989). The finding that good long term outcome after brain injury has been achieved by some participants is perhaps the greatest legacy of this study. Although many participants had not returned to pre-injury levels of functioning, there was evidence of good adjustment and an absence of significant deterioration in many areas. However, this finding was in the absence of knowledge about the duration and quality of rehabilitation that some participants might have experienced or other variables that could have had an impact in the early years post injury.

8.6 Future Directions

The findings of this study suggest that several avenues for further exploration would be worthwhile. A difficulty when interpreting results of this study was the lack of comparable studies that also evaluate very long term outcome. The difference in length of follow-ups across studies introduces a confounding variable when comparing results of this study to outcome studies conducted at earlier stages after injury. The influence of predictive factors, such as social support, injury severity, functional competency and cognitive ability, at earlier stages post injury appears to reduce to an extent where they are no longer of importance at late stages of recovery. Therefore, of great necessity is a study utilising prospective methodology, that investigates the timing when variables that result from injury, including neurobehavioural sequelae, begin to become less predictive of multidimensional outcome. Identifying this time would enable clinicians to begin targeting those factors that remain influential for the longest time, and as a consequence, are the greatest hindrance to successful recovery. A related study needs to establish the nature of relationships between each factor at earlier times post injury because it appears this is when injury-related factors are most important. It may also be the case that appropriate appraisal and selection of coping strategies are more critical at earlier stages post injury than was found in this study. Confirming the findings of this study using a prospective methodology would enable the identification of individuals who are 'at-risk' of having a poor long term outcome. Consequently, resources could be allocated more effectively in early stages of recovery to prevent a poor outcome.

8.7 Conclusion

A cross-sectional follow-up study was conducted to evaluate long term outcome after brain injury. Aims included identifying variables that are important in predicting multidimensional outcome and establishing the nature of the interaction between these predictors. A large cohort of people who had suffered a traumatic brain injury at least 10 years previously participated. They were interviewed and neuropsychologically assessed, and then asked to complete questionnaires measuring a variety of psychosocial factors identified in literature as being related to outcome after brain injury. Quality of life and emotional outcomes after brain injury were not found to be as compromised in the long term, as hypothesised. However, employment status and levels of community integration were more severely affected. The initial effects of injury appeared to have a long lasting impact in limiting the capacity to work. Brain injury also appeared to have a long term effect on cognitive ability, in that recovery rarely reached pre-injury levels. However, deterioration of cognitive functions did not appear to occur, therefore individuals could be able to adapt to their new level of intellectual ability and learn to compensate for impairments. Demographic and cognitive factors both predicted multidimensional outcome at this late stage post injury when considered independently of each other, and of psychosocial variables. However, when combined, the latter set of factors played a more important role, over-powering the influence of demographic and cognitive variables. The relationship between psychosocial variables and outcome did not conform to the cognitive-phenomenological theory of stress and adjustment. Appraisal and coping variables did not influence the relationship by acting as mediators or moderators. However, in the form of self-efficacy, they were found to influence outcome directly. Other important variables that consistently influenced all outcomes included self-concept and personality type, and the amount of variance explained by these variables was good in comparison to other reports in the literature.

Limitations were evident within the study, which restricts the extent to which findings can be generalised. The sample was not representative of the population with traumatic brain injury because those with severe injuries were over-represented, and also a majority of the cohort were involved in litigation after injury. Much of the information was obtained by self-completed measures, which introduced issues of awareness and reliability. The design limits the ability to draw conclusions regarding prediction of long term outcome at early stages post injury because some predictor variables were not assessed until the same time that outcome was assessed. Therefore, in order to further establish the course and nature of long term recovery after brain injury, prospective longitudinal studies need to be conducted that assess a variety of different outcomes, and incorporate a number of potential important predictors such as injury characteristics and psychosocial variables. Assessment points need to be frequent establishing the exact times when sequelae of injury become less important.

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Appendices

Appendix 1

Appendix 2

Appendix 3

Appendix 4

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Appendix 1

Appendix 1.1

Approach Letter

Dear ....

I hope you don't mind me writing to you like this, but you were seen by Professor Rodger Wood / Dr. Rodger Weddell for a neuropsychological examination many years ago, following your head injury. We are currently carrying out a national study on the long term effects of head injury.

We would like to invite you to take part in a neuropsychological examination that will involve completing some measures of memory and information processing, and some questionnaires. We are happy to visit you at your home to carry out these tests to minimise any inconvenience to you. The results of any tests we carry out will be reported back to you if you wish, or we will provide the information to your GP.

We would very much appreciate your cooperation, and enclose an information sheet about the study to help you make your decision. If you are willing to participate in the study, please complete and return the enclosed reply form in the envelope provided.

Yours sincerely

Neil Rutterford

Appendix 1.2

Patient Information Sheet

The Significant Factors Influencing Outcome after Brain Injury

Dear........

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the study?

This study aims to discover more about what factors, after acquiring a brain injury, are associated with the individual's return to normal living. By assessing a wide range of areas regarding the effects of the injury, it is hoped that it will be possible to identify those areas that predict the ability to resume as normal a life as possible.

Why have I been chosen?

We are asking many people who have been assessed by Professor Rodger Wood and also those who have been assessed by Dr. Rodger Weddell as part of their hospital assessment.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. This will not affect the standard of care you receive or any future financial settlements.

What do I have to do?

Taking part in this study will involve completing a number of questionnaires as well as completing some neuropsychological tests administered by the trained researcher. This can be done in your own home and will take approximately 3 hours. More than one period of time can be arranged to carry out the assessment if this is more convenient.

A member of your family, or a close friend who knows you well is also asked to complete some questionnaires to give their views.

The questions will centre around your circumstances and feelings since before the injury up to the present time.

Your medical records may also need to be accessed by the researcher in order to minimise the amount of information that has to be asked of you directly.

Will my taking part in the study be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential.

What will happen to the results of the research study?

The findings of the study will be written up and submitted for publication in a relevant academic journal. In addition the results will also form a part of the primary researcher's own Ph.D. studies. The study is likely to be completed by the end of 2005. You will of course not be identified in any report or publication.

What would happen if something went wrong?

We do not anticipate that participation in the study would result in any harm. However, if you are harmed by taking part in this research project, there would be no special compensation arrangements. If you were harmed due to someone's negligence, then you may have grounds for a legal action but you may have to pay for it. Regardless of this, if you wished to complain about any aspect of the way you have been approached or treated during the course of this study, should you choose to participate, the normal University of Wales, Swansea complaints mechanisms might be available to you.

Who has reviewed the study?

The study has been reviewed and approved by the ethics committee of the University of Wales, Swansea.

Thank you for reading this summary.

With kind regards,

Neil Rutterford
Primary Researcher
Department of Psychology
University of Wales, Swansea
Tel: 01792 295928
Email: n.a.rutterford@swansea.ac.uk

Appendix 1.3

Reply Form

Name..............................

Address...

....

....

....

Contact Telephone Numbers: Daytime........................

.

Evening........................

Please delete as appropriate.

I **do / do not** wish to be contacted to discuss my participation in your study investigating the long term effects of head injury.

Appendix 1.4

Consent Form

Identification Number:

Researcher: Neil Rutterford
Telephone: 01792 295928

The Significant Factors Influencing Outcome after Brain Injury

Please place your initials in the appropriate box for each statement:

1. I have read and understood the information sheet about this study ☐

2. I have had the opportunity to ask questions about this study ☐

3. I have received satisfactory answers to any questions I may have had ☐

4. I have received sufficient information about the study to allow me to decide whether I would like to take part ☐

5. I understand that neither myself or my family are obliged to take part in the study and that I can withdraw at any time without affecting my own or my family's future care ☐

6. I am willing to allow access to my medical records but understand that strict confidentiality will be maintained (the purpose of this is to minimise the amount of information that has to be asked to me directly, as it may be in the notes) ☐

7. I agree to participate in the study ☐

Now please PRINT your name below, and then sign on the relevant line:

.... (Participant's name)

Signed...(Participant) Date...........

Signed...(Researcher) Date...........

Appendix 1.5

Ethics Approval Letters

Department of
Psychology

ETHICS
COMMITTEE

Memo

To: **Neil Rutterford**

From: Professor David Clark, Chair of Ethics Committee

CC: Professor Rodger Wood

Date: 18th June, 2002

Re: **The influence of litigation on course of recovery and social outcome after brain injury**

Your proposed study, The influence of litigation on course of recovery and social outcome after brain injury, has now been reviewed. Provided the information obtained is kept absolutely confidential and that no personally identifiable is entered on computer, it was agreed that no substantive ethical issues are raised and you may therefore proceed with your study.

Morgannwg
Health

LOCAL RESEARCH ETHICS COMMITTEE
Chairman : Mr Scott Pegler - Drug Information Pharmacist
Secretary : Mrs Nicola John - Consultant in Pharmaceutical Public Health
Administrator : Miss Lawmary Champion
Direct Telephone : 01792 - 607416
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Internet: http://www.morgannwg-ha.wales.nhs.uk

Your ref / Eich cyf:

Our ref / Ein cyf:
2002.088

Enquiries to / Holwch:
Lawmary Champion

Direct Dial No. / Rhif Deialu Uniongyrchol:
Extension 7416

Mr Neil Rutterford, Professor Rodger Wood
Primary Researcher
University of Wales
Dept of Psychology
Singleton Park
SWANSEA SA2 8PP

04/07/02

Dear Mr Neil Rutterford, Professor Rodger Wood

2002.088 **The influence of litigation on course of recovery and social outcome after brain injury**

I acknowledge receipt of your amendments received all as outlined in your letter dated 25th June 2002, as requested by the Committee. I am now pleased to advise that the above Study has been approved from an ethical perspective via Chairman's Action, and registered.

Please quote our Reference Number in all future correspondence. Chairman's Action Aproval will be ratified by the Committee at its July 22nd 2002 meeting and also note :

1 The enclosed document is confidential and not for publication
2 Any publication resulting from the Protocol must define how subjects were chosen and to what extent they were volunteers.
3 That the form of consent must be read and signed by each subject or, if oral consent has been approved by the Committee, that the consent of each subject must be appropriately recorded. In either case, forms and records must be kept for subsequent examination, if required, by the Committee
4 That changes to the Protocol as approved must be referred to the Committee
5 Ethical approval does not imply acceptance of materials and drug costs by the Authorities or provider units
6 Any untoward incident which occurs in connection with this Protocol must be reported back to the Chairman of the Committee **without delay**.

Yours sincerely

NICOLA JOHN
CONSULTANT IN PHARMACEUTICAL PUBLIC HEATH
DIRECTORATE OF PUBLIC HEALTH
& SECRETARY OF THE LOCAL RESEARCH ETHICS COMMITTEE
cc

Appendix 2

Appendix 2.1

SUPERVISION RATING SCALE

Instructions: Circle the rating that is closest to the amount of supervision that the patient *actually* receives. “Supervision” means that someone is responsible for being with the patient.

Rating	Description
	Level 1: INDEPENDENT
1	The patient lives alone or independently. Other persons can live with the patient, but they cannot take responsibility for supervision (for example, a child or elderly person).
2	The patient is unsupervised overnight. The patient lives with one or more persons who *could* be responsible for supervision (for example, a spouse or roommate), but they are *all* sometimes absent overnight.
	Level 2: OVERNIGHT SUPERVISION
3	The patient is only supervised overnight. One or more supervising persons are always present overnight but they are *all* sometimes absent for the rest of the day.
	Level 3: PART-TIME SUPERVISION
4	The patient is supervised overnight and part-time during waking hours, but is allowed on independent outings. One or more supervising persons are always present overnight and are also present during part of waking hours every day. However, the patient is sometimes allowed to leave the residence without being accompanied by someone who is responsible for supervision.
5	The patient is supervised overnight and part-time during waking hours, but is unsupervised during working hours. Supervising persons are *all* sometimes absent for enough time for them to work full-time outside the home.
6	The patient is supervised overnight and during most waking hours. Supervising persons are *all* sometimes absent for periods longer than one hour, but less than the time needed to hold a full-time job away from home.

7 The patient is supervised overnight and during almost all waking hours. Supervising persons are *all* sometimes absent for periods shorter than one hour.

Level 4: FULL-TIME INDIRECT SUPERVISION

8 The patient is under full-time indirect supervision. At least one supervising person is *always* present, but the supervising person does not check on the patient more than once every 30 minutes.

9 Same as #8 plus requires overnight safety precautions (for example, a deadbolt on outside door).

Level 5: FULL-TIME DIRECT SUPERVISION

10 The patient is under full-time direct supervision. At least one supervising person is always present and the supervising person checks on the patient more than once every thirty minutes.

11 The patient lives in a setting in which the exits are physically controlled by others (for example, a locked ward).

12 Same as #11 plus a supervising person is designated to provide full-time line-of-sight supervision (for example, an escape watch or suicide watch).

13 The patient is in physical restraints.

Appendix 2.2

COMMUNITY INTEGRATION QUESTIONNAIRE

Please complete this questionnaire in relation to your ***present*** circumstances.

1. Who usually does the shopping for groceries or other necessities in your household?	○ Yourself alone ○ Yourself and someone else ○ Someone else
2. Who usually prepares meals in your household?	○ Yourself alone ○ Yourself and someone else ○ Someone else
3. In your home who usually does the everyday housework?	○ Yourself alone ○ Yourself and someone else ○ Someone else
4. Who usually cares for the children in your home?	○ Yourself alone ○ Yourself and someone else ○ Someone else ○ Not applicable, No children under 17 in the home
5. Who usually plans social arrangements such as get-togethers with family and friends?	○ Yourself alone ○ Yourself and someone else ○ Someone else
6. Who usually looks after your personal finances, such as banking or paying bills?	○ Yourself alone ○ Yourself and someone else ○ Someone else
7. Approximately how many times a month do you usually participate in shopping *outside* your home?	○ Never ○ 1-4 times ○ 5 or more
8. Approximately how many times a month do you usually participate in leisure activities such as movies, sports, restaurants, etc.	○ Never ○ 1-4 times ○ 5 or more
9. Approximately how many times a month do you usually visit your friends or relatives?	○ Never ○ 1-4 times ○ 5 or more

Please complete page two

COMMUNITY INTEGRATION QUESTIONNAIRE (Page 2)

10. When you participate in leisure activities do you usually do this alone or with others?	○ Mostly alone ○ Mostly with friends who have head injuries ○ Mostly with family members ○ Mostly with friends who do not have head injuries ○ With a combination of family and friends
11. Do you have a best friend with whom you confide?	○ Yes ○ No
12. How often do you travel outside the home?	○ Almost every day ○ Almost every week ○ Seldom/never (less than once per week)
13. Please choose the answer that best corresponds to your current (during the past month) work situation:	○ Full-time (more than 20 hours/week) ○ Part-time (less than or equal to 20 hrs/week) ○ Not working, but actively looking for work ○ Not working, not looking for work ○ Not applicable, retired due to age
14. Please choose the answer that best corresponds to your current (during the past month) school or training program situation:	○ Full-time ○ Part-time ○ Not attending school, or training program ○ Not applicable, retired due to age
15. In the past month, how often did you engage in volunteer activities?	○ Never ○ 1-4 times ○ 5 or more

Comments:

Appendix 2.3

COMMUNITY INTEGRATION QUESTIONNAIRE

Please complete this questionnaire in relation to your circumstances ***at the time just before*** the injury.

1. Who usually did the shopping for groceries or other necessities in your household?	○ Yourself alone ○ Yourself and someone else ○ Someone else
2. Who usually prepared meals in your household?	○ Yourself alone ○ Yourself and someone else ○ Someone else
3. In your home who usually did the everyday housework?	○ Yourself alone ○ Yourself and someone else ○ Someone else
4. Who usually cared for the children in your home?	○ Yourself alone ○ Yourself and someone else ○ Someone else ○ Not applicable, No children under 17 in the home
5. Who usually planned social arrangements such as get-togethers with family and friends?	○ Yourself alone ○ Yourself and someone else ○ Someone else
6. Who usually looked after your personal finances, such as banking or paying bills?	○ Yourself alone ○ Yourself and someone else ○ Someone else
7. Approximately how many times a month did you usually participate in shopping *outside* your home?	○ Never ○ 1-4 times ○ 5 or more
8. Approximately how many times a month did you usually participate in leisure activities such as movies, sports, restaurants, etc.	○ Never ○ 1-4 times ○ 5 or more
9. Approximately how many times a month did you usually visit your friends or relatives?	○ Never ○ 1-4 times ○ 5 or more

Please complete page two

COMMUNITY INTEGRATION QUESTIONNAIRE (Page 2)

10. When you participated in leisure activities did you usually do this alone or with others?	○ Mostly alone ○ Mostly with friends who have head injuries ○ Mostly with family members ○ Mostly with friends who do not have head injuries ○ With a combination of family and friends
11. Did you have a best friend with whom you could confide?	○ Yes ○ No
12. How often did you travel outside the home?	○ Almost every day ○ Almost every week ○ Seldom/never (less than once per week)
13. Please choose the answer that best corresponded to your (just before the injury) work situation:	○ Full-time (more than 20 hours/week) ○ Part-time (less than or equal to 20 hrs/week) ○ Not working, but actively looking for work ○ Not working, not looking for work ○ Not applicable, retired due to age
14. Please choose the answer that best corresponded to your (just before the injury) school or training program situation:	○ Full-time ○ Part-time ○ Not attending school, or training program ○ Not applicable, retired due to age
15. In the month before injury, how often did you engage in volunteer activities?	○ Never ○ 1-4 times ○ 5 or more

Comments:

Appendix 2.4

SATISFACTION WITH LIFE SCALE

Below are five statements with which you may agree or disagree. Using a 1 to 7 scale, indicate your agreement with each item by placing the appropriate number in the box next to that item. Please be open and honest in your responses. The 7-point scale is:

1 = strongly disagree
2 = disagree
3 = slightly disagree
4 = nether agree nor disagree
5 = slightly agree
6 = agree
7 = strongly agree

☐ In most ways my life is close to ideal.

☐ The conditions of my life are excellent.

☐ I am satisfied with my life.

☐ So far I have got the important things I want in life.

☐ If I could live my life again, I would change almost nothing.

Appendix 2.5

HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS)

Read each item below and **underline the reply** which comes closest to how you have been feeling in the past week. Ignore the numbers printed at the edge of the questionnaire.

Don't take too long over your replies, your immediate reaction to each item will probably be more accurate than a long, thought-out response.

A	D	
		feel tense or 'wound up'
3		Most of the time
2		A lot of the time
1		From time to time, occasionally
0		Not at all
		I still enjoy the things I used to enjoy
	0	Definitely as much
	1	Not quite so much
	2	Only a little
	3	Hardly at all
		I get a sort of frightened feeling as if something awful is about to happen
3		Very definitely and quite badly
2		Yes, but not too badly
1		A little, but it doesn't worry me
0		Not at all
		I can laugh and see the funny side of things
	0	As much as I always could
	1	Not quite as much now
	2	Definitely not so much now
	3	Not at all

	A	D
I feel as if I am slowed down		
Nearly all the time		3
Very often		2
Sometimes		1
Not at all		0
I get a sort of frightened feeling like 'butterflies' in the stomach		
Not at all	0	
Occasionally	1	
Quite often	2	
Very often	3	
I have lost interest in my appearance		
Definitely		3
I don't take as much care as I should		2
I may not take quite as much care		1
I take just as much care as ever		0
I feel restless as if I have to be on the move		
Very much indeed	3	
Quite a lot	2	
Not very much	1	
Not at all	0	

Worrying thoughts go through my mind

3	A great deal of the time
2	A lot of the time
1	Not too often
0	Very little

I look forward with enjoyment to things

As much as I ever did	0
Rather less than I used to	1
Definitely less than I used to	2
Hardly at all	3

I feel cheerful

3	Never
2	Not often
1	Sometimes
0	Most of the time

I get sudden feelings of panic

Very often indeed	3
Quite often	2
Not very often	1
Not at all	0

I can sit at ease and feel relaxed

0	Definitely
1	Usually
2	Not often
3	Not at all

I can enjoy a good book or radio or television programme

Often	0
Sometimes	1
Not often	2
Very seldom	3

Appendix 2.6

QUALITY OF LIFE RATING

Could you rate your current Quality of Life on the following rating scale by circling your response please.

1	2	3	4	5
Poor	Fair	Good	Very Good	Excellent

Appendix 2.7

HEAD INJURY SEMANTIC DIFFERENTIAL

Place a tick between each pair of words to indicate where you think you lie as a person, in general.

Bored	:______:______:______:______:______:______:______:	Interested
Unhappy	:______:______:______:______:______:______:______:	Happy
Helpless	:______:______:______:______:______:______:______:	In control
Worried	:______:______:______:______:______:______:______:	Relaxed
Dissatisfied	:______:______:______:______:______:______:______:	Satisfied
Unattractive	:______:______:______:______:______:______:______:	Attractive
Despondent	:______:______:______:______:______:______:______:	Hopeful
Lacks Confidence	:______:______:______:______:______:______:______:	Self-confident
Emotional	:______:______:______:______:______:______:______:	Stable
Worthless	:______:______:______:______:______:______:______:	Of Value
Forgetful	:______:______:______:______:______:______:______:	Mindful
Irritable	:______:______:______:______:______:______:______:	Calm
Unfeeling	:______:______:______:______:______:______:______:	Caring
Clumsy	:______:______:______:______:______:______:______:	Skillful
Dependent	:______:______:______:______:______:______:______:	Independent
Inactive	:______:______:______:______:______:______:______:	Active
Difficult	:______:______:______:______:______:______:______:	Co-operative
Withdrawn	:______:______:______:______:______:______:______:	Talkative
Unfriendly	:______:______:______:______:______:______:______:	Friendly
Stupid	:______:______:______:______:______:______:______:	Clever

Appendix 2.8

ADULT EPQ-R

INSTRUCTIONS: Please answer each question by putting a circle around the 'YES' or 'NO' following the question. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the questions.

PLEASE REMEMBER TO ANSWER EACH QUESTION

1	Do you have many different hobbies?	YES	NO
2	Do you stop to think things over before doing anything?	YES	NO
3	Does your mood often go up and down?	YES	NO
4	Have you ever taken the praise for something you knew someone else had really done?	YES	NO
5	Do you take much notice of what people think?	YES	NO
6	Are you a talkative person?	YES	NO
7	Would being in debt worry you?	YES	NO
8	Do you ever feel 'just miserable' for no reason?	YES	NO
9	Do you give money to charities?	YES	NO
10	Were you ever greedy by helping yourself to more than your share of anything?	YES	NO
11	Are you rather lively?	YES	NO
12	Would it upset you a lot to see a child or animal suffer?	YES	NO
13	Do you often worry about things you should not have done or said?	YES	NO
14	Do you dislike people who don't know how to behave themselves?	YES	NO
15	If you say you will do something, do you always keep your promise no matter how inconvenient it might be?	YES	NO
16	Can you usually let yourself go and enjoy yourself at a lively party?	YES	NO
17	Are you an irritable person?	YES	NO
18	Should people always respect the law?	YES	NO
19	Have you ever blamed someone for doing something you knew was really your fault?	YES	NO
20	Do you enjoy meeting new people?	YES	NO
21	Are good manners very important?	YES	NO
22	Are your feelings easily hurt?	YES	NO
23	Are *all* your habits good and desirable ones?	YES	NO
24	Do you tend to keep in the background on social occasions?	YES	NO
25	Would you take drugs which may have strange or dangerous effects?	YES	NO
26	Do you often feel 'fed-up'?	YES	NO
27	Have you ever taken anything (even a pin or button) that belonged to someone else?	YES	NO
28	Do you like going out a lot?	YES	NO
29	Do you prefer to go your own way rather than act by the rules?	YES	NO
30	Do you enjoy hurting people you love?	YES	NO

31	Are you often troubled about feelings of guilt?	YES	NO
32	Do you sometimes talk about things you know nothing about?	YES	NO
33	Do you prefer reading to meeting people?	YES	NO
34	Do you have enemies who want to harm you?	YES	NO
35	Would you call yourself a nervous person?	YES	NO
36	Do you have many friends?	YES	NO
37	Do you enjoy practical jokes that can sometimes really hurt people?	YES	NO
38	Are you a worrier?	YES	NO
39	As a child, did you do as you were told immediately and without grumbling?	YES	NO
40	Would you call yourself happy-go-lucky?	YES	NO
41	Do good manners and cleanliness matter much to you?	YES	NO
42	Have you often gone against your parents' wishes?	YES	NO
43	Do you worry about awful things that might happen?	YES	NO
44	Have you ever broken or lost something belonging to someone else?	YES	NO
45	Do you usually take the initiative in making new friends?	YES	NO
46	Would you call yourself tense or 'highly-strung'?	YES	NO
47	Are you mostly quiet when you are with other people?	YES	NO
48	Do you think marriage is old-fashioned and should be done away with?	YES	NO
49	Do you sometimes boast a little?	YES	NO
50	Are you more easy-going about right and wrong than most people?	YES	NO
51	Can you easily get some life into a rather dull party?	YES	NO
52	Do you worry about your health?	YES	NO
53	Have you ever said anything bad or nasty about anyone?	YES	NO
54	Do you enjoy cooperating with others?	YES	NO
55	Do you like telling jokes and funny stories to your friends?	YES	NO
56	Do most things taste the same to you?	YES	NO
57	As a child, were you ever cheeky to your parents?	YES	NO
58	Do you like mixing with people?	YES	NO
59	Does it worry you if you know there are mistakes in your work?	YES	NO
60	Do you suffer from sleeplessness?	YES	NO
61	Have people said that you sometimes act too rashly?	YES	NO
62	Do you always wash before a meal?	YES	NO
63	Do you nearly always have a 'ready answer' when people talk to you?	YES	NO
64	Do you like to arrive at appointments in plenty of time?	YES	NO
65	Have you often felt listless and tired for no reason?	YES	NO
66	Have you ever cheated at a game?	YES	NO
67	Do you like doing things in which you have to act quickly?	YES	NO
68	Is (or was) your mother a good woman?	YES	NO
69	Do you often make decisions on the spur of the moment?	YES	NO
70	Do you often feel life is very dull?	YES	NO
71	Have you ever taken advantage of someone?	YES	NO
72	Do you often take on more activities than you have time for?	YES	NO
73	Are there several people who keep trying to avoid you?	YES	NO
74	Do you worry a lot about your looks?	YES	NO

75	Do you think people spend too much time safeguarding their future with savings and insurance?	YES	NO
76	Have you ever wished that you were dead?	YES	NO
77	Would you dodge paying taxes if you were sure you could never be found out?	YES	NO
78	Can you get a party going?	YES	NO
79	Do you try not to be rude to people?	YES	NO
80	Do you worry too long after an embarrassing experience?	YES	NO
81	Do you generally 'look before you leap'?	YES	NO
82	Have you ever insisted on having your own way?	YES	NO
83	Do you suffer from 'nerves'?	YES	NO
84	Do you often feel lonely?	YES	NO
85	Can you on the whole trust people to tell the truth?	YES	NO
86	Do you always practice what you preach?	YES	NO
87	Are you easily hurt when people find fault with you or the work you do?	YES	NO
88	Is it better to follow society's rules than go your own way?	YES	NO
89	Have you ever been late for an appointment or work?	YES	NO
90	Do you like plenty of bustle and excitement around you?	YES	NO
91	Would you like other people to be afraid of you?	YES	NO
92	Are you sometimes bubbling over with energy and sometimes very sluggish?	YES	NO
93	Do you sometimes put off until tomorrow what you ought to do today?	YES	NO
94	Do other people think of you as being very lively?	YES	NO
95	Do people tell you a lot of lies?	YES	NO
96	Do you believe one has special duties to one's family?	YES	NO
97	Are you touchy about some things?	YES	NO
98	Are you always willing to admit it when you have made a mistake?	YES	NO
99	Would you feel sorry for an animal caught in a trap?	YES	NO
100	When your temper rises, do you find it difficult to control?	YES	NO
101	Do you lock up your house carefully at night?	YES	NO
102	Do you believe insurance schemes are a good idea?	YES	NO
103	Do people who drive carefully annoy you?	YES	NO
104	When you catch a train, do often arrive at the last minute?	YES	NO
105	Do your friendships break up easily without it being your fault?	YES	NO
106	Do you sometimes like teasing animals?	YES	NO

PLEASE CHECK THAT YOU HAVE ANSWERED ALL THE QUESTIONS

Appendix 2.9

RECENT LIFE CHANGES QUESTIONNAIRE

Please could you indicate which of the following life events you have experienced in the past two years by placing a tick in the relevant column next to the relevant event. You will see that the columns have been divided into six monthly intervals. Therefore when reading each item try to remember whether it occurred in the last 6 months, between 6-12 months ago, between 12-18 months ago, or between 18-24 months ago. Having considered this place a tick in the relevant column. If you experienced the event in more than one time range then place as many ticks as is necessary in the relevant columns.

	Months Ago			
Health	0-6	6-12	12-18	18-24
An injury or illness which:				
1. kept you in bed a week or more, or sent you to the hospital				
2. was less serious than above				
3. Major dental work				
4. Major change in eating habits				
5. Major change in sleeping habits				
6. Major change in your usual type and/or amount of recreation				
Work				
7. Change to a new type of work				
8. Change in your work hours or conditions				
Change in your responsibilities at work:				
9. more responsibilities				
10. fewer responsibilities				
11. promotion				
12. demotion				
13. transfer				

	Months Ago			
Troubles at work:	0-6	6-12	12-18	18-24
14. with your boss				
15. with coworkers				
16. with persons under your supervision				
17. other work troubles				
18. Major business adjustment				
19. Retirement				
Loss of job:				
20. laid off from work				
21. fired from work				
22. Correspondence course to help you in your work				
Home and Family				
23. Major change in living conditions				
Change in residence:				
24. move within the same town or city				
25. move to a different town, city, or county				
26. Change in family get togethers				
27. Major change in health or behaviour of family member				
28. Marriage				
29. Pregnancy				
30. Miscarriage or abortion				
Gain of a new family member:				
31. birth of a child				
32. adoption of a child				
33. a relative moving in with you				
34. Spouse beginning or ending work				

		Months Ago			
Child leaving home:		0-6	6-12	12-18	18-24
35.	to attend college				
36.	due to marriage				
37.	for other reasons				
38.	Change in arguments with spouse				
39.	In-law problems				
Change in the marital status of your parents:					
40.	divorce				
41.	remarriage				
Separation from spouse					
42.	due to work				
43.	due to marital problems				
44.	Divorce				
45.	Birth of grandchild				
46.	Death of spouse				
Death of other family member:					
47.	child				
48.	brother or sister				
49.	parent				
Personal and Social					
50.	Change in personal habits				
51.	Beginning or ending school or college				
52.	Change of school or college				
53.	Change in political beliefs				
54.	Change in religious beliefs				
55.	Change in social activities				
56.	Holiday				
57.	New, close, personal relationship				

		Months Ago			
		0-6	6-12	12-18	18-24
58.	Engagement to marry				
59.	Girlfriend or boyfriend problems				
60.	Sexual difficulties				
61.	“Falling out” of a close personal relationship				
62.	An accident				
63.	Minor violation of the law				
64.	Being held in jail				
65.	Death of a close friend				
66.	Major decision regarding your immediate future				
67.	Major personal achievement				
	Financial				
Major change in finances:					
68.	increased income				
69.	decreased income				
70.	investment and/or credit difficulties				
71.	Loss or damage of personal property				
72.	Moderate purchase				
73.	Major purchase				
74.	Foreclosure on a mortgage or loan				

Appendix 2.10

THE SIGNIFICANT OTHERS SCALE
Short (questionnaire) version

Instructions

Listed below are various people who may be important in your life. For each person please circle a number from 1 to 7 to show how well he or she provides the type of help that is listed.

The second part of each question asks you to rate how you would like things to be if they were exactly what you hoped for. As before, please put a circle around one number between 1 and 7 to show what your rating is.

Please note: If there is no such person in your life, please leave that section blank and go on to the next section.

PERSON 1: SPOUSE/PARTNER			NEVER			SOME-TIMES			ALWAYS
1	a)	Can you trust, talk to frankly and share your feelings with your spouse/partner?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
2	a)	Can you lean on and turn to your spouse/partner in times of difficulty?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
3	a)	Does he or she give you practical help?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
4	a)	Can you spend time with him or her socially?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7

PERSON 2: MOTHER									
1	a)	Can you trust, talk to frankly and share your feelings with your mother?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
2	a)	Can you lean on and turn to your mother in times of difficulty?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
3	a)	Does she give you practical help?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
4	a)	Can you spend time with her socially?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7

PERSON 3: FATHER			NEVER			SOME-TIMES			ALWAYS
1	a)	Can you trust, talk to frankly and share your feelings with your father?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
2	a)	Can you lean on and turn to your father in times of difficulty?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
3	a)	Does he give you practical help?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
4	a)	Can you spend time with him socially?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7

PERSON 4: BROTHER/SISTER									
1	a)	Can you trust, talk to frankly and share your feelings with your brother or sister?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
2	a)	Can you lean on and turn to him or her in times of difficulty?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
3	a)	Does he or she give you practical help?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
4	a)	Can you spend time with him or her socially?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7

PERSON 5: SON/DAUGHTER

			NEVER			SOME-TIMES		ALWAYS	
1	a)	Can you trust, talk to frankly and share your feelings with your son or daughter?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
2	a)	Can you lean on and turn to your son or daughter in times of difficulty?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
3	a)	Does he or she give you practical help?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
4	a)	Can you spend time with him or her socially?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7

PERSON 6: BEST FRIEND

1	a)	Can you trust, talk to frankly and share your feelings with your best friend?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
2	a)	Can you lean on and turn to your best friend in times of difficulty?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
3	a)	Does he or she give you practical help?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7
4	a)	Can you spend time with him or her socially?	1	2	3	4	5	6	7
	b)	What rating would your ideal be?	1	2	3	4	5	6	7

Appendix 2.11

DEX QUESTIONNAIRE

This questionnaire looks at some of the difficulties that people sometimes experience. We would like you to read the following statements, and rate them on a five-point scale according to your experience of ______________________ (the participant):

1 Has problems understanding what other people mean unless they keep things simple and straightforward.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

2 Acts without thinking, doing the first thing that comes to mind.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

3 Sometimes talks about events or details that never actually happened, but s/he believes did happen.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

4 Has difficulty thinking ahead or planning for the future.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

5 Sometimes gets over-excited about things and can be a bit ‘over the top’ at these times.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

6 Gets events mixed up with each other, and gets confused about the correct order of events.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

7 Has difficulty realizing the extent of his/her problems and is unrealistic about the future.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

8 Seems lethargic, or unenthusiastic about things.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

9 Does or says embarrassing things when in the company of others.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

10 Really wants to do something one minute, but couldn't care less about it the next.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

11 Has difficulty showing emotion.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

12 Loses his/her temper at the slightest thing.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

13 Seems unconcerned about how s/he should behave in certain situations.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

14 Finds it hard to stop repeating saying or doing things once started.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

15 Tends to be very restless, and 'can't sit still' for any length of time.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

16 Finds it difficult to stop doing something even if s/he knows s/he shouldn't.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

17 Will say one thing, but will do something different.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

18 Finds it difficult to keep his/her mind on something, and is easily distracted.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

19 Has trouble making decisions, or deciding what s/he wants to do.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

20 Is unaware of, or unconcerned about, how others feel about his/her behaviour.

☐0	☐1	☐2	☐3	☐4
Never	Occasionally	Sometimes	Fairly often	Very often

Appendix 2.12

PATIENT COMPETENCY RATING (PARTICIPANT'S FORM)

Instructions

The following is a questionnaire that asks you to judge your ability to do a variety of very practical skills. Some of the questions may not apply directly to things you often do, but you are asked to complete each question as if it were something you "had to do." On each question, you should judge how easy or difficult a particular activity is for you and mark the appropriate space.

Competency Rating

1	2	3	4	5
Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease

______ 1. How much of a problem do I have in preparing my own meals?

______ 2. How much of a problem do I have in dressing myself?

______ 3. How much of a problem do I have in taking care of my personal hygiene?

______ 4. How much of a problem do I have in washing the dishes?

______ 5. How much of a problem do I have in doing the laundry?

______ 6. How much of a problem do I have in taking care of my finances?

______ 7. How much of a problem do I have in keeping appointments on time?

______ 8. How much of a problem do I have in starting conversation in a group?

______ 9. How much of a problem do I have in staying involved in work activities even when bored or tired?

______ 10. How much of a problem do I have in remembering what I had for dinner last night?

1	2	3	4	5
Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease

______ 11. How much of a problem do I have in remembering names of people I see often?

______ 12. How much of a problem do I have in remembering my daily schedule?

______ 13. How much of a problem do I have in remembering important things I must do?

______ 14. How much of a problem would I have driving a car if I had to?

______ 15. How much of a problem do I have in getting help when confused?

______ 16. How much of a problem do I have in adjusting to unexpected changes?

______ 17. How much of a problem do I have in handling arguments with people I know well?

______ 18. How much of a problem do I have in accepting criticism from other people?

______ 19. How much of a problem do I have in controlling crying?

______ 20. How much of a problem do I have in acting appropriately when I'm around friends?

______ 21. How much of a problem do I have in showing affection to people?

______ 22. How much of a problem do I have in participating in group activities?

______ 23. How much of a problem do I have in recognizing when something I say or do has upset someone else?

______ 24. How much of a problem do I have in scheduling daily activities?

______ 25. How much of a problem do I have in understanding new instructions?

1	2	3	4	5
Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease

______ 26. How much of a problem do I have in consistently meeting my daily responsibilities?

______ 27. How much of a problem do I have in controlling my temper when something upsets me?

______ 28. How much of a problem do I have in keeping from being depressed?

______ 29. How much of a problem do I have in keeping my emotions from affecting my ability to go about the day's activities?

______ 30. How much of a problem do I have in controlling my laughter?

Appendix 2.13

PATIENT COMPETENCY RATING (RELATIVE'S FORM)

Instructions

The following is a questionnaire that asks you to judge the participant's ability to do a variety of very practical skills. Some of the questions may not apply directly to things they often do, but you are asked to complete each question as if it were something they "had to do." On each question, you should judge how easy or difficult a particular activity is for them and mark the appropriate space.

Competency Rating

1	2	3	4	5
Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease

______ 1. How much of a problem do they have in preparing their own meals?

______ 2. How much of a problem do they have in dressing themselves?

______ 3. How much of a problem do they have in taking care of their personal hygiene?

______ 4. How much of a problem do they have in washing the dishes?

______ 5. How much of a problem do they have in doing the laundry?

______ 6. How much of a problem do they have in taking care of their finances?

______ 7. How much of a problem do they have in keeping appointments on time?

______ 8. How much of a problem do they have in starting conversation in a group?

______ 9. How much of a problem do they have in staying involved in work activities even when bored or tired?

1	2	3	4	5
Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease

______ 10. How much of a problem do they have in remembering what they had for dinner last night?

______ 11. How much of a problem do they have in remembering names of people they see often?

______ 12. How much of a problem do they have in remembering their daily schedule?

______ 13. How much of a problem do they have in remembering important things they must do?

______ 14. How much of a problem would they have driving a car if they had to?

______ 15. How much of a problem do they have in getting help when they are confused?

______ 16. How much of a problem do they have in adjusting to unexpected changes?

______ 17. How much of a problem do they have in handling arguments with people they know well?

______ 18. How much of a problem do they have in accepting criticism from other people?

______ 19. How much of a problem do they have in controlling crying?

______ 20. How much of a problem do they have in acting appropriately when they are around friends?

______ 21. How much of a problem do they have in showing affection to people?

______ 22. How much of a problem do they have in participating in group activities?

1	2	3	4	5
Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease

______ 23. How much of a problem do they have in recognizing when something they say or do has upset someone else?

______ 24. How much of a problem do they have in scheduling daily activities?

______ 25. How much of a problem do they have in understanding new instructions?

______ 26. How much of a problem do they have in consistently meeting their daily responsibilities?

______ 27. How much of a problem do they have in controlling their temper when something upsets them?

______ 28. How much of a problem do they have in keeping from being depressed?

______ 29. How much of a problem do they have in keeping their emotions from affecting their ability to go about the day's activities?

______ 30. How much of a problem do they have in controlling their laughter?

Appendix 2.14

REVISED CAUSAL DIMENSIONS SCALE (CDSII)

I would like you to think of a reason for you having your injury and write it below please.

____

____

____

Think about the reason for your injury you have written above. The items below concern your impressions or opinions of this cause of your injury. Circle one number for each of the following questions.

Is the cause something:

1. That reflects an aspect of yourself	**9 8 7 6 5 4 3 2 1**	Reflects an aspect of the situation
2. Manageable by you	**9 8 7 6 5 4 3 2 1**	Not manageable by you
3. Permanent	**9 8 7 6 5 4 3 2 1**	Temporary
4. You can regulate	**9 8 7 6 5 4 3 2 1**	You cannot regulate
5. Over which others have control	**9 8 7 6 5 4 3 2 1**	Over which others have no control
6. Inside of you	**9 8 7 6 5 4 3 2 1**	Outside of you
7. Stable over time	**9 8 7 6 5 4 3 2 1**	Variable over time
8. Under the power of other people	**9 8 7 6 5 4 3 2 1**	Not under the power of other people
9. Something about you	**9 8 7 6 5 4 3 2 1**	Something about others
10. Over which you have power	**9 8 7 6 5 4 3 2 1**	Over which you have no power
11. Unchangeable	**9 8 7 6 5 4 3 2 1**	Changeable
12. Other people can regulate	**9 8 7 6 5 4 3 2 1**	Other people cannot regulate

Appendix 2.15

GENERALIZED SELF-EFFICACY SCALE

Please circle the response you think applies to you.

	Not at all true	Barely true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough.	1	2	3	4
2. If someone opposes me, I can find means and ways to get what I want.	1	2	3	4
3. It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4
4. I am confident that I could deal efficiently with unexpected events.	1	2	3	4
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	1	2	3	4
6. I can solve most problems if I invest the necessary effort.	1	2	3	4
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4
8. When I am confronted with a problem, I can usually find several solutions.	1	2	3	4
9. If I am in a bind, I can usually think of something to do.	1	2	3	4
10. No matter what comes my way, I'm usually able to handle it.	1	2	3	4

Brief COPE

We are interested in how people respond when they confront difficult or stressful events in their lives. There are lots of ways to try to deal with stress. This questionnaire asks you to indicate what you generally do and feel when you experience stressful events. Obviously, different events bring out somewhat different responses, but think about what you usually do when you are under a lot of stress.

Then respond to each of the following items by writing the number that corresponds to one of the response choices listed below. Choose your answers thoughtfully, and make your answers as true FOR YOU as you can. Indicate what YOU usually do when YOU experience a stressful event.

1 = I usually **don't do this at all**
2 = I usually **do this a little bit**
3 = I usually **do this a medium amount**
4 = I usually **do this a lot**

1. I turn to work or other activities to take my mind off things. __
2. I concentrate my efforts on doing something about the situation I'm in. __
3. I say to myself "this isn't real". __
4. I use alcohol or other drugs to make myself feel better. __
5. I get emotional support from others __
6. I give up trying to deal with it. __
7. I take action to try to make the situation better. __
8. I refuse to believe that it has happened. __
9. I say things to let my unpleasant feelings escape. __
10. I get help and advice from other people. __
11. I use alcohol and drugs to help me get through it. __

12. I try to see it in a different light, to make it seem more positive. __

13. I criticize myself. __

14. I try to come up with a strategy about what to do. __

15. I get comfort and understanding from someone. __

16. I give up the attempt to cope. __

17. I look for something good in what's happening. __

18. I make jokes about it. __

19. I do something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping. __

20. I accept the reality of the fact that it has happened. __

21. I express my negative feelings. __

22. I try to find comfort in my religion or spiritual beliefs. __

23. I try to get advice or help from other people about what to do. __

24. I learn to live with it. __

25. I think hard about what steps to take. __

26. I blame myself for things that happen. __

27. I pray or meditate. __

28. I make fun of the situation. __

APPENDIX 3

Appendix 3.1

Brief COPE Correlation Matrix

Table 9.1 Brief COPE correlation matrix

	SD	AC	D	SU	ES	IS	BD	V	PR	P	H	A	R
AC	0.132												
D	0.290	-0.109											
SU	0.316	-0.044	0.290										
ES	0.487	0.078	0.327	0.317									
IS	0.244	0.238	0.218	-0.009	0.632								
BD	0.068	-0.182	0.559	0.276	0.173	0.110							
V	0.310	0.009	0.368	0.341	0.557	0.363	0.288						
PR	0.289	0.273	-0.023	-0.052	0.133	0.183	-0.228	0.047					
P	0.184	0.452	-0.167	-0.018	0.212	0.266	-0.394	0.302	0.478				
H	0.234	0.098	-0.042	0.149	0.224	0.084	-0.057	0.151	0.474	0.250			
A	0.008	0.048	-0.173	0.054	0.070	0.017	-0.251	0.128	0.223	0.503	0.149		
R	0.122	0.031	0.320	0.117	0.070	0.023	0.263	0.030	0.278	0.063	-0.071	-0.099	
SB	0.117	-0.092	0.404	0.357	0.253	0.166	0.400	0.506	-0.119	0.022	-0.176	-0.114	0.264

SD - Self-Distraction; AC - Active Coping; D - Denial: SU - Substance Use; ES - Use of Emotional Support; IS - Use of Instrumental Support; BD - Behavioural Disengagement; V - Venting; PR - Positive Reframing; P - Planning; H - Humour; A - Acceptance; R - Religion; SB - Self-Blame

Appendix 3.2

Psychosocial Predictor Variables Correlation Matrix

Table 9.2 Psychosocial predictor variables correlation matrix

	Self-Concept	Psychoticism	Neuroticism	Extraversion	Competency	Awareness	Actual Social Support	Ideal Social Support
Psychoticism	-0.349							
Neuroticism	-0.519	0.332						
Extraversion	0.452	-0.041	-0.233					
Competency	0.470	-0.302	-0.360	0.175				
Awareness	-0.188	0.132	0.205	-0.247	0.458			
Actual Social Support	0.153	-0.247	-0.235	0.161	0.104	-0.247		
Ideal Social Support	0.057	-0.227	-0.103	-0.075	0.108	-0.002	0.589	
Life Events	-0.037	0.391	0.091	0.135	0.001	0.004	-0.112	-0.168

APPENDIX 4

Appendix 4.1

Full Version of Table 7.8

Summary of multiple regression analyses for PI demographic variables predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.238	7.777**		
Severity			-0.078	-0.971
Gender			0.289	3.539**
Years of Education			0.174	2.106*
Age at Injury			-0.090	-0.798
Paid Work			-0.090	-1.143
Relationship Status			-0.238	-2.290*
SWLS	0.085	3.020**		
Severity			-0.316	-3.595**
Gender			-0.081	-0.904
Years of Education			0.111	1.223
Age at Injury			-0.011	-0.092
Paid Work			0.090	1.043
Relationship Status			-0.111	-0.976
Anxiety	-0.001	0.974		
Severity			0.035	0.377
Gender			0.071	0.759
Years of Education			-0.115	-1.216
Age at Injury			-0.068	-0.525
Paid Work			-0.126	-1.392
Relationship Status			0.138	1.160
Depression	0.029	1.645		
Severity			0.027	0.304
Gender			-0.72	-0.786
Years of Education			-0.118	-1.265
Age at Injury			-0.077	-0.610
Paid Work			-0.070	-0.781
Relationship Status			0.232	1.972

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale
* p<0.05 ** p<0.01

Appendix 4.2

Full Version of Table 7.9

Summary of logistic regression analyses for PI demographic variables predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class (%)	Wald Statistic	Odds Ratio
Emp Status	18.998**	0.182	65.6		
Severity				2.872	1.024
Gender				1.082	1.075
Years of Education				1.805	0.895
Age at Injury				4.835*	1.051
Paid Work				1.612	0.364
Relationship Status				0.273	1.317
QoL	11.092	0.124	77.1		
Severity				0.057	1.003
Gender				0.964	0.128
Years of Education				3.375	1.253
Age at Injury				0.025	1.004
Paid Work				0.374	0.610
Relationship Status				2.126	2.451

Class – Classification
* $p<0.05$ ** $p<0.01$

Appendix 4.3

Full Version of Table 7.10

Summary of multiple regression analyses for T1 demographic variables predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.254	7.320**		
Severity			-0.108	-1.374
Gender			0.325	4.057**
Years of Education			0.161	1.940
Age			-0.214	-2.100*
Paid Work			0.106	1.322
Relationship Status			-0.136	-1.410
Time Since Injury			0.144	1.821
SWLS	0.121	3.554**		
Severity			-0.295	-3.469**
Gender			-0.087	-1.001
Years of Education			0.066	0.736
Age			-0.030	-0.274
Paid Work			0.237	2.737**
Relationship Status			-0.115	-1.103
Time Since Injury			-0.008	-0.093
Anxiety	0.011	1.201		
Severity			0.012	0.131
Gender			0.087	0.944
Years of Education			-0.079	-0.825
Age			-0.074	-0.627
Paid Work			-0.202	-2.200
Relationship Status			0.173	1.563
Time Since Injury			0.055	0.602
Depression	0.034	1.647		
Severity			0.021	0.232
Gender			-0.062	-0.683
Years of Education			-0.104	-1.109
Age			-0.068	-0.589
Paid Work			-0.120	-1.321
Relationship Status			0.256	2.335
Time Since Injury			0.072	0.801

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* $p<0.05$ ** $p<0.01$

Appendix 4.4

Full Version of Table 7.11

Summary of logistic regression analyses for T1 demographic variables predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	51.305**	0.437	74.8		
Severity				2.155	1.018
Gender				1.468	0.547
Years of Ed				0.069	0.975
Age				11.205**	1.092
Paid Work				21.439**	11.346
Rel Status				1.259	1.958
Time Since Injury				3.924*	1.004
QoL	11.883	0.133	76.3		
Severity				0.093	1.004
Gender				0.387	1.355
Years of Ed				2.964	1.236
Age				0.041	0.996
Paid Work				1.914	0.497
Rel Status				1.355	1.930
Time Since Injury				0.179	1.001

Class – Classification; Ed – Education; Rel - Relationship

* $p<0.05$ ** $p<0.01$

Appendix 4.5

Full Version of Table 7.12

Summary of multiple regression analyses for T2 demographic variables predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.265	7.698**		
Severity			-0.122	-1.485
Gender			0.279	3.440**
Years of Education			0.163	2.008*
Age			-0.144	-1.623
Paid Work			0.253	3.029**
Relationship Status			-0.196	-2.322*
Time Since Injury			0.080	1.001
SWLS	0.140	4.030**		
Severity			-0.214	-2.417*
Gender			-0.019	-0.211
Years of Education			0.096	1.097
Age			-0.100	-1.043
Paid Work			0.084	0.926
Relationship Status			0.254	2.778**
Time Since Injury			-0.036	-0.415
Anxiety	0.017	1.316		
Severity			-0.021	-0.224
Gender			0.071	0.759
Years of Education			-0.090	-0.964
Age			-0.032	-0.316
Paid Work			-0.209	-2.163
Relationship Status			-0.001	-0.010
Time Since Injury			0.112	1.206
Depression	0.007	1.136		
Severity			0.002	0.017
Gender			-0.087	-0.925
Years of Education			-0.108	-1.147
Age			0.050	0.488
Paid Work			-0.117	-1.210
Relationship Status			0.004	0.043
Time Since Injury			0.080	0.856

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale

* $p<0.05$ ** $p<0.01$

Appendix 4.6

Full Version of Table 7.13

Summary of logistic regression analyses for T2 demographic variables predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	117.268**	0.797	91.6		
Severity				0.060	0.995
Gender				1.924	0.342
Years of Ed				0.378	0.902
Age				0.619	1.026
Paid Work				36.047**	224.965
Rel Status				2.622	3.437
TSI				1.819	1.002
QoL	11.694	0.131	76.3		
Severity				0.085	1.004
Gender				0.044	1.111
Years of Ed				3.140	1.248
Age				0.243	0.990
Paid Work				1.528	0.540
Rel Status				0.441	0.710
TSI				1.992	1.001

Class. – Classification; Ed – Education; Rel – Relationship; TSI – Time Since Injury

* $p<0.05$ ** $p<0.01$

Appendix 4.7

Full Version of Table 7.17

Summary of multiple regression analyses for T1 cognitive domains predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.083	3.924**		
Verbal Ability			0.081	0.777
Info Pro			0.225	2.254*
Vis Reas			0.133	1.365
Memory			-0.077	-0.829
SWLS	0.088	4.151**		
Verbal Ability			0.062	0.597
Info Pro			0.117	1.170
Vis Reas			0.214	2.192*
Memory			0.066	0.716
Anxiety	0.032	2.068		
Verbal Ability			0.039	0.370
Info Pro			-0.074	-0.717
Vis Reas			-0.225	-2.244
Memory			0.099	1.030
Depression	0.071	3.492*		
Verbal Ability			-0.038	-0.360
Info Pro			-0.231	-2.298*
Vis Reas			-0.139	-1.409
Memory			0.153	1.630

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Info Pro – Information Processing Speed; Vis Reas – Visuospatial Reasoning

* $p<0.05$ ** $p<0.01$

Appendix 4.8

Full Version of Table 7.18

Summary of logistic regression analyses for T1 cognitive domains predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	7.454	0.075	63.4		
Verbal Ability				0.002	0.988
Info Pro				1.724	0.67
Vis Reas				1.509	0.769
Memory				0.250	0.903
QoL	6.826	0.078	77.1		
Verbal Ability				2.435	1.604
Info Pro				0.212	1.188
Vis Reas				0.530	1.213
Memory				1.057	0.776

Class. – Classification; Info Pro – Information Processing Speed; Vis Reas – Visuospatial Reasoning

* $p<0.05$ ** $p<0.01$

Appendix 4.9

Full Version of Table 7.19

Summary of multiple regression analyses for T2 cognitive domains predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-values	Beta	t-value
CIQ	0.146	4.173**		
Verbal Ability			0.077	0.641
Info Pro			0.223	1.823
Vis Reas			-0.132	-1.013
Executive Functioning			0.034	0.329
Visual Memory			-0.090	-0.859
Auditory Memory			0.018	0.135
Working Memory			0.310	2.278*
SWLS	0.067	2.326*		
Verbal Ability			-0.005	-0.039
Info Pro			-0.034	-0.266
Vis Reas			0.035	0.261
Executive Functioning			-0.013	-0.121
Visual Memory			0.081	0.743
Auditory Memory			-0.028	-0.196
Working Memory			0.320	2.245*
Anxiety	0.048	1.934		
Verbal Ability			-0.045	-0.360
Info Pro			0.120	0.929
Vis Reas			-0.003	-0.018
Executive Functioning			-0.052	-0.473
Visual Memory			-0.049	-0.444
Auditory Memory			0.075	0.521
Working Memory			-0.346	-2.407
Depression	0.129	3.747**		
Verbal Ability			-0.028	-0.229
Info Pro			-0.048	-0.385
Vis Reas			0.232	1.767
Executive Functioning			-0.100	-0.961
Visual Memory			-0.094	-0.891
Auditory Memory			0.098	0.714
Working Memory			-0.460	-3.344**

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Info Pro – Information Processing Speed; Vis Reas – Visuospatial Reasoning

* $p<0.05$ ** $p<0.01$

Appendix 4.10

Full Version of Table 7.20

Summary of logistic regression analyses for T2 cognitive domains predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	19.392*	0.185	69.5		
Verbal Ability				0.764	0.762
Info Pro				3.575	0.668
Vis Reas				0.011	1.033
Exec Functioning				1.858	0.715
Visual Memory				0.399	0.812
Auditory Memory				2.474	1.669
Working Memory				0.215	0.842
QoL	10.325	0.116	74.8		
Verbal Ability				3.035	1.874
Info Pro				0.622	0.851
Vis Reas				0.028	0.940
Exec Functioning				0.201	0.885
Visual Memory				0.456	1.280
Auditory Memory				0.199	0.854
Working Memory				2.037	1.868

Class. – Classification; Info Pro – Information Processing Speed; Vis Reas – Visuospatial Reasoning; Exec - Executive

*$p<0.05$ ** $p<0.01$

Appendix 4.11

Full Version of Table 7.21

Summary of multiple regression analyses for T1 cognitive domains predicting appraisal and coping mediators (self-efficacy and coping components)

	Adjusted R squared	F-value	Beta	t-value
Self- Efficacy	0.121	5.461**		
Verbal Ability			0.088	0.387
Information Processing Speed			0.221	0.025*
Memory			-0.048	0.597
Visuospatial Reasoning			0.191	0.048*
Avoidance - Coping	0.066	3.282*		
Verbal Ability			-0.267	-2.552*
Information Processing Speed			-0.034	-0.337
Memory			0.070	0.744
Visuospatial Reasoning			-0.071	-0.719
PFB – Coping	0.047	2.618*		
Verbal Ability			0.239	2.257*
Information Processing Speed			0.169	1.662
Memory			-0.158	-1.666
Visuospatial Reasoning			-0.157	-1.580
PFC – Coping	0.052	2.789*		
Verbal Ability			0.038	0.362
Information Processing Speed			0.301	2.964**
Memory			-0.175	-1.846
Visuospatial Reasoning			-0.050	-0.500
Religion – Coping	0.064	3.211*		
Verbal Ability			0.069	0.656
Information Processing Speed			0.072	0.710
Memory			0.220	2.340*
Visuospatial Reasoning			-0.204	-2.068*
PI – Coping	0.018	1.603		
Verbal Ability			0.088	0.818
Information Processing Speed			0.116	1.118
Memory			0.053	0.552
Visuospatial Reasoning			0.036	0.353

PFB – Problem Focused Behaviour; PFC – Problem Focused Cognitions; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

Full Version of Table 7.21 Continued

Summary of multiple regression analyses for T1 cognitive domains predicting appraisal and coping mediators (causal attribution scales)

	Adjusted R squared	F-value	Beta	t-value
Stability – Causal Attribution	0.005	1.169	-0.047	-0.434
Verbal Ability			-0.061	-0.587
Information Processing Speed			-0.007	-0.070
Memory			-0.124	-1.219
Visuospatial Reasoning				
PC – Causal Attribution	-0.016	0.493		
Verbal Ability			-0.025	-0.228
Information Processing Speed			-0.046	-0.436
Memory			0.123	1.252
Visuospatial Reasoning			-0.040	-0.386
EC – Causal Attribution	-0.012	0.608		
Verbal Ability			0.070	0.643
Information Processing Speed			-0.052	-0.491
Memory			0.117	1.194
Visuospatial Reasoning			-0.006	-0.054
LoC – Causal Attribution	-0.016	0.481		
Verbal Ability			-0.086	-0.784
Information Processing Speed			0.008	0.073
Memory			0.040	0.407
Visuospatial Reasoning			-0.067	-0.649

PC – Personal Control; EC – External Control; LoC – Locus of Causality
* $p<0.05$ ** $p<0.01$

Appendix 4.12

Full Version of Table 7.22

Summary of hierarchical regression analyses testing for mediation between T1 cognitive domains and community integration, satisfaction with life, and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ – Block One	0.207	7.768**		
Avoidance – Coping			0.002	0.025
PFC – Coping			0.021	0.266
PFB – Coping			0.153	1.955
Religion - Coping			0.035	0.449
Self-Efficacy			0.458	5.001**
CIQ - Block Two	0.215	6.919**		
Avoidance – Coping			0.004	0.048
PFC – Coping			-0.003	-0.041
PFB – Coping			0.133	1.688
Religion - Coping			0.18	0.221
Self-Efficacy			0.421	4.456**
Information Processing Speed			0.129	1.509
SWLS – Block One	0.351	15.031**		
Avoidance – Coping			-0.129	-1.592
PFC – Coping			0.094	1.311
PFB – Coping			0.156	2.205*
Religion - Coping			-0.153	-2.149*
Self-Efficacy			0.460	5.548**
SWLS - Block Two	0.357	13.038**		
Avoidance – Coping			-0.121	-1.494
PFC – Coping			0.092	1.285
PFB – Coping			0.157	2.227
Religion - Coping			-0.143	-2.003
Self-Efficacy			0.431	5.081
Visuospatial Reasoning			0.113	1.514
Depression – Block One	0.313	12.866**		
Avoidance – Coping			0.150	1.792
PFC – Coping			-0.078	-1.048
PFB – Coping			-0.153	-2.109*
Religion - Coping			0.047	0.635
Self-Efficacy			-0.449	-5.265**
Depression - Block Two	0.310	10.738**		
Avoidance – Coping			0.149	1.778
PFC – Coping			-0.068	-0.897
PFB – Coping			-0.146	-1.970
Religion - Coping			0.054	0.721
Self-Efficacy			-0.434	-4.904**
Information Processing Speed			-0.051	-0.634

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour

* $p<0.05$ ** $p<0.01$

Appendix 4.13

Full Version of Table 7.23

Summary of multiple regression analyses for T2 cognitive domains predicting appraisal and coping mediators (coping components)

	Adjusted R squared	F-value	Beta	t-value
Avoidance - Coping	0.088	2.784*		
Verbal Ability			-0.246	-1.987*
Visuospatial Reasoning			-0.012	-0.091
Information Processing Speed			0.151	1.193
Executive Functioning			0.034	0.319
Auditory Memory			0.148	1.054
Visual Memory			-0.088	-0.813
Working Memory			-0.334	-2.375*
PI – Coping	0.106	3.203**		
Verbal Ability			-0.045	-0.371
Visuospatial Reasoning			-0.351	-2.631*
Information Processing Speed			0.476	3.800**
Executive Functioning			-0.056	-0.531
Auditory Memory			0.014	0.101
Visual Memory			0.007	0.062
Working Memory			0.126	0.907
PFB – Coping	-0.012	0.776		
Verbal Ability			0.029	0.226
Visuospatial Reasoning			-0.028	-0.199
Information Processing Speed			0.231	1.737
Executive Functioning			-0.132	-1.175
Auditory Memory			-0.132	-0.897
Visual Memory			-0.009	-0.077
Working Memory			0.107	0.719
PFC – Coping	0.003	1.049		
Verbal Ability			-0.003	-0.020
Visuospatial Reasoning			-0.024	-0.169
Information Processing Speed			-0.207	-1.563
Executive Functioning			0.026	0.233
Auditory Memory			0.106	0.725
Visual Memory			0.081	0.715
Working Memory			0.208	1.412
Religion – Coping	-0.012	0.778		
Verbal Ability			0.131	1.006
Visuospatial Reasoning			-0.262	-1.848
Information Processing Speed			0.037	0.276
Executive Functioning			-0.001	-0.006
Auditory Memory			0.056	0.379
Visual Memory			0.0005	-0.003
Working Memory			-0.037	-0.247

PI – Positive Interpretation; PFB – Problem Focused Behaviour; PFC – Problem Focused Cognitions

* $p<0.05$ ** $p<0.01$

Full Version of Table 7.23 Continued

Summary of multiple regression analyses for T2 cognitive domains predicting appraisal and coping mediators (self-efficacy and causal attribution scales)

	Adjusted R squared	F-value	Beta	t-value
Self-Efficacy	0.182	5.140**		
Verbal Ability			0.086	0.738
Visuospatial Reasoning			0.219	1.721
Information Processing Speed			-0.029	-0.238
Executive Functioning			0.044	0.433
Auditory Memory			-0.049	-0.366
Visual Memory			0.067	0.656
Working Memory			0.217	1.627
Stability – Causal Attribution	0.038	1.733		
Verbal Ability			-0.136	-1.066
Visuospatial Reasoning			-0.265	-1.918
Information Processing Speed			0.010	0.078
Executive Functioning			0.155	1.411
Auditory Memory			-0.048	-0.333
Visual Memory			-0.030	-0.273
Working Memory			0.076	0.528
PC – Causal Attribution	0.025	1.485		
Verbal Ability			-0.096	-0.752
Visuospatial Reasoning			-0.080	-0.578
Information Processing Speed			0.014	0.103
Executive Functioning			-0.021	-0.189
Auditory Memory			0.286	1.974
Visual Memory			-0.249	-2.229
Working Memory			-0.088	-0.606
EC – Causal Attribution	-0.003	0.953		
Verbal Ability			0.139	1.069
Visuospatial Reasoning			0.080	0.567
Information Processing Speed			-0.074	-0.560
Executive Functioning			-0.150	-1.342
Auditory Memory			-0.179	-1.219
Visual Memory			0.229	2.018
Working Memory			-0.002	-0.015
LoC – Causal Attribution	0.028	1.525		
Verbal Ability			-0.138	-1.079
Visuospatial Reasoning			-0.258	-1.858
Information Processing Speed			0.026	0.203
Executive Functioning			-0.017	-0.154
Auditory Memory			0.144	0.996
Visual Memory			-0.185	-1.655
Working Memory			0.200	1.379

PI – Positive Interpretation; PC – Personal Control; EC – External Control; LoC – Locus of Causality

*p<0.05 **p<0.01

Appendix 4.14

Full Version of Table 7.24

Summary of hierarchical regression analyses testing for mediation between T2 cognitive domains and community integration, satisfaction with life, and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ – Block One	0.203	12.027**		
Self-Efficacy			0.444	4.891**
Avoidance – Coping			-0.005	-0.051
PI - Coping			0.097	1.226
CIQ - Block Two	0.243	11.445**		
Self-Efficacy			0.361	3.869**
Avoidance – Coping			0.030	0.335
PI - Coping			0.073	0.938
Working Memory			0.239	2.788**
SWLS – Block One	0.307	20.236**		
Self-Efficacy			0.496	5.866**
Avoidance – Coping			-0.112	-1.335
PI - Coping			0.055	0.736
SWLS - Block Two	0.310	15.587**		
Self-Efficacy			0.462	5.188**
Avoidance – Coping			-0.098	-1.158
PI - Coping			0.045	0.599
Working Memory			0.098	1.197
Depression – Block One	0.303	19.881**		
Self-Efficacy			-0.457	-5.381**
Avoidance – Coping			0.146	1.739
PI - Coping			-0.106	-1.424
Depression - Block Two	0.317	16.097**		
Self-Efficacy			-0.403	-4.550**
Avoidance – Coping			0.124	1.478
PI - Coping			-0.090	-1.218
Working Memory			-0.154	-1.884

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

Appendix 4.15

Full Version of Table 7.26

Summary of multiple regression analyses for psychosocial components predicting appraisal and coping mediators (coping components)

	Adjusted R squared	F-value	Beta	t-value
Avoidance - Coping	0.296	14.670**		
Personality			-0.512	-6.958**
Social Support			-0.098	-1.325
Competency			-0.054	-0.732
Life Stress			0.208	2.824**
PFC - Coping	0.106	4.870**		
Personality			0.215	2.594*
Social Support			-0.232	-2.802**
Competency			-0.089	-1.074
Life Stress			-0.161	-1.936
PFB – Coping	0.133	5.996**		
Personality			0.031	0.379
Social Support			0.383	4.696**
Competency			0.038	0.463
Life Stress			-0.102	-1.254
PI – Coping	0.179	8.092**		
Personality			0.248	3.119**
Social Support			0.099	1.250
Competency			-0.167	-2.104*
Life Stress			0.324	4.081**
Religion – Coping	-0.010	0.691		
Personality			-0.134	-1.524
Social Support			0.030	0.341
Competency			0.018	0.208
Life Stress			0.047	0.532

PFC – Problem Focused Cognitions; PFB – Problem Focused Behaviour; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

Full Version of Table 7.26 Continued

Summary of multiple regression analyses for psychosocial components predicting appraisal and coping mediators (self-efficacy and causal attribution scales)

	Adjusted R squared	F-value	Beta	t-value
Self-Efficacy	0.409	23.494**		
Personality			0.649	9.633**
Social Support			0.006	0.093
Competency			0.066	0.982
Life Stress			0.031	0.455
Stability – Causal Attribution	0.093	4.350**		
Personality			-0.228	-2.730**
Social Support			0.128	1.538
Competency			-0.209	-2.505*
Life Stress			-0.095	-1.142
PC –Causal Attribution	0.023	1.749		
Personality			-0.004	-0.041
Social Support			0.065	0.747
Competency			-0.025	-0.283
Life Stress			0.219	2.522
EC – Causal Attribution	0.010	1.324		
Personality			-0.036	-0.416
Social Support			-0.152	-1.747
Competency			-0.006	-0.072
Life Stress			0.125	1.438
LoC – Causal Attribution	0.029	1.972		
Personality			0.024	0.281
Social Support			0.143	1.649
Competency			-0.166	-1.926
Life Stress			0.102	1.176

PC – Personal Control; EC – External Control; LoC – Locus of Causality

* $p<0.05$ ** $p<0.01$

Appendix 4.16

Full Version of Table 7.27

Summary of multiple regression analyses for psychosocial components predicting community integration, satisfaction with life, anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.262	12.516**		
Personality			0.477	6.330**
Social Support			0.085	1.122
Competency			0.194	2.580*
Life Stress			0.109	1.443
SWLS	0.345	18.092**		
Personality			0.600	8.446**
Social Support			0.020	0.286
Competency			0.039	0.545
Life Stress			-0.057	-0.807
Anxiety	0.375	20.469**		
Personality			-0.574	-8.237**
Social Support			0.022	0.321
Competency			-0.054	-0.774
Life Stress			0.247	3.568**
Depression	0.452	27.811**		
Personality			-0.661	-10.177**
Social Support			-0.101	-1.559
Competency			-0.041	-0.633
Life Stress			0.143	2.199*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale
* $p<0.05$ ** $p<0.01$

Appendix 4.17

Full Version of Table 7.28

Summary of logistic regression analyses for psychosocial components predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	10.279*	0.102	64.1		
Personality				7.883**	0.582
Social Support				0.695	0.857
Competency				1.116	0.819
Life Stress				0.025	1.030
QoL	22.134**	0.238	83.2		
Personality				17.048**	3.058
Social Support				0.012	1.027
Competency				0.410	1.151
Life Stress				0.048	0.951

Class. – Classification
* $p<0.05$ ** $p<0.01$

Appendix 4.18

Full Version of Table 7.29

Summary of hierarchical regression analyses testing for mediation between psychosocial components and community integration and satisfaction with life

	Adjusted R squared	F-value	Beta	t-value
CIQ - Block One	0.234	7.618**		
Avoidance – Coping			0.012	0.130
PFC - Coping			0.007	0.093
PFB – Coping			0.165	2.138*
PI - Coping			0.105	1.344
Self-Efficacy			0.403	4.394**
Stability – Causal Attribution			-0.163	-2.019*
CIQ - Block Two	0.299	7.922**		
Avoidance – Coping			0.099	1.090
PFC - Coping			-0.015	-0.198
PFB – Coping			0.149	2.024*
PI - Coping			0.075	0.964
Self-Efficacy			0.247	2.455*
Stability – Causal Attribution			-0.117	-1.478
Personality			0.321	3.014**
Competency			0.165	2.136*
SWLS - Block One	0.325	11.426**		
Avoidance – Coping			-0.126	-1.512
PFC - Coping			0.095	1.280
PFB – Coping			0.154	2.135*
PI - Coping			0.058	0.786
Self-Efficacy			0.475	5.505**
Stability – Causal Attribution			0.019	0.245
SWLS - Block Two	0.401	13.424**		
Avoidance – Coping			-0.012	-0.140
PFC - Coping			0.039	0.554
PFB – Coping			0.146	2.137*
PI - Coping			-0.016	-0.218
Self-Efficacy			0.292	3.151**
Stability – Causal Attribution			0.032	0.441
Personality			0.402	4.089**

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour; PI – Positive Interpretation
* $p<0.05$ ** $p<0.01$

Full Version of Table 7.29 Continued

Summary of hierarchical regression analyses testing for mediation between psychosocial components and anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
Anxiety – Block One	0.345	12.394**		
Avoidance – Coping			0.2421	2.934**
PFC - Coping			-0.164	-2.261*
PFB – Coping			0.000	0.000
PI - Coping			0.086	1.188
Self-Efficacy			-0.445	-5.239**
Stability – Causal Attribution			-0.126	-1.690
Anxiety - Block Two	0.433	13.399**		
Avoidance – Coping			0.078	0.921
PFC - Coping			-0.075	-1.061
PFB – Coping			0.026	0.393
PI - Coping			0.095	1.301
Self-Efficacy			-0.301	-3.317**
Stability – Causal Attribution			-0.109	-1.545
Personality			-0.372	-3.885**
Life Stress			0.190	2.534*
Depression – Block One	0.319	11.161**		
Avoidance – Coping			0.152	1.805
PFC - Coping			-0.075	-1.018
PFB – Coping			-0.156	-2.156*
PI - Coping			-0.110	-1.503
Self-Efficacy			-0.427	-4.929**
Stability – Causal Attribution			0.041	0.533
Depression - Block Two	0.473	15.577**		
Avoidance – Coping			-0.053	-0.646
PFC - Coping			0.033	0.486
PFB – Coping			-0.128	-1.989*
PI - Coping			-0.070	-1.002
Self-Efficacy			-0.212	-2.426*
Stability – Causal Attribution			0.051	0.757
Personality			-0.524	-5.681**
Life Stress			0.180	2.493*

PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

Appendix 4.19

Full Version of Table 7.30

Summary of hierarchical logistic regression analyses testing for mediation between psychosocial components and employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status- Block One	8.415	0.084	62.6		
Avoidance – Coping				0.763	1.207
PFC - Coping				0.104	1.065
PFB – Coping				1.658	1.287
PI - Coping				0.152	0.929
Self-Efficacy				1.505	0.978
Stability – Causal				0.766	1.030
Attribution				0.879	2.774
QoL - Block One	17.763**	0.194	77.1		
Avoidance – Coping				0.032	0.957
PFC - Coping				0.822	1.249
PFB – Coping				6.925	1.973**
PI - Coping				0.706	0.401
Self-Efficacy				5.674	1.051*
Stability – Causal				0.066	1.011
Attribution				0.721	0.352
QoL - Block Two	36.224**	0.370	80.9		
Avoidance – Coping				2.444	1.616
PFC - Coping				0.163	1.116
PFB – Coping				7.319	2.242**
PI - Coping				4.112	0.582
Self-Efficacy				0.075	1.007
Stability – Causal				0.164	1.020
Attribution				14.411	4.720**
Personality				0.604	3.233

Class. – Classification; PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour; PI – Positive Interpretation

* $p<0.05$ ** $p<0.01$

Appendix 4.20

Full Version of Table 7.37

Summary of multiple regression analyses for psychosocial components, appraisal and coping predicting community integration and satisfaction with life

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.309	5.156**		
Personality			0.325	2.903**
Social Support			0.063	0.738
Competency			0.165	2.103*
Life Stress			0.113	1.316
Avoidance – Coping			0.097	0.996
PFC – Coping			0.009	0.112
PFB – Coping			0.113	1.397
PI – Coping			0.046	0.539
Religion - Coping			0.063	0.808
Self-Efficacy			0.258	2.526*
LoC – Causal Attribution			0.039	0.339
EC – Causal Attribution			-0.027	-0.292
Stability – Causal Attribution			-0.104	-1.268
PC – Causal Attribution			-0.218	-2.233*
SWLS	0.423	7.821**		
Personality			0.388	3.796**
Social Support			-0.057	-0.734
Competency			0.018	0.250
Life Stress			-0.071	-0.907
Avoidance – Coping			-0.026	-0.287
PFC – Coping			0.022	0.297
PFB – Coping			0.181	2.438*
PI – Coping			0.005	0.071
Religion - Coping			-0.127	-1.778
Self-Efficacy			0.271	2.904**
LoC – Causal Attribution			-0.057	-0.538
EC – Causal Attribution			-0.023	-0.273
Stability – Causal Attribution			0.021	0.276
PC – Causal Attribution			0.218	2.450*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour; PI – Positive Interpretation; LoC – Locus of Causality; EC – External Control; PC – Personal Control;
* $p<0.05$** $p<0.01$

Full Version of Table 7.37 Continued

Summary of multiple regression analyses for psychosocial components, appraisal and coping predicting anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
Anxiety	0.450	8.595**		
Personality			-0.285	-2.850**
Social Support			0.009	0.125
Competency			-0.087	-1.238
Life Stress			0.200	2.611*
Avoidance – Coping			0.144	1.646
PFC – Coping			-0.095	-1.293
PFB – Coping			0.042	0.576
PI – Coping			0.041	0.544
Religion - Coping			0.164	2.361*
Self-Efficacy			-0.313	-3.435**
LoC – Causal Attribution			-0.233	-2.262*
EC – Causal Attribution			-0.123	-1.513
Stability – Causal Attribution			-0.089	-1.210
PC – Causal Attribution			0.118	1.356
Depression	0.463	9.009**		
Personality			-0.483	-4.900**
Social Support			-0.055	-0.734
Competency			-0.045	-0.647
Life Stress			0.177	2.343*
Avoidance – Coping			-0.034	-0.392
PFC – Coping			0.022	0.306
PFB – Coping			-0.086	-1.196
PI – Coping			-0.090	-1.215
Religion - Coping			0.009	0.126
Self-Efficacy			-0.236	-2.622*
LoC – Causal Attribution			-0.153	-1.503
EC – Causal Attribution			-0.018	-0.223
Stability – Causal Attribution			0.072	0.996
PC – Causal Attribution			0.128	1.489

PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour; PI – Positive Interpretation; LoC – Locus of Causality; EC – External Control; PC – Personal Control
* $p<0.05$** $p<0.01$

Appendix 4.21

Full Version of Table 7.38

Summary of logistic regression analyses for psychosocial components, appraisal and coping, predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	19.453	0.186	63.4		
Personality				3.651	0.561
Social Support				1.919	0.734
Competency				0.547	0.857
Life Stress				0.004	1.014
Avoidance – Coping				0.109	0.918
PFC – Coping				0.416	1.156
PFB – Coping				4.273	1.601
PI – Coping				0.003	1.012
Religion - Coping				0.890	0.825
Self-Efficacy				0.133	0.992
LoC – Causal Attribution				0.011	1.005
EC – Causal Attribution				2.222	1.049
Stability – Causal Attribution				0.735	1.033
PC – Causal Attribution				2.070	1.065
QoL	43.715**	0.435	84.7		
Personality				12.910**	4.990
Social Support				0.498	0.792
Competency				1.352	1.377
Life Stress				0.514	1.259
Avoidance – Coping				1.069	1.417
PFC – Coping				0.757	1.304
PFB – Coping				7.625**	2.918
PI – Coping				2.982	0.574
Religion - Coping				3.619	0.523
Self-Efficacy				0.136	1.010
LoC – Causal Attribution				0.276	1.038
EC – Causal Attribution				1.033	1.055
Stability – Causal Attribution				0.344	1.038
PC – Causal Attribution				0.793	0.946

Class. – Classification; PFC – Problem Focused Cognition; PFB – Problem Focused Behaviour; PI – Positive Interpretation; LoC – Locus of Causality; EC – External Control; PC – Personal Control

* $p<0.05$ ** $p<0.01$

Appendix 4.22

Full Version of Table 7.39

Summary of multiple regression analyses for the significant demographic variables, cognitive domains and psychosocial components predicting community integration and satisfaction with life

	Adjusted R squared	F-value	Beta	t-value
CIQ	0.479	10.197**		
Gender			0.269	3.866**
Years of Education			0.033	0.441
Relationship Status at PI			-0.102	-1.172
Relationship Status at T2			-0.167	-2.295*
Age at T1			-0.160	-1.661
Paid Work at T2			0.104	1.405
NART			0.125	1.316
Info Pro – T1			0.095	1.023
Working Memory – T2			-0.109	-0.950
Personality			0.266	2.947**
Competency			0.140	2.111*
Self-Efficacy			0.198	2.278*
PC – Causal Attribution			-0.133	-2.020*
SWLS	0.510	14.509**		
Severity			-0.120	-1.807
Paid Work at T1			0.047	0.684
Relationship Status at T2			0.219	3.205**
NART			-0.071	-0.820
Vis Reas – T1			0.068	0.898
Working Memory – T2			0.006	0.068
Personality			0.356	4.136**
PFB – Coping			0.187	2.990**
Self-Efficacy			0.281	3.343**
PC – Causal Attribution			0.163	2.595*

CIQ – Community Integration Questionnaire; SWLS – Satisfaction With Life Scale; Info Pro – Information Processing; PC – Personal Control; Vis Reas – Visuospatial Reasoning; PFB – Problem Focused Behaviour

*p<0.05 ** p<0.01

Full Version of Table 7.39 Continued

Summary of multiple regression analyses for the significant demographic variables, cognitive domains and psychosocial components predicting anxiety and depression

	Adjusted R squared	F-value	Beta	t-value
Anxiety	0.443	18.226**		
NART			-0.054	-0.725
Personality			-0.334	-3.775**
Life Stress			0.272	3.992**
Religion - Coping			0.132	1.979*
Self-Efficacy			-0.312	-3.468**
LoC – Causal Attribution			-0.088	-1.287
Depression	0.460	19.448**		
NART			-0.046	-0.497
Info Pro – T1			-0.024	-0.269
Working Memory – T2			-0.010	-0.091
Personality			-0.514	-5.732**
Life Stress			0.162	2.418*
Self-Efficacy			-0.185	-2.112*

LoC – Locus of Causality; Info Pro – Information Processing Speed
*p<0.05 ** p<0.01

Appendix 4.23

Full Version of Table 7.40

Summary of logistic regression analyses for the significant demographic variables, cognitive domains and psychosocial components predicting employment status and QoL

	Chi Square	Nagelkerke R squared	Class. (%)	Wald Statistic	Odds Ratio
Emp Status	109.223**	0.762	91.6		
Age at Injury				0.172	0.891
Age at T1				0.240	1.146
TSI at T1				0.004	1.000
Paid Work at T1				0.487	1.735
Paid Work at T2				29.202**	127.743
QoL	30.771**	0.321	80.9		
NART				1.002	1.020
Personality				13.426**	2.834
PFB - Coping				7.034**	2.069

Class. – Classification; TSI – Time Since Injury; PFB – Problem Focused Behaviour
* $p<0.05$ ** $p<0.01$