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Glossary

Abbreviation	Term
ACC	Accident Compensation Corporation
BDI-II	Beck Depression Inventory-II
FIS	Fatigue Impact Scale
GCS	Glasgow Coma Scale
ICF	International Classification of Functioning, Health and Disability
LOC	Loss Of Consciousness
MFIS	Modified Fatigue Impact Scale
MTBI	Mild Traumatic Brain Injury
NZ	New Zealand
OECD	Organisation for Economic Co-operation and Development
PTA	Post Traumatic Amnesia
RTW	Return To Work
SPSS	Statistical Package for Social Sciences
TBI	Traumatic Brain Injury

1 Introduction

Traumatic Brain Injury poses significant problems to individuals sustaining injury, their families, social health care providers, and funders alike. Because of improving survival rates associated with developments in primary intervention,(1) TBI has been predicted to be the third leading cause of death and disability in the world by the year 2020.(2) Although research has shown there to be a spectrum in the effect of TBI on cognitive and behavioural function, virtually all survivors of severe TBI are left with some form of impairment.(3) The influence of these functional changes has been implicated as sources of difficulty for individuals attempting to engage in social participation following their injury. In particular, research has shown that individuals with TBI have consistently been found to have lower levels of employment than before their injury. While reported levels vary,(4) research indicates that individuals who sustain TBI, especially more severe injuries, have associated low levels of employment following injury.(5-7)

In an effort to identify which populations are most at risk of low employment following injury, a massive research effort has been undertaken to identify the influences of employment following TBI. The intention of this research has been cited as being to identify the rehabilitation needs and goals to facilitate positive employment outcomes, as well as to guide clinical decision making during TBI intervention.(8) However, improving vocational outcomes after TBI remains a challenge to researchers and practitioners alike. At the time that this thesis was undertaken, no system had been developed that adequately predicted who was at most risk of failure to Return To Work (RTW) following TBI, or how accurate prediction could be used to guide the development of intervention. This thesis was therefore undertaken with the intention of asking the research question;

- Can employment after TBI be predicted?

The specific purpose stemming from this question was to develop a method of identify individuals at risk of poor employment outcome following TBI. This was done with the intention of developing methods that could inform the development of vocational interventions for individuals with TBI. The specific research aims addressing this purpose were to:

- Systematically integrate research investigating associations with predictors of employment after TBI.
- Investigate the factors that stakeholders in the rehabilitation process considered to influence employment following TBI.

These aims guided the development of two studies; a) a systematic review of the predictors of employment following TBI; and b) a descriptive qualitative study investigating the factors that individuals with TBI and professionals delivering rehabilitation perceived to be the influences of employment after TBI. The intention of undertaking these two studies was to systematically assess what was known about the predictors of employment after TBI in published research and to triangulate findings from the perspectives of people who had attempted to RTW after TBI and professional groups

involved in vocational rehabilitation. The second study also aimed to identify where gaps in the predictive literature existed to further improve methods of prediction of employment after TBI.

All participant groups interviewed in the descriptive qualitative study proposed fatigue to be a key influence of employment after TBI. Additionally, professional groups involved in intervention identified that they believed that the experience of fatigue following TBI was often attributable to co-morbid depression. These findings informed development of the third study of this thesis which was a quantitative study evaluating the association between fatigue, employment, and depression following TBI.

1.1 Structure of Thesis

This thesis is comprised of six chapters (this being the first chapter). These chapters are summarised as follows:

1.1.1 Chapter 2: Literature Review Underpinning the Thesis

Chapter 2 presents definitions and research relating to TBI and disability. Epidemiological data concerning TBI is examined and the relationship between TBI and impairments is given. Models of disability are then evaluated with respect to work disability following TBI. Finally, the need for a systematic review of the predictors of employment after TBI is outlined.

1.1.2 Chapter 3: Systematic Review of Predictors of Employment after Traumatic Brain Injury

Chapter 3 presents the methodology, methods, findings, and conclusions of the systematic review of literature evaluating predictors of employment after TBI. This review aimed to minimise the differences in research findings that can be attributed to heterogeneity of methodological design so as to identify the factors most consistently identified as being associated with employment after TBI. This systematic review was performed in 2004 with that work underpinning the subsequent two studies.

1.1.3 Chapter 4: Influences of Employment after Traumatic Brain Injury from the Perspectives of Rehabilitation Stakeholders

Chapter 4 reports the methodology and findings of a descriptive qualitative study which used grounded theory methods to investigate the perceptions of stakeholders in vocational rehabilitation of what they believed to be the influences of employment after TBI. In addition to individuals with TBI (n=7), professionals with clinical experience in designing, informing and/or implementing vocational rehabilitation were sought including a multidisciplinary vocational rehabilitation service (n=6), neuropsychologists (n=3), case managers (n=3), and medical specialists (n=3).

1.1.4 Chapter 5: Fatigue, Depression and Employment Following Traumatic Brain Injury: A Retrospective Cohort Study

Chapter 5 describes a quantitative study investigating the relationship between fatigue and employment and the associations between fatigue and depression following TBI (n=97). Following a

description of literature investigating fatigue, generally and with specific reference to people with TBI, the justification of this study, methodology, methods, and findings are presented.

1.1.5 Chapter 6: Discussion

Chapter 6 brings together the key findings of the studies in this thesis and proposes the application of work disability as a framework to guide future research and clinical practice. In addition, what has been learnt as a researcher throughout the process is explored before addressing possible areas of future research stemming from the findings of studies in this thesis.

1.2 Context of research

Because the studies in this thesis were conducted in New Zealand (NZ), there are a number of contextual factors that influence research findings. The most important of these is that rehabilitation services in NZ are funded by the Accident Compensation Corporation (ACC). ACC removes the need for litigation as individuals are eligible to up to eighty percent of pre-injury income while off work, as well as mostly free rehabilitation services. As Chapter 2 further describes, the presence of ACC has implications for both the incidence rates of TBI in New Zealand and the financial cost of individuals with TBI not being in employment (see Section 2.1.1).

1.3 Language

The Vancouver referencing system is used in this thesis.(9) The terminology of the International Classification of Functioning, Health and Disability (ICF) (10) has been adopted throughout this thesis to reflect the importance of biopsychosocial models of disability in the explanation of employment after TBI identified in Chapter 2 (see Section 2.4).

2 Literature Review Underpinning the Thesis

This chapter provides the context to this thesis by presenting definitions and research relating to TBI and disability. First, epidemiological data of TBI internationally and in New Zealand is examined and the relationship between TBI and its consequences is presented. Secondly, models of disability are presented to identify the relationship between TBI and impairment. Lastly, an overview of the literature regarding predictors of employment following injury is reviewed and the need for a systematic review of the predictors of employment after TBI is justified.

2.1 Traumatic Brain Injury

Traumatic Brain Injury has been defined as a nondegenerative, noncongenital insult to the brain by an external mechanical force, potentially leading to permanent or temporary impairments of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness.(11) TBI is most commonly classified as mild, moderate, or severe using the Glasgow Coma Scale (GCS), duration of Post-Traumatic Amnesia (PTA), or duration of Loss of Consciousness (LOC). Although the GCS measures depth of impaired consciousness,(12) PTA the time between brain injury and return of continuous day-to-day memory,(13) and LOC the duration of the time that an individual remains unconscious following TBI, they can all be used to measure TBI severity (see Table 1). This can be problematic when severity is used to distinguish sub populations in TBI research as GCS, PTA, and, LOC quantify different aspects of physiological response to TBI at different timeframes. Additionally, because severity of injury does not differentiate between which areas of the brain are injured, TBI severities only give an indication of the likely type and levels of impairments and timeframe of recovery.

Table 1: Criteria for the Classification of Traumatic Brain Injury Severity.

Characteristics	Mild	Moderate	Severe
GCS 30 minutes after accident (12)	13-15	9-12	8 or less
Duration of PTA (14)	Less than 60 minutes	1-24 hours	1-7 days or more
Duration of LOC (15)	Up to 30 minutes	Between 30 and 24 hours	More than 24 hours

2.1.1 Incidence of Traumatic Brain Injury

Incidence rates of TBI in NZ are higher than most developed countries. For example, estimates of TBI incidence in North America range from 175-200 cases per 100,000 per annum (16) and 62.3 cases per 100,000 per annum in Canada.(17) In comparison, ACC reported 17,514 cases of concussion severe enough to warrant some form of funder intervention in NZ in 2003 (approximately 437 cases per 100,000 per annum),(18) with the cost of new and ongoing brain injury claims in NZ reported to be $45,930,000 in 2006.(19) New Zealand research also indicates that males sustain head injuries severe enough to warrant hospital intervention twice as often as females (315 and 142 cases per 100,000 per annum respectively) and that Maori incidences of TBI are twice that of non-Maori (463 and 204 cases per 100,000 per annum respectively).(20)

The high incidence rates of TBI in New Zealand may be explained by the high number of motor vehicle accidents in NZ and the influence of ACC's data collection methods. New Zealand has one of the highest rates of road traffic deaths and hospitalisations per fatality in OECD[1] countries.(21, 22) High levels of vehicle accident are reflected in causation data from public hospital admissions in NZ that report that 36% of TBI's are caused by motor vehicle accidents, 29% by accidental falls, 14% by non-intentional accidents, 11% by assaults, and 10% by bicycle or animal rider crashes.(20) Additionally, statistics of TBI from countries other than NZ are generally compiled from reported hospital admissions. In comparison, ACC's reported incidence rates also include those who don't go to hospital but are still counted when they receive community based assessment or intervention for their TBI.

2.2 Biological Mechanisms of Traumatic Brain Injury

Damage to brain tissue can occur at the time of injury due to laceration, compression, tension, or shearing of neural tissue,(23) referred to as primary TBI, or as a consequence of a cascading sequence of interacting biological, chemical, and mechanical forces resulting in secondary TBI.(11) As a result, impairments following TBI can vary significantly depending on a number of factors including the area of brain injured and the level of damage to brain tissue. The following are widely accepted explanations of the biological processes of primary and secondary TBI.

2.2.1 Primary Brain Injury

Different patterns of brain injury can result from different types of trauma to the head and brain. Whilst focal injuries may result in localised primary brain damage, acceleration/deceleration forces (common in car accidents), can cause wide spread shearing of neural tissue of different densities and diffuse axonal injury.(24) Focal injury such as lacerations, contusions, and intracranial hematomas often result from collisions between the brain and the skull's internal bony ridges (coup injury) followed by collisions with the opposite side to the initial impact site of the skull (contrecoup injury) numerous times.(25) Tissue strain in the deepest brain structures of the midbrain and brain stem can also occur during primary injury causing damage to grey matter nuclei and axonal tracts.(26) Diffuse axonal injury occurs during primary TBI when rotational forces produce shearing of neural tissue of different densities,(27) resulting in micro-haemorrhages, tissue disruption, and eventual axonal degeneration.(25) While focal and diffuse patterns of damage have been presented as discrete patterns of brain injury in this section, they commonly occur together during accidents.(13)

Primary injury may also cause damage at a cellular and molecular level where widespread changes in cell membrane functioning can result in neural cell death.(28, 29) Additionally, injured neural cells may release excitatory amino acids, cytokines, and other mediators of injury resulting in further damage to neighbouring cells.(26)

[1] Organisation for Economic Co-operation and Development

2.2.2 Secondary Traumatic Brain Injury

Secondary TBI can occur minutes, hours, and even days following primary TBI due to a combination of raised intracranial pressure, chemical reactions, and biological attempts by the brain to attain homeostasis. Because the skull is a closed system, increased intracranial pressure occurs when increased mass within the skull leads to decreased cerebral blood flow (and hence oxygen) being carried by blood to neural tissue.(30) The most common causes of mass increase within the skull following TBI are haematomas, oedema, and hydrocephalus (see Table 2). Brain shift may also occur during secondary TBI when brain tissue becomes compressed or herniated due to raised intracranial pressure.(26)

Table 2: Causes of Raised Intracranial Pressure Following Traumatic Brain Injury

Brain swelling mechanism	Description
Haematoma	Lacerations in the vessels supplying blood to the brain result in blood pooling.(25)
Oedema	Increases in brain water content result in increases in brain tissue volume.(26)
Hydrocephalus	Blockages in cerebrospinal fluid circulation can lead to increases in intracranial pressure due to increases in cerebrospinal fluid in the skull.(25)

Cellular chemical reactions during secondary TBI can result in swelling and bursting of the cellular membrane (necrosis), or destruction from within the cell through DNA changes (apoptosis).(23) The destruction of neural cellular material during secondary TBI occurs as the result of a cascade of cellular, biochemical, and electrical reactions that starts with the production of exocitoxic amino acids, leading to cell death (see Table 3).(31)

Table 3: Biochemical Pathway during Secondary Traumatic Brain Injury

Stage	Types of hematoma	Description
1	Excitoxic amino acid are released and cellular depolarization occurs	Release of glutamate and aspartate leads to influx of calcium and sodium ions and may lead to increases in free radical production.(11)
2	Calcium and sodium ion influx	Calcium and sodium influx leads to neuronal swelling.(32)
3	Phopholipase and protease activations	Calcium overload leads to production of proteases.(33)
4	Cytosolic swelling and membrane breakdown	Swelling of cytoplasm leads to cellular membrane breakdown of neural tissue.(32)
5	Cell death	Cell structure and all contents die

2.3 Impairment Following Traumatic Brain Injury

Primary and secondary TBI can result in a wide range of impairments that have been identified as sources of difficulty performing work functions after injury.(34, 35) Impairment following TBI may be cognitive, physical, behavioural, or relating to sensory functioning depending on the location, pattern, and severity of injury. Impairments following TBI have been found to vary significantly from person to person irrespective of severity of injury.(36) While some form of cognitive impairment is almost universal across all TBI severities, long-term physical impairments due to spasticity, dysphagia,

dysarthria or balance problems are relatively rare (1 per 100,000) and usually transient following TBI other than for those with severe injury.(37, 38) Personality changes after TBI including low tolerance, volatility, impulsivity and emotional lability are reported in up to 66% of moderate to severe TBI survivors.(39)

Cognitive impairment after TBI can occur in an individual's attention, sensory functioning, concentration, memory, language, and executive function depending on the area of brain damaged and the damage to cognitive processes involved in the pathways of cognitive function (see Table 4).(24) While cognitive *impairment* after TBI may be permanent, cognitive *function* can show ongoing recovery depending on the location and severity of injury, environmental influences, and compensatory strategy use. Cognitive recovery after MTBI typically occurs rapidly, with individuals returning to approximately pre-injury levels within one to three months of injury for most aspects of cognitive functioning.(40) In comparison, cognitive recovery following moderate or severe TBI can be expected to extend for a period of over two years, with cognitive functioning remaining permanently impaired once recovery potential slows.(41)

Table 4: Cognitive Impairments Associated with Traumatic Brain Injury

Cognitive set	Areas of cognition potentially impaired by TBI	Potential effects of impairment	Brain structures involved
Attention and concentration (42)	1. Focused attention 2. Sustained attention 3. Selective attention 4. Split attention	• Difficulties with vigilance and concentration (distractibility) • Perseverative attention (inability to shift focus of attention) • Learning difficulties • Inability to multitask	Multiple interacting parts of the brain including: • The brainstem • Basal ganglia • Frontal, posterior parietal and cingulate cortices
Executive function (43)	1. Volitional behaviour 2. Planning 3. Purposeful action 4. Monitoring and regulating behaviour	• Difficulties initiating behaviour • Poor motivation • Impaired judgement of appropriateness of behaviour • Lack of flexibility in reasoning processes • Poor planning • Poor problem solving • Perseveration (continuing behavioural response despite environmental feedback that the behaviour is maladaptive) (44)	Frontal lobes
Language (45)	1. Auditory processing 2. Word retrieval 3. Verbal memory 4. Integration and synthesis of linguistic information 5. Written language	Spoken language (46) • Simplification of phonemic structure, word finding difficulties, syntactic errors (Broca's aphasia) • Deficits in word access or retrieval (Anomic aphasia) • Repetition of verbal output (Conduction aphasia) • Severe impairment in all language processes (Global aphasia) • Substitutions of words in speech (Wernicke's aphasia) • Impairment of articulation (Dysarthia)	Temporal lobe in language dominant cortex
		Written language (47) Inability to select correct letter shapes, poor letter formation or defective regulation of speed and amplitude of handwriting	Written language disorders can be a result of damage to any of the cognitive, linguistic, or sensorimotor processes involved in writing.(47)
Memory (48)	1. Short term memory • Central executive memory	• Deficits in co-ordination and integration of visual and auditory information • Impaired ability to manipulate and encode visual information	• Frontal lobes • Occipital/parietal lobes

	• Visuo-spatial sketchpad • Phonological loop	• Impaired ability to manipulate and encode auditory information • Impaired ability to remember general facts (semantic memory) • Impaired ability to remember autobiographical experience (episodic memory) • Deficits in learning new skills (procedural memory)	• Left temporal/parietal lobes • Temporal lobe • Medial temporal (hippocampus) diencephalon • Basal ganglia/motor cortex
	2. Long term memory • Explicit memory • Implicit memory	• Deficits learning new associations (classical conditioning)	• Throughout central nervous system
Sensory	1. Vision (49)	• Literal blindness • Perceptual blindness (neglect) • Difficulties with visual acuity • Deficits with depth perception • Deficits in colour perception • Deficits in motion perception • Recognition disorders	• Visual dysfunction can stem from focal or diffuse damage to the mid-brain, the ocular structures, cortical areas (especially the occipital lobe), or cranial nerve nuclei (53)
	2. Hearing (50)	• Loss of recognition of sounds (auditory sound agnosia) • Loss of recognition of words (verbal word deafness) • "Cortical deafness" (abnormal pure tone, sound localisation, temporal auditory analysis)	• Primarily the temporal lobes
	3. Smell/taste (51)	• Loss of smell (anosmia) • Distortion of smell (parosmia) • Loss of taste (ageusia)	• Orbital and temporal lobes
	4. Touch (50)	• Tactile agnosia with respect light touch, position sense, vibration, two-point discrimination, pain perception, texture perception and temperature	• Somatosensory cortex
	5. Balance (52)	• Dizziness • Vertigo	• Balance deficits have been associated with damage to basal ganglia and cerebellum, vestibular pathology and sensory loss (54)

2.3.1 Fatigue after Traumatic Brain Injury

Research has identified fatigue as one of the most commonly reported symptoms after TBI,(55-65) and suggests that while fatigue after MTBI has been found to reduce over time (57, 66), it frequently endures for at least two to five years following moderate to severe TBI.(58) A number of explanations of fatigue after TBI have been suggested and are discussed in this section including: (a) neurological pathways; (b) the requirement for increased effort with attention and concentration following injury (the coping hypothesis); (c) being a co morbid by-product of depression, and (d) as a result of TBI related sleep disruption.

The exact neuropathology of fatigue after TBI remains unexplained. There is however growing evidence of biological pathways of fatigue from comparisons between illnesses such as multiple sclerosis, cancer, and chronic fatigue syndrome with healthy controls.(67-70) This research differentiates between fatigue caused by central or peripheral nervous system dysfunction (see Table 5), with brain injury referring to the latter due to the cognitive components of TBI related fatigue.(67)

Table 5: Peripheral and Central Causes of Fatigue

	Causes	Symptoms
Peripheral	Damage or pathology of the peripheral nervous system due to disorders of muscle and neuromuscular junction(67)	Inability to sustain physical activity or exercise with no loss of mental functioning
Central	Damage or pathology of the central nervous system including the reticular system, limbic systems, and the basal ganglia (68)	Failure of physical and cognitive tasks that require self-motivation in the absence of cognitive failure or motor weakness characterised by feelings of constant exhaustion

A number of areas of neuropathology have been related to central fatigue, most notably due to failure in the integration of limbic input and motor functions within the basal ganglia affecting the striatal-thalamic-frontal cortical system.(67) Other neuro-pathological explanations of fatigue include neuro-inflammation processes disrupting glutamate neurotransmission,(69) and as a result of diffuse axonal injury.(70) However, these pathways remained unexplored in published TBI literature at the time that this thesis was undertaken.

The ‘coping hypothesis’ developed by van Zomeren et al (71) explains fatigue after TBI as being caused by the increased cognitive effort required by individuals with attention and concentration problems. A small number of studies have investigated the association between impairments in attention and concentration on task performance and reported fatigue after TBI. This research has shown that individuals with TBI expend more cognitive energy to maintain stable attention and concentration over time than controls,(72) and that reports of subjective fatigue were related to decreased performance of tasks requiring higher levels of attention.(73)

Depression has also been implicated as a source of fatigue after TBI. For example, Kreutzer et al found that fatigue was the most commonly reported symptom of depression in a large sample of participants who were an average of 2.5 years post injury (n=722) with 46% of this sample reporting

feeling tired often or all the time.(74) Similarly, Seel et al found that fatigue was the most commonly reported symptom of depression in a sample of TBI outpatients an average of three years post injury, with 56% reporting persistent fatigue.(60) While it is evident that fatigue and depression are commonly experienced together after TBI, research to date has not elucidated the causal pathway between the two.

Like depression, sleep disturbances and fatigue after TBI are reported to commonly occur together, either as a primary effect of trauma or secondary to other neuro-psychiatric symptoms.(75) This relationship is not yet clearly defined as sleep disturbances have been suggested to cause fatigue and vice versa. Rao et al state that the relationship between fatigue and sleep disturbances is complicated as they may co-exist, be present as isolated entities, or appear as symptoms of another medical or psychiatric syndrome.(75)

The many possible impairments associated with TBI have been summarised in this section. The explanations of how these impairments influence individuals' functioning are given in the following section exploring models of disability.

2.4 Definitions of Disability

There have been three major approaches to the development of models and definitions of disability; the medical model, social constructionist theory, and the biopsychosocial model.(76) Medical model explanations report disability as a functional restriction directly produced and proportional to pathology.(77) The social construction theory of disability expands on the medical model, viewing disability as the product of interactions between an individual's impairments and their social environment, where the influence of impairments on activities can either be reduced or exacerbated by environmental factors.(78) However, the social constructionist theory of disability can be criticised for not accounting for the cognitive processes of an individual, such as motivations, in determining disability.(79) The biopsychosocial model has consequently become the dominant model for evaluating employment outcomes after injury as it incorporates both medical and social constructionist theory, with the appreciation of the injured individual's cognitions and motivations.(78)

The World Health Organization – International Classification of Functioning, Health and Disability (ICF) is arguably the most recognised biopsychosocial model of disability (see Figure 1).(10) In relation to the aims and focus of this thesis, a number of the elements of the ICF are helpful in explaining the influences on employment outcomes following TBI. The ICF defines pathology as the manifestation of a biochemical and/or physiological abnormality and impairments as "problems in a body function or structure" (p.10) related to pathology which can result in functional limitations in activity.(10) Within this model, employment is seen as a form of social participation. The ICF is useful in relation to the aims and purpose of this thesis because it acknowledges that, in addition to changes in body functions and structures, environmental factors (such as supports) and personal factors (such as motivations) can also influence employment outcome. Therefore, rather than directly being the result of injury related pathology and/or impairment, the ICF identifies that work disability is conditional on a number of

contextual factors. Additionally, the ICF acknowledges the interactive nature of each of the influences of participation restriction.

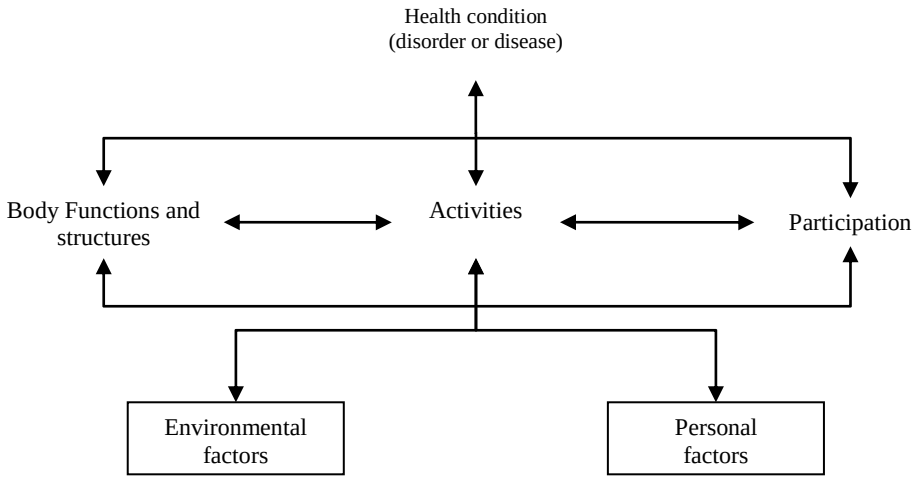


Figure 1: Interactions between the Components of the International Classification of Functioning(10)

The conceptualisation of employment as a form of participation in the ICF is also helpful in regards to the purpose of this thesis. While paid employment has obvious fiscal benefits, employment has also been argued to provide five opportunities: time structure, shared experiences and contacts with people outside the family, goals and purposes that transcend the individuals, definition of aspects of personal status and identity, and the enforcement of activity.(80) As such, employment can be argued to provide a number of opportunities to engage in social aspects that are beneficial to the individual.

2.5 Work Disability Following Traumatic Brain Injury

Work disability, sometimes referred to as occupational disability,(81, 82) is an emerging area of research specifically investigating the factors that influence employment following injury and has been reported to occur when impairments lead to functional limitations in work activities.(83) The term occupational disability can be slightly misleading when applied to this field of research, given that *occupation* has multiple connotations beyond just *work.*(84) The term *work disability* (increasingly used in the rehabilitation literature)(85-87) is therefore used in this thesis in preference to occupational disability.

In agreement with the ICF, work disability is theorised to be mediated by the injured individual's resources including; residual work capacity, the individual's skills, education, job history, adaptability, age, coping/motivation, and characteristics of the workplace and/or job,(88, 89) and has been identified as reflecting the individual's capacity to perform job tasks contingent on the influence of environmental conditions.(90) In addition to impairments, it has been argued that other factors intrinsic to the injured individual can effect employment, including their motivations and consequent work focused behaviours.(79) Central to the decisions that the individual with TBI makes regarding employment, are their levels of self efficacy,(91) or the belief that they will be successful in their actions to gain employment. However, self efficacy may change as the individual tries to return to

employment and finds difficulties in performing in their pre-injury roles and has been found to be linked with levels of depression.(92)

2.5.1 Environmental Influences of Employment

To reflect the conceptualisation of work disability as the interaction between impairments and the individual's environment, Krause et al argue that there are seven major groups of factors that influence employment outcome following injury, (i) worker characteristics, (ii) injury descriptors, (iii) medical and vocational rehabilitation, (iv) job task level physical and psychosocial job characteristics, (v) organisational level employer characteristics, (vi) employer or insurer-based disability prevention programs, and (vii) societal level legislation, social policy, and macroeconomic factors.(93) Additionally, families and social support networks have also been argued to influence employment outcomes following TBI.(94, 95)

Work environments have been identified to be widely heterogeneous with respect to physical, emotional, social, cognitive, language, speed and productivity demands; degree of structure and support; flexibility in scheduling tasks and activities; availability and type of supervision and performance coaching; skill discretion; availability of breaks; shift work and access to physical and psychological job accommodation.(88) The differences between these dimensions can mean that some jobs are more difficult to return to after TBI than others. For example, jobs that require high levels of memory and attention may be difficult for the majority of individuals with TBI due to the frequency of memory and attention impairments following injury.(51)

The influence of employers on employment outcome is argued to occur through their control of the work environment and the ability to provide accommodations to support the injured worker.(95) On a much broader level, payers/insurers and society influence employment after injury indirectly through other stakeholders. This can occur either by supporting stakeholders in being off-work, as is the case with injured employees receiving compensation, employers receiving subsidies and by paying for health-care providers, or by placing expectations on stakeholders such as legislating RTW programmes for injured employees.(93)

Health care providers' influence on employment after TBI occurs through delivery of rehabilitation interventions which are often highly individualised and can vary in intensity and duration.(96) Vocational interventions following TBI can involve a number of different strategies including work adjustment training, compensatory technique training, and supported job placement.(96) Supported employment strategies focus on educating job site personnel about the consequences of TBI, looking for accommodations that can be made to the individuals role to minimise disability caused by impairments, teaching compensatory strategies, job restructuring, and modifying work schedules.(97) Ongoing supported employment strategies may also involve on-site supports from a job coach who assists the individual maintain satisfactory job performance.(98) Vocational rehabilitation strategies for individuals who are unable to return to pre-injury roles, or who were unemployed at time of injury,

include job placement based on the match of clients interests and potential skills to work requirements.(99)

Case management or case coordination is often provided during TBI rehabilitation in NZ to communicate between the stakeholders of employment after TBI, and to coordinate transitions between phases of TBI rehabilitation. During the entire period of rehabilitation after injury in NZ, the case manager has the responsibility of identifying the needs of their client with TBI, facilitating communication between rehabilitation services, monitoring ongoing progress and costs of care,(100) and acting as a liaison between the individual with TBI, their family, and service providers.(96)

This section of this chapter has introduced a number of theorised pathways between TBI and work disability and given an indication of the complexity regarding the many different influences of employment following TBI. The following section describes the research that has endeavoured to uncover which factors are associated with employment outcome after TBI, and why further research in this area was necessary.

2.6 Prediction of Employment after Traumatic Brain Injury

A large number of studies have investigated factors associated with employment after TBI to identify which individuals are most likely to be unemployed following injury (these are formally reviewed in Chapter 3). A distinction is made in this literature between predictors of employment outcome (existing pre-injury), and indicators of outcome, (variables occurring during acute rehabilitation or later).(101) However, methodological differences between sample characteristics, the timeframe for follow up, how employment outcome and predictive variables are measured, and other confounding factors have been suggested to lead to inconclusive evidence as to which factors are related to employment after TBI.(102) The effect of confounding factors on results of predictive research is evident in a subset of the TBI literature investigating RTW rates for individuals who were employed prior to TBI (see Table 6).

Table 6: Reported Return to Work Rates after Traumatic Brain Injury

Authors	n	TBI severity	Follow up	Percentage of participants returning to work
Brooks, McKinlay, Symington, Beattie, Campsie (103)	98	Severe (coma of at least six hours)	2-7 years	29%
Johnson (104)	47	Severe	3.5 years	38.20%
Rao, Kilgore (105)	57	Severe (PTA of at least 24 hours)	up to 26 months post injury	66%
Godfrey, Bishara, Partridge, Knight (106)	59	Severe only	Either six months, one year, or 2-3 years post injury	58% full time, 17% part time, 25% failed
Rao, Rosenthal, Cronin-Stubbs, Lambert, Barnes, Swanson (105)	73	97% severe	16.5 months post discharge	63%
Dikmen, Temkin, Machamer,	366	25% severe, 15%	2 year	37% severe, 64%

Holubkov, Fraser, Winn (4)		moderate, 60% mild		moderate, 83% mild
Fraser, Dikmen, McLean, Miller, Temkin. (107)	102	30% severe, 12 % moderate, 60% mild	1 year	44%
Wagner, Hammond, Sasser, Wiercisiewski (108)	88	31% severe, 64% moderate-severe	1 year	75%
Greenspan, Wrigley, Krensnow, Branche-Dorsy, Fine. (109)	343	77.6% mild, 18.4%, 4% severe	1 year	67% mild, 50.8% moderate, 21.4% severe
McCullagh, Ouchterlony, Protzner, Blair, Feinstein (110)	57	Mild	5-6 months post injury	90%
Ruffolo, Friendland, Dawson, Colantonio, Lindsay (111)	50	Mild	6-9 months post injury	42%

Analysis of the studies in Table 6 reveals that while severe injuries are associated with lower RTW rates than moderate and mild injuries,(4, 109) RTW rates vary within TBI severity groups between studies. For example, 90% of participants successfully returned to work five to six months after MTBI in McCullugah et al's study.(110) In comparison, 42% of participants successfully returned to work by six to nine months after MTBI in Ruffolo et al's study.(111) However, Ruffolo et al's study was comprised entirely of individuals involved in motor vehicle accidents who reported physical impairment relating to orthopaedic injuries as the major reason for failure to RTW. These findings demonstrate the necessity to evaluate beyond strictly TBI related factors when investigating employment outcome after TBI.

The systematic review in the following chapter aimed to address the identified methodological considerations when integrating research evaluating predictors of employment after TBI by investigating the following questions:

1. Have methodological differences in studies evaluating influences of employment after TBI lead to differences in study findings?
2. Which factors are most consistently associated with employment status after TBI once methodological differences are accounted for?
3. What gaps in the literature evaluating influences of employment following TBI exist with reference to a work disability framework?
4. Do multivariate studies identify where shared variance in employment outcome after TBI is given by factors identified as predictive of employment outcome in univariate analysis?

3 Systematic Review of Predictors of Employment after Traumatic Brain Injury

As identified in Chapter 2, studies investigating variables associated with employment outcome following TBI present contradictory evidence as to the best set of predictors and indicators of employment outcome. Although there were a number of systematic reviews evaluating predictors of employment after TBI at the time this review was undertaken,(112-114) uncontrolled heterogeneity of research design of the studies involved in these reviews limits the inferences that could be drawn from findings. By restricting synthesis to the most homogeneous and rigorous studies, this review aimed to minimise the differences in findings that can be attributed to methodological design. This chapter reports the methodology, findings, and conclusions of this systematic review performed in 2004 with that work underpinning the subsequent studies in this thesis. Relevant research published subsequent to the review date is considered within the discussion section of this chapter (see Section 3.3.1) and/or Chapter 6 as appropriate.

3.1 Methodology for Systematic Review

A Cochrane review process (115) was considered for this review but deemed inappropriate because of the need to integrate prognostic studies, rather than just interventions, and no protocol for the systematic review of prognostic studies had been developed by the Cochrane Collaboration Group, this being formed in 2008.(116) Instead, the methodological sequence for systematic reviews proposed by the NHS Centre for Reviews and Dissemination,(117) Egger, Smith, and Altman,(118) and Glasziou et al (119) was used. The following sequence was undertaken: the need for a review was scoped, a review protocol developed, studies were identified through implementing a search strategy, identified studies were screened for relevance, and eligible studies assessed for methodological quality. Finally, data from studies assessed as being methodologically sound were extracted and study findings synthesised.

3.1.1 Scoping of Systematic Review

A preliminary literature search for reviews of predictors of employment after TBI identified the publications in Table 7 by searching the online databases Medline, PsychINFO, Embase, AMED, Cinahl with the terms “brain injury” AND “employment” and limiting results to literature reviews. Reviews identified by the preliminary search for review articles found that review articles published at the time this thesis was done produced inconclusive results with regards to the most consistent set of predictors and indicators of employment after TBI (see Table 7).(102, 112-114, 120)

Table 7: Reviews of Predictors of Employment after Traumatic Brain Injury

Authors	Number of studies reviewed	Methodology	Variables identified as most predictive of employment after TBI.
Crisp (120)	60	No inclusion/exclusion criteria stated. No evidence of methodological ratings of studies	Severity of injury, cognitive impairments, personality change, psychosocial adaptation, physical disability, age, pre-injury work/education access to rehabilitation
Ownsworth and McKenna (112)	50	Inclusion and exclusion criteria used. Studies graded for methodological quality.	Pre-morbid occupational status, functional status at discharge, global cognitive functioning, perceptual functioning, executive functioning, involvement in rehabilitation services, and emotional status.
Sherer, Novack, Sandler, Struchen, Alderson, Thompson (114)	23	No inclusion/exclusion criteria stated Studies graded for methodological quality.	Early neuropsychological assessment found to be more strongly associated with employment outcome than later neuropsychological assessment
Yasuda, Wehman, Target, Cifu and West (102)	45	No inclusion/exclusion criteria stated. No evidence of methodological ratings of studies	Descriptive analysis only, no factors identified as more predictive than others.
Crepeau and Scherzer (121)	41	Inclusion and exclusion criteria used. Meta-analysis of the findings of studies	Executive dysfunction, emotional disturbances, deficits in activities of daily living, access to vocational rehabilitation services

The differences in findings between the reviews in Table 7 can in part be attributable to the differences in review methodologies. The reviews by Crisp's and Yasuda et al, for example, evaluated all identified studies together, whereas the reviews conducted by Ownsworth and McKenna and Sherer et al used a number of different inclusion/exclusion criteria to limit the methodological heterogeneity of studies involved, before systematically integrating findings. However, no studies in Table 7 were identified to have controlled for methodological variation when assessing predictors of employment after TBI.

The importance of multivariate statistics in identifying the factors that influence outcome following injury was identified by Krause et al (93) who commented that "given the multifactorial nature of the RTW process, multivariate statistical methods are critical if future studies are to accurately estimate the independent and combined contributions of the many risk factors involved"(p. 477). Glasziou et al also commented that the assessment of multivariate statistical results is essential in the synthesis of predictive studies to identify interactions between variables considered for associations with outcome.(119). A review in addition to those identified in Table 7 was deemed necessary to identify where methodological variation in timeframe of follow up, sample characteristics of participants, and how employment outcome is measured has confounded study integration and to integrate studies that had used multivariate statistics.

3.1.2 Developing a Review Protocol

A review protocol was developed to guide the systematic review including a search strategy for literature, inclusion/exclusion criteria for the studies in the review, and study quality checklists. The review protocol for inclusion in the systematic review specified the population of interest as individuals of working age who have sustained TBI of any severity, study type as prognostic/predictive studies, and outcome as employment.

3.1.3 Search Strategy

Identification of research investigating factors associated with employment after TBI was done using electronic searches of the health specific online databases Medline, PsychINFO, Embase, AMED, Cinahl, and Web of Science. Database searches were augmented by manual searches of reference lists of identified literature and published reviews. Search results from each database were imported into Endnote, where duplicates were identified and deleted. Only articles published in English were included and no grey literature searches were conducted due to the limited budget for the thesis.

Database searches were done using combinations of the following keywords: “brain injury” OR “brain injuries” OR “traumatic brain injury” AND “predict” OR “predictors” OR “prediction” OR “predictive” AND “employment” OR “employability” OR “job” OR “vocation” OR “vocational” OR “work”. Limits were placed on searches so that only human populations, studies published in English, adult samples, and research published after 1980 were included.

3.1.4 Screening for Relevance

Abstracts of the studies identified in the online databases and manual searches were read to identify whether they met inclusion/exclusion criteria (see Table 8). The full journal article was retrieved and read when insufficient information was available in the abstract for evaluation of inclusion/exclusion criteria. Given the purpose of this review (to evaluate predictors of employment after TBI), and because the intention was to integrate the most rigorous research possible, the review only included cohort studies, with statistical analyses appropriate to prognostic studies (univariate or multivariate). Studies that had mixed samples of brain damage; including TBI but also damage from anoxia, stroke, and aneurysm; were excluded to ensure homogeneity of study populations. Studies that had evidence of spinal cord injury and amputation associated with injury at the same time as TBI were also excluded to avoid confounding of conclusions drawn concerning the influence of TBI on employment.

Table 8: Inclusion/Exclusion Criteria of Studies Involved in Systematic Review

Inclusion criteria	(1)	Published research investigating the prediction of employment after TBI (community integration and employability were excluded) on the open employment market (ie, not supported employment or sheltered military duty)
	(2)	Research of at least quasi-experimental design (qualitative and descriptive studies were excluded)
	(3)	Samples of individuals of working age (between 16-65)
	(4)	Published no earlier than 1980 (as suggested by Ownsworth and McKenna(112) to aid consistency in the measurement tools used in studies)
	(5)	Published in English
Exclusion criteria	(1)	Brain damage caused by non-traumatic events including such as anoxia, stroke or aneurysm
	(2)	Studies with evidence of co-morbid conditions that significantly influence employability (spinal cord injury, amputation)

Once studies were assessed for a match with inclusion/exclusion criteria, it became apparent that two studies that met the inclusion criteria, comprised adult samples who sustained TBI as children (younger than 15).(122, 123) While these studies were not excluded due to the criteria developed in the review protocol, they were excluded from the review on the grounds that patterns of neural recovery following TBI in children are different than adults (124) and children's abilities will subsequently be influenced by TBI differently than adults. Additionally, one of the studies identified in the search of literature had insufficient information to confirm the sample as being made up of individuals who had sustained TBI,(125) referring only to head injury throughout the full journal article and was consequently excluded.

3.1.5 Quality Screening

When assessing which criteria would be most suitable to assess the rigour of studies meeting inclusion and exclusion criteria of this review, it was first identified that this review was of prognostic studies and not of randomised controlled trials. Whilst quality criteria have been developed to assess randomised control trials and interventions, such as those developed by the Cochrane Library,(126) Jadad,(127) and Schultz,(128) there were no generally accepted guidelines for quality assessment of prognostic studies at the time of this work.(129) It was necessary that criteria used to evaluate the methodological rigour of studies in this review met recommended principles of prognostic study assessment at the time of review, and that the criteria were congruent with the aims of the review.

Reviewing prognostic evaluation criteria were available at the time of this review, Altman's recommendation was to include assessment of sample characteristics (representative of population, sample selection explained), be of sufficiently long follow up, have objective outcome, have clearly defined and measured prognostic variables, conduct appropriate analysis, and fully describe treatment (where appropriate).(8) As identified earlier in this chapter, Krause et al (93) had argued that multivariate statistical methods are necessary in prognostic studies aiming to estimate the independent and combined contributions of the factors influencing employment following injury.

Therefore, methodological criteria that gave preference to multivariate studies and/ or controlled for other factors in evaluation can be identified as being most relevant to the aims of this review.

The assessment criteria used by Ownsworth and McKenna (see Table 9) in their review of predictors and indicators of employment after TBI were identified as being particularly relevant to this review. In addition to meeting the minimum criteria suggested by Altman, Ownsworth and Mckenna's criteria also including a rating of whether studies conducted multivariate modelling and adjusted analyses for known predictors and indicators of employment. Additionally, Ownsworth and McKenna's quality criteria also included other key factors such as explained attrition and blinding of assessors, criteria commonly used in intervention quality assessment criteria. (126-128) Finally, as they were specifically developed to assess predictive studies of employment after TBI, using the same evaluation framework in this study would allow comparison of results between reviews. Studies eligible for the review were therefore graded using the nine categorical criteria of methodological quality developed by Ownsworth and McKenna.

Table 9: Criteria of Methodological Quality used in Ownsworth and McKenna's Review

Methodological quality criteria	Score Yes = 1 No = 0
Prospective or well designed longitudinal studies: Involved the early assessment of a predictor (at the resolution of PTA for neuropsychological measures) and late follow-up for employment Or Well designed longitudinal studies required a period of at least 12 months between the initial measurement and subsequent employment	Yes/No
Multivariate modelling: Multivariate analyses were used to examine the relationship between predictors or indicators and employment.	Yes/No
Predictive power: Analyses were adjusted for potential predictors of outcome such as age, education level, pre-injury employment status and injury severity	Yes/No
Selection criteria for study were clearly stated: Characteristics measured included all of the following: referral source, inclusion/exclusion criteria, age, education or pre-injury occupational status, time since injury and injury severity data.	Yes/No
Attrition explained: Reasons for loss of participants at follow-up were explained and lost participants described. Comparisons were conducted between those lost or who chose not to participate and those who did.	Yes/No
Adequate sample size: Sample size used in final analyses was at comprised of ≥ 10 participants per variable	Yes/No
Representative sampling: Sampling was multi centre or involved large samples from consecutive admission/referrals from trauma units or rehabilitation facilities	Yes/No
Standardised measures: Majority of measures used to assess variables were standardised with normative data and/or reliability and validity analyses. Other information was collected from objective sources (such as from relatives or clinical notes)	Yes/No
Assessors were blind: Clear evidence of that measurement of employment were collected independently to the assessment of predictors	Yes/No

The methodology sections of eligible studies were read and graded as being of flawed, marginal, acceptable, or commendable methodological quality by summing the scores of the nine categorical quality criteria using the quality thresholds developed by Ownsworth and McKenna (see Table 10).(112) Studies originally graded in Ownsworth and McKenna's review were evaluated again in this review.

Table 10: Studies Ratings of Methodological Quality

Total methodological score	Methodological category
$\geq 3/9$	Flawed
4-5/9	Marginal
6-7/9	Acceptable
8-9/9	Commendable

A number of studies were identified as providing insufficient information about analysis of variables to be included in this systematic review when being assessed for quality criteria. One study was excluded from the review as it did not consider individual predictors in analysis (predictors only analysed as a block),(130) and another two studies were excluded for not separating populations in analysis of predictors (TBI and non TBI populations analysed together).(131, 132)

3.1.6 Data Extraction

Data was extracted from eligible studies by reading the methods and results section of each study to identify relevant information to be copied into an excel spreadsheet. Data extracted included sample characteristics, outcome measure, length of follow up, variables evaluated, variables identified as statistically significantly associated with employment outcome, type of statistical analysis used, and percentage of variation in employment outcome identified by predictors (where appropriate). Multivariate findings were recorded in instances where both multivariate and univariate statistics were used. Data extraction revealed that there was too much variation in study design to allow for meta-analysis of results. Therefore, as suggested appropriate for data integration of predictive studies,(119) integration of findings is limited to descriptive synthesis.

3.2 Results of Systematic Review

Figure 2 provides details of the study identification process and reasons that studies were excluded from the systematic review. Table 11 identifies studies excluded from the review. The methodological quality ratings of eligible studies are given in Table 12.

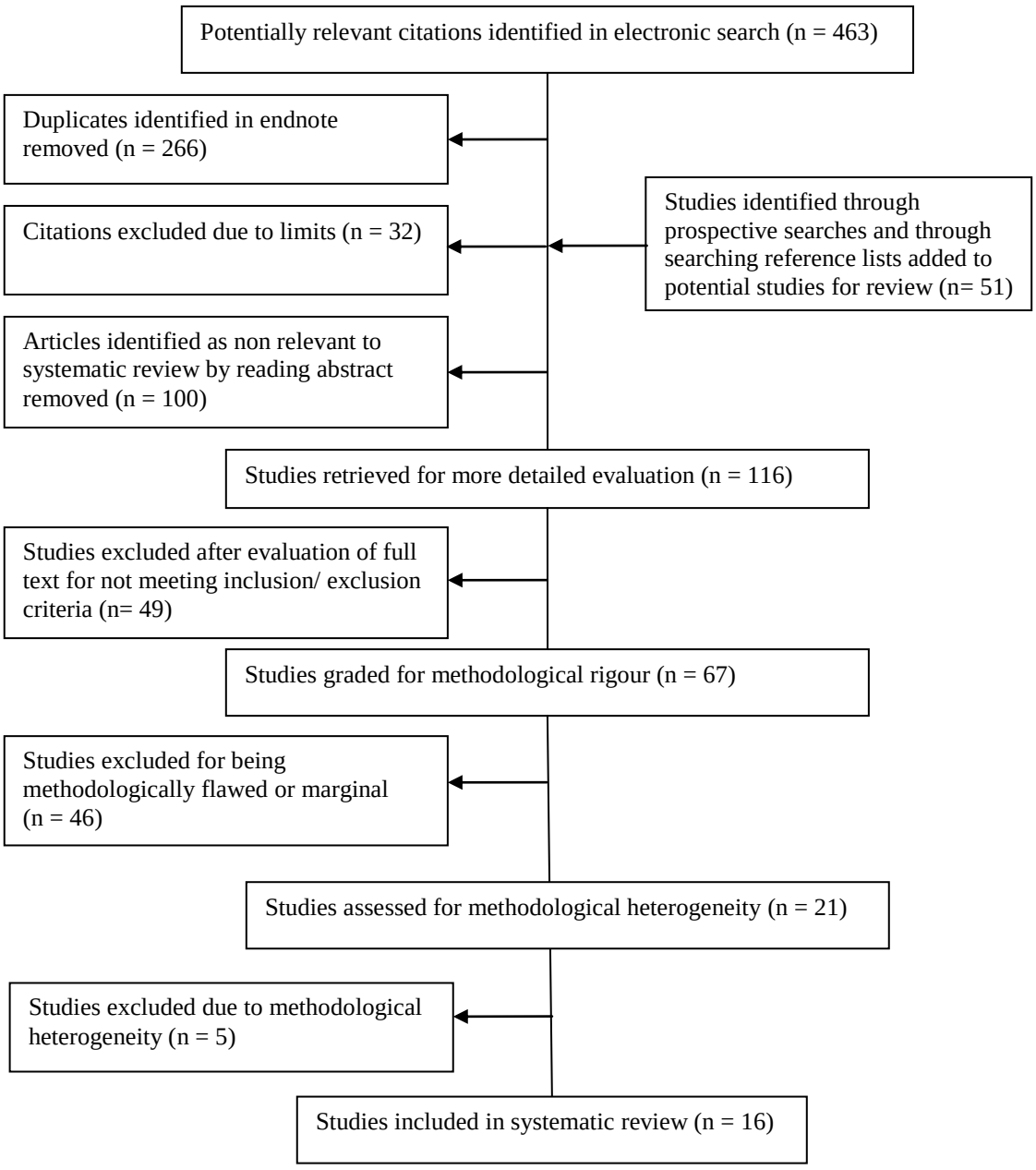


Figure 2: Studies Included/Excluded in Systematic Review

Table 11: Studies Excluded from Systematic Analysis

N	Reason for exclusion	Studies excluded
21	Did not use employment as an outcome (i.e. focused on employability or community integration) or did not focus on the prediction of employment on the open job market (133-153)	Ben-Yishay, Silver, Piasetsky, & Rattok, 1987; Drake, Gray, Yoder, Pramuka, & Llewellyn, 2000; Hammond et al, 2004; Harradine et al, 2004; Kendall, 2003; Klonoff, Costa, & Snow, 1986; LeBlanc, Hayden, & Paulman, 2000; Lezak & O'Brien, 1988; Malec, Brown, & Moessner, 2004; Millis, Rosenthal, & Lourie, 1994; Mysiw, Corrigan, Hunt, Cavin, & Fish, 1989; Prigatano & Altman, 1990; Rappaport, Herrero-Backe, Rappaport, & Winterfield, 1989; Ross, Millis, & Rosenthal, 1997; Ryan, Sautter, Capps, Meneese, & Barth, 1992; Satz et al, 1998; Tate, 2003; Tate & Broe, 1999; Thomsen, 1984, 1989; West, 1995
20	Graded as methodologically flawed (62, 103, 104, 154-170)	Ainsley, 1989; Bayless, Varney, & Roberts, 1989; Brooks, McKinlay, Symington, Beattie, & Campsie, 1987; Burke, Wesolowski, & Guth, 1988; Cattelani, Tanzi, Lombardi, & Mazzucchi, 2002; Franulic, Carbonell, Pinto, & Sepulveda, 2004; Isaki & Turkstra, 2000; Johnson, 1987; Kaplan, 1990; Kibby, Schmitter-Edgecombe, & Long, 1998; Lam, Priddy, & Johnson, 1991; Lubusko, Moore, Stambrook, & Gill, 1994; Macmillan, Martelli, & Zasler, 2002; Melamed, Stern, Rahmani, Groswasser, & Najenson, 1985; Sander, Kreutzer, & Fernandez, 1997; Trudel, Tryon, & Purdum, 1998; van Zomeren & van den Burg, 1985; Watt & Penn, 2000; Weddell, Oddy, & Jenkins, 1980; Wrightson & Gronwall, 1980
10	Included descriptive statistics only (171-180)	Boake & High, 1996; Englander, Hall, Stimpson, & Chaffin, 1992; Jacobs, 1988; Matheson, 1982; Najenson, Groswasser, Mendelson, & Hackett, 1980; Oddy, Coughlan, Tyerman, & Jenkins, 1985; Reynolds, Paniak, Toller-Lobe, & Nagy, 2003; Tate, Lulham, Broe, Strettles, & Pfaff, 1989; Wehman et al, 1990; Wenden, Crawford, Wade, King, & Moss, 1998,
9	Participants with non traumatic brain injury from either hypoxia, stroke, tumor, encephalopathy, aneurism or poisoning (181-189)	Coetzer & du Toit, 2002; Jellinek & Harvey, 1982; Johansson & Bernspang, 2001; Kaplan, 1988; Malec, 2001; Malec, Buffington, Moessner, & Degiorgio, 2000; McMordie, Barker, & Paolo, 1990; Roberts, Coetzer, & Blackwell, 2004; Teasdale, Hansen, & Gade, 1997
2	Focused on the long term outcome of paediatric TBI samples (122, 123)	Asikainen, Kaste, & Sarna, 1996; Nybo & Koskiniemi, 1999
2	Were qualitative studies (190, 191)	Kowalske, Plenger, Lusby, & Hayden, 2000; P. Wehman et al, 1994
2	Included participants who had co-morbid conditions that severally affect employability (eg. amputation, spinal cord injury) (192, 193)	Johnstone, Vessell, Bounds, Hoskins, & Sherman, 2003; MacKenzie et al, 1987
1	Did not separate the TBI subsample from the non-TBI subsample in their analyses (131)	Friedland & Dawson, 2001;
1	Clustered predictors together without exploring the potential contributions of individual predictors to employment (130)	Bowman, 1996
1	Insufficient sample information given (eg, referring to head injury without specifically stating TBI) (125)	Vogenthaler, Smith, & Goldfader, 1989

Table 12: Methodological Ratings of Studies Included in Systematic Review

Author	Methodological criteria								
	Longitudinal	Multivariate	Multivariate adjustment	Selection criteria	Attrition explained	Adequate sample	Representative sampling	Standardised measures	Blinding
Bogner, 2001 (194)	1	1	1	1	1	1	0	1	1
Greenspan,.1996 (109)	1	1	0	1	1	1	1	1	1
Harrison-Felix, 1998 (195)	1	1	1	1	0	1	1	1	1
Kreutzer,2003 (5)	1	1	1	1	1	1	1	1	1
Ponsford, 1995 (7)	1	1	1	0	1	1	1	1	1
Sherer, 2003 (196)	1	1	1	1	1	1	1	1	1
Vanderploeg, 2004 (197)	1	1	1	1	1	1	1	1	1
Dawson, 2004 (198)	1	1	1	1	0	1	0	1	1
Dikmen, 1994 (4)	1	1	1	1	0	1	1	0	1
Felmingham, 2001 (199)	1	1	1	0	1	0	0	1	1
Fleming, 1999 (200)	1	1	1	1	0	1	1	0	1
Growasser, 2002 (201)	1	1	0	1	0	0	1	1	1
Gurka, 1999 (202)	1	1	0	0	0	0	1	1	1
Keyser-Marcus, 2002 (203)	1	1	1	0	0	0	1	1	1
Rao, 1992 (105)	1	1	0	1	0	0	1	1	1
Rosenthal, 1996 (204)	1	1	1	0	0	1	1	1	0
Ruff, 1993 (205)	0	1	1	1	1	0	1	1	1
Sherer, 2002 (206)	0	1	1	1	0	1	1	1	1
Stemmer, 2000 (207)	1	1	1	1	0	0	0	1	1
van der Naalt, 1999 (61)	1	1	1	1	0	1	0	1	1
Wagner, 2002 (108)	1	1	0	0	0	1	1	1	1
Boake, 2001 (208)	0	0	0	1	1	1	1	1	0
Chamelian, 2004 (209)	0	1	0	1	0	1	0	1	1
Cifu, 1997 (210)	1	0	0	0	0	0	1	1	1
Ezrachi, 1991 (211)	0	1	1	0	0	0	0	1	1
Fabiano,. 1995 (212)	1	0	0	0	0	1	1	1	1
Fraser, 1988 (107)	1	0	0	1	0	0	1	1	1
Godfrey, 1993 (213)	1	1	1	0	0	0	0	0	1
Gollaher, 1998 (214)	1	0	0	0	0	1	0	1	1
Goran, 1997 (215)	1	0	0	0	0	1	1	1	1
Goranson, 2003 (216)	1	1	1	1	0	0	0	1	0
Hanlon, 1999 (217)	1	0	0	0	1	1	0	1	1
Hoofien, 2002 (218)	1	1	0	0	0	0	0	1	1
Ip, 1995 (219)	0	1	0	1	0	0	1	1	0
McCullagh, 2001 (110)	0	0	0	1	0	0	1	1	1
O'Connell, 2000 (220)	1	0	0	1	0	0	0	1	1
Paniak, 2000 (221)	0	0	0	0	0	1	1	1	1
Prigatano, 1984 (222)	1	0	0	0	1	1	0	1	1
Rao, 1990 (223)	1	0	0	0	0	0	1	1	1
Ruffolo, 1999 (111)	0	0	0	1	1	0	0	1	1
Sander, 1996 (224)	1	0	0	1	0	0	1	1	1
Sherer, 1999 (225)	1	1	0	0	0	0	1	1	1
Sherer, 1998 (226)	1	1	1	0	0	0	0	1	1
Simpson, 2002 (227)	0	1	1	0	0	1	1	1	0
Stambrook, 1990 (228)	1	1	1	0	0	0	0	1	1
Uzzell, 1997 (229)	1	0	0	1	0	0	0	1	1
Vilkki, 1994 (230)	1	1	0	0	0	0	0	1	1

Dark grey highlighting = commendable studies, light grey highlighting = acceptable studies, no highlighting = marginal studies.

Of the studies that met inclusion criteria, six were rated as methodologically commendable (indicated in dark grey in Table 12), 15 were graded as methodologically acceptable (indicted in light grey in Table 12) and 26 rated as methodologically marginal (indicated by no shading in Table 12).

Following analysis of the methodological heterogeneity of eligible studies, a synthesis of results at each of the four different timeframes (pre-injury, emergency care, acute rehabilitation, and other timeframe) is presented. Rather than synthesising all studies together, the rest of the analysis for this systematic review integrates the studies of acceptable and commendable methodological rating to focus synthesis on the most rigorous studies.

3.2.1 Additional Data – Appendices 1 and 2

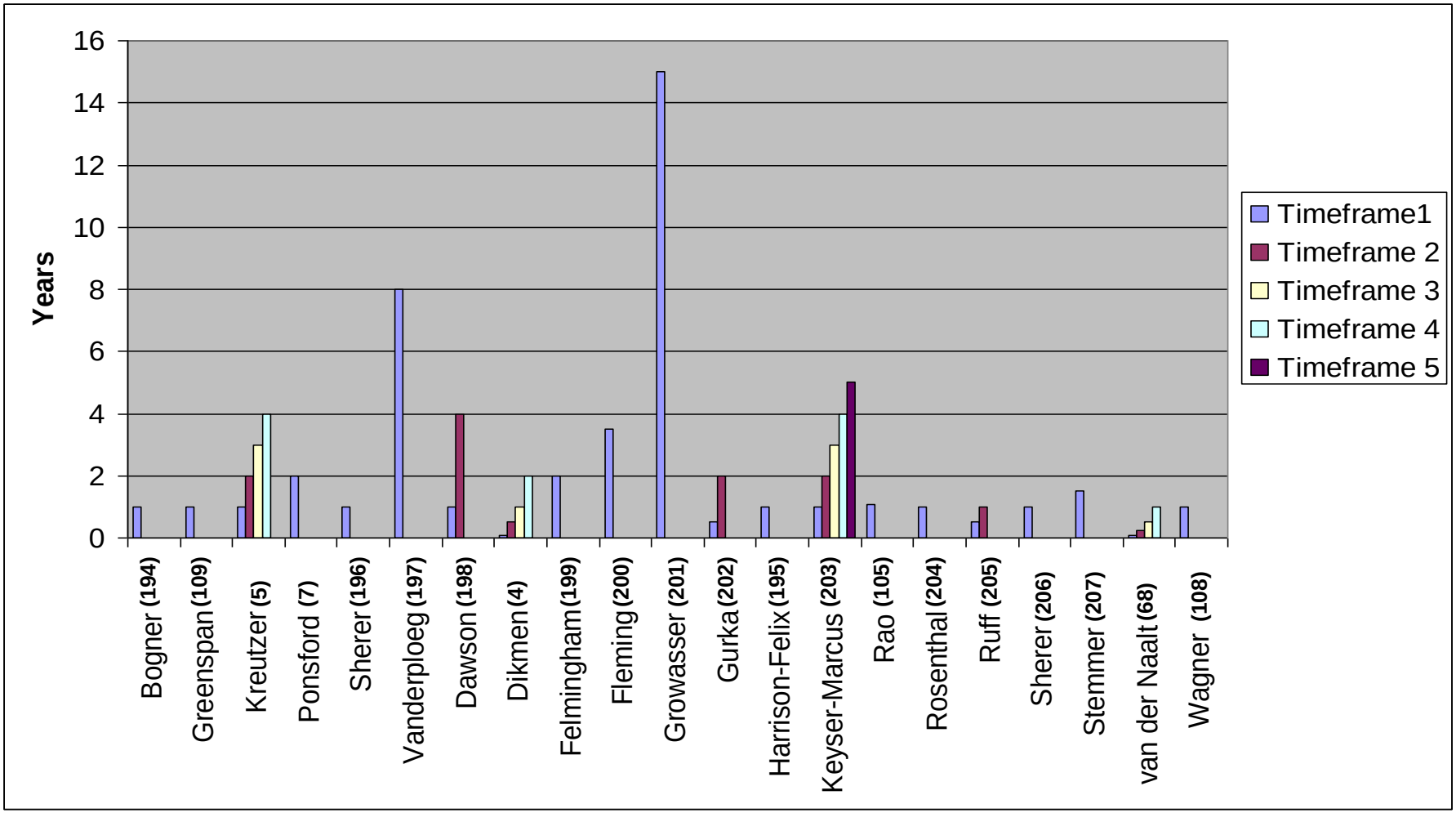
Data extracted from commendable and acceptable studies are presented in Appendix 1, with data extracted from marginal studies presented in Appendix 2. To reflect the distinction between predictors (existing pre-injury or during injury/emergency care) and indicators (occurring during acute rehabilitation or later),(101) variables evaluated for associations with employment outcome after TBI are separated across 4 different timeframes; pre-injury, measured at time of injury or in emergency care, measured while in acute rehabilitation, and measured at any other timeframe.

Study findings in Appendix 1 and Appendix 2 are presented in the data extraction tables in three sections, (1) type of statistical analysis used to evaluate results, (2) the total percentage of variation in employment outcome explained in the best predictive model (where applicable), and (3) the variables that contributed statistically significant amounts of variance in the best predictive model of outcome.

3.2.2 Analysis of Study Heterogeneity

As suggested by Glasziou, Bain, and Colwitz,(119) analysis of the heterogeneity of the methodology of studies in the systematic review was undertaken to identify where differences in study design limits integration. Evaluation of the heterogeneity of eligible studies included the following domains: timeframe of follow up, sample composition, and outcome variable.

Figure 3 shows the timeframe of follow-up for the studies included in the systematic review. Studies that had more than one timeframe of follow-up are indicated by Timeframe 1 through to Timeframe 5. As Figure 3 demonstrates, the majority of studies measured employment outcome in the first one-two years after either injury or post discharge.(4, 5, 7, 61, 105, 108, 109, 194-196, 198, 199, 202-207) The three studies that followed up in excess of two years; at eight years after injury (197), 3.5 years after injury (200), and 15 years after injury;(201) were excluded from synthesis of results to focus evaluations on the most heterogeneous set of studies possible. Although the study by Dawson (198) is indicated as having follow up timeframes of one and four years, contributions of variance explained by each variable was only reported for the four year follow up and was consequently excluded.



N.B. Timeframes in this figure refer to the number of different timeframes in which outcome measures were taken from a single evaluation of outcome (as indicated in timeframe 1) to up to five different measurements of outcome (as indicated in timeframe 1-5)

Figure 3: Timeframe of Follow-up of Studies Included in Systematic Review

Figure 4 shows the distribution of injury severity for the studies evaluated for the synthesis of results. Data for the percentages of different injury severity groups from the studies conducted by Greenspan,(109) Fleming,(200) Harrison-Felix,(195) Keyser-Marcus,(203) Rosenthal,(204) and Stemmer (207) were not given, but did include summary statistics indicating their sample crossed all severity of TBI. The studies conducted by Vanderploeg,(197) Rao,(105) and Ruff (205) contained participants exclusively with either severe or MTBI. While the studies conducted by Vanderploeg and Rao were already excluded from synthesis on the grounds of long term follow up only, the study conducted by Ruff was also excluded so that all studies in the synthesis had participants representing the TBI population rather than a subpopulation of severity.

A number of different outcome variables were used in the studies comprising the synthesis of results including; RTW (n=6), the Community Integration Questionnaire productivity scale (n=4), employed versus unemployed (n=4), and productive versus non productive (n=3). Only the studies evaluating the Community Integration Questionnaire productivity scale (194, 195, 199, 204) and employed versus unemployed (7, 202, 203, 207) were consistent in their evaluation of outcome variable. For example, studies using RTW varied between those that quantified return to the same job (61, 108) and those that measured return to any employment.(4, 105, 109, 198) Additionally, the study by Kreutzer categorised being a student or homemaker as being non productive at follow up,(5) whereas other studies categorised being a student or homemaker as being productive.(105, 108, 196, 198, 206) Studies with different outcome variables were synthesised together as there were no grounds to separate any of the studies based on how the outcome variable were measured. The implications of evaluating all employment outcomes together equally are explored in the discussion section of this chapter.

3.2.3 Synthesis of Findings

A synthesis of findings from the studies included in this review is given in Table 13, Table 14, and Table 15 with factors most consistently identified as significantly associated with employment outcome in the top rows of the tables. Preinjury predictors are presented in Table 13, indicators taken during acute rehabilitation/at time of injury are given in Table 14, and indicators taken at another timeframe are given in Table 15. Variables that were statistically significant predictors/indicators in either univariate or multivariate analysis in these tables are indicated by an X. Where variables have been associated due to a dual interaction with another variable, both variables have been marked with an X. Variables that were investigated for associations with outcome but did not explain significant amounts of variance are indicated in Table 13 as a dash. Following Table 13-15 is an analysis of results across the different timeframes of predictors/indicators and a summary of total amount of variance explained in outcome by variables entered into equations.

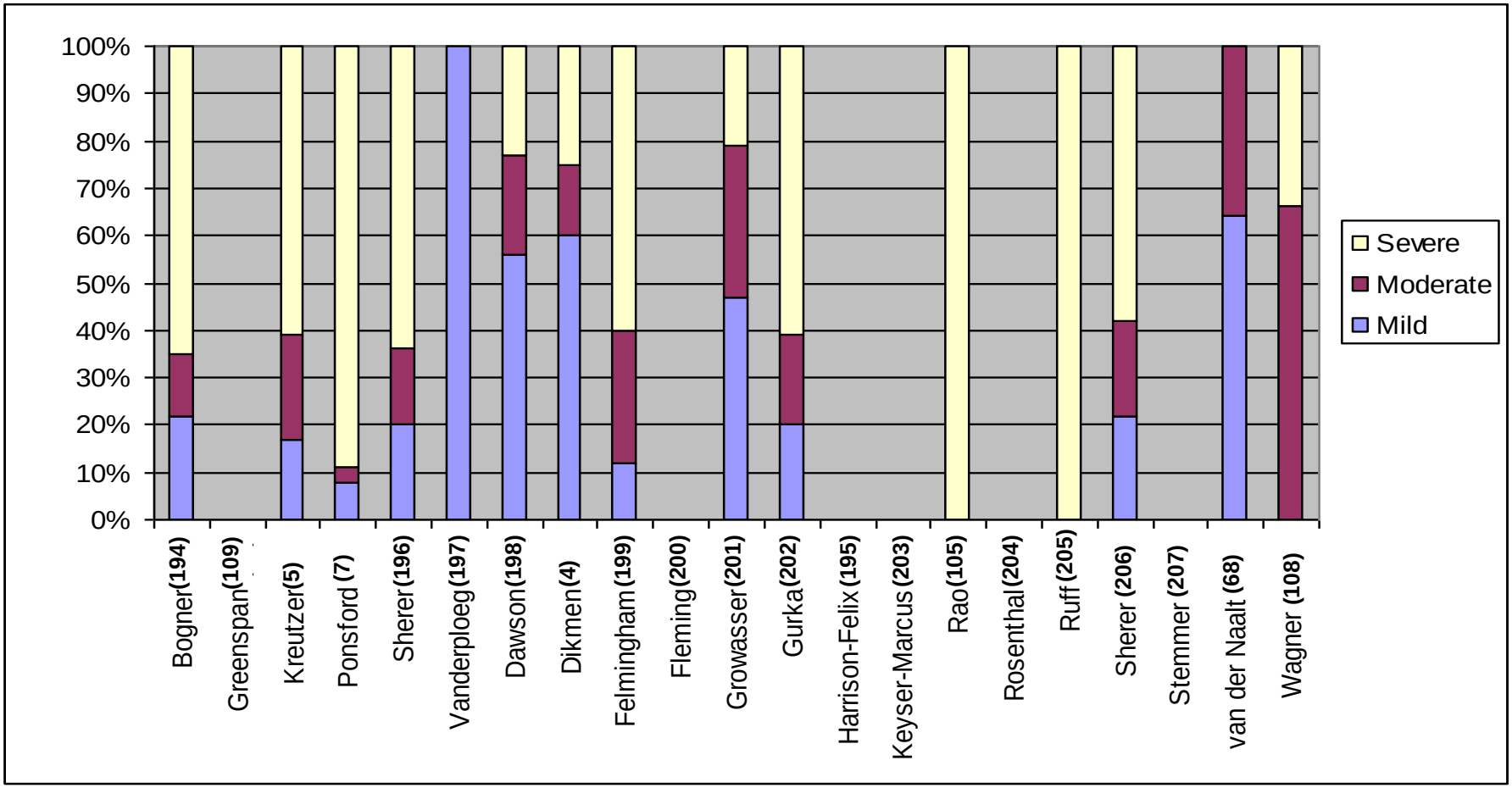


Figure 4: Distribution of Traumatic Brain Injury Severity in Studies Included in Systematic Review

Table 13: Synthesis of Pre-injury Predictor of Employment Outcome after Traumatic Brain Injury

Variable	Study citation															
	(194)	(109)	(5)	(7)	(196)	(4)	(199)	(202)	(195)	(203)	(105)	(204)	(206)	(207)	(61)	(108)
Age	X	-	X	X	X	X	X		-	X		X	-	X	-	-
Pre injury employment/productivity	X				X	X	X		X	X			X			
Education	-	X	-	-	X	X			-	X		-	X	-	-	-
Race	-	-	-		X	-			-			X				-
Psychiatric history																X
Substance abuse	X															-
Occupation				-		-										
Gender	-	-	-	-	-	-			-			-		-	-	-
Marital status	-		-		-	-			-							
Other disease		-				-										
Earnings						-										-
Insurer																-
Prior brain injury																-
History of disease		-														

X = Statistically significant relationship - = Non statistically significant relationship

Table 14: Synthesis of Acute Rehabilitation Indicators of Employment Outcome after Traumatic Brain Injury

Variable	Study citation															
	(194)	(109)	(5)	(7)	(196)	(4)	(199)	(202)	(195)	(203)	(105)	(204)	(206)	(207)	(61)	(108)
Disability Rating Score				X	-					-	X	X				
GCS	-		-	X	-	X	-		-	-		-	-		-	-
PTA				-	-							-	X		X	
Length of stay	-		-	-	X				-	X						
Neuropsychological measures						-							X	X		
Functional Independence Measure	X				X				-	-				-		
Site of lesion														X		
Cause of injury	-	-	-		-				-			X				-
LOC			X						-							
Levels of Cognitive Functioning Scale											X					
Patient Evaluation Conference System											X					
CT scan																-
Abbreviated Injury Scale		-				-									-	-
Injury Severity Score		-				-										-
Other injury				-												
Trauma score																-
Blood alcohol									-							

X = Statistically significant relationship - = Non statistically significant relationship

Table 15: Synthesis of Follow Up Indicators of Employment Outcome after Traumatic Brain Injury

Variable	Study citation															
	(194)	(109)	(5)	(7)	(196)	(4)	(199)	(202)	(195)	(203)	(105)	(204)	(206)	(207)	(61)	(108)
Drug abuse												X				
Functional Independence Measure	-	X	-					-								
Functional Assessment Measure							-	X								
Disability Rating Scale			X													
Neuropsychological measures													-			
Discharge destination												-				X
Income												X				
Physical symptoms															X	
General Health Questionnaire, distress							X									
Marital status		X										-				
Employment			-				-									
Driving own vehicle			-													
Community Integration Questionnaire							-									
Time since injury					-											
Insurance									-							
Alcohol									-			-				

X = Statistically significant relationship - = Non statistically significant relationship

3.2.4 Pre-injury Predictors

The most consistent pre-injury predictors of employment outcome in the studies in this review were pre-injury productivity/employment, age, and education (see Table 16). While two studies found that being an ethnic minority was predictive of outcome, one of these studies did not find race to be significantly associated with outcome in multivariate outcome as a standalone predictor, only when entered as a race/age interaction.(196)

Table 16: Significant Pre-injury Predictors

Variable	Number of studies evaluating predictor	Number of studies with findings associated with outcome (%)
Age	14	9 (64.3%)
Education	13	5 (38.5%)
Productivity/employment	7	7 (100%)
Race	8	2 (25%)
Substance abuse	2	1 (50%)
Psychiatric history	1	1 (100%)

Only a small number of studies investigated the association between pre-injury substance abuse and/or psychiatric history and outcome. However, because psychiatric history (4, 61, 198, 200, 207) and substance abuse (4, 61, 198, 207) were used as exclusion criteria for a number of studies, the influence of both on outcome is likely to be under represented in the studies included in the synthesis of results. There was no evidence of an association with outcome for gender, marital status, other diseases, earnings, type of insurer, prior brain injury, or history of disease.

3.2.5 Injury Related Predictors

The most consistent injury related predictor of outcome was length of PTA, with little evidence to support GCS and cause of injury as predictors in studies evaluating their association with employment outcome (see Table 17). In two studies where both GCS and PTA were entered together in multivariate analysis,(61, 206) PTA was found to be predictive and GCS not. In the one study where GCS was predictive and PTA not, the authors indicated that they did not enter PTA into the multivariate prediction because of its high correlation with the Disability Rating Scale during acute rehabilitation, rather than it failing to add significantly to a predictive model.(7)

Table 17: Significant Injury Related Predictors

Variable	Number of studies evaluating predictor	Number of studies with findings associated with outcome (%)
GCS	12	2 (16.7%)
Cause	7	1 (14.7%)
PTA	5	2 (40%)
LOC	2	1 (50%)
Site of lesion	1	1 (100%)

The effect of injury related predictors on shared variance must be viewed in light of the other variables that were also entered into multivariate predictive equations for each study. For example, when studies included measures of impairment at either acute or other timeframe, severity indicators did not

add further to variance explained,(5, 199, 203, 204) suggesting that the influence of severity measures on outcome is a proxy measure for later levels of impairment.

There was no evidence to support the Abbreviated Injury Scale, Injury Severity Scale, Functional Independence Measure (during emergency care), blood alcohol level, other injury, or neurosurgery as associated with employment outcome.

3.2.6 Acute Rehabilitation Indicators

The most consistent indicators of employment outcome during acute rehabilitation in the studies in the systematic review were results of the Disability Rating Scale, various neuropsychological measures, Functional Independence Measure, and the length of stay (see Table 18).

Table 18: Significant Acute Rehabilitation Indicators

Variable/Measure	Number of studies evaluating predictor	Number of studies with findings associated with outcome (%)
Length Of Stay	6	3 (50%)
Disability Rating Scale	5	3 (60%)
Functional Independence Measure	4	2 (50%)
Neuropsychological measures	3	2 (66.7%)
Levels of Cognitive Functioning Scale	1	1 (100%)
Patient Evaluation Conference System	1	1 (100%)

Although the results of neuropsychological measures have been added together for the synthesis of results, the studies evaluating the association between neuropsychological tests and employment outcomes have evaluated different batteries of neuropsychological tests.(4, 206, 207) There is therefore some evidence that the results of neuropsychological tests taken during acute rehabilitation are associated with outcome, but there is insufficient evidence to suggest that one set of tests is any more associated than another from the studies synthesised. In the one study that evaluated the association of the results of the Levels of Cognitive Functioning Scale and Patient Evaluation Conference System with employment after TBI, no other variables at pre-injury, time of injury, or other timeframe were controlled for, limiting inferences that can be drawn from results.(105) There was no evidence to support the Trauma Score, Computed Tomography scan, Abbreviated Injury Scale, Injury Severity Score, other injury, Trauma Score, or blood alcohol level at the time of acute rehabilitation as being associated with employment outcome.

3.2.7 Other Timeframe Indicators

While a number of studies included in the systematic review evaluated potential indicators at timeframes later than during acute rehabilitation, there were too few studies to synthesise reliability (see Table 19). However, the one study that found the results of the Functional Independence Measure and Functional Assessment Measure taken during follow up to be associated with employment outcome after TBI did not control for any other variables at any other timeframe, limiting inferences that can be drawn from results.(202) In addition to the studies shown in Table 19, the results of the Disability Rating Scale, reported drug abuse, level of income, physical symptoms

associated with head injury, and depression as measured by the General Health Questionnaire distress score were all found to be associated with employment outcome at a follow up timeframe in one study each. Variables at follow up where there was no support for additional variance explained in outcome were employment soon after injury, individual driving own vehicle, the results of the Community Integration Questionnaire, type of insurer, time since injury, and level of alcohol intake.

Table 19: Significant Other Timeframe Indicators

Variable	Number of studies evaluating predictor	Number of studies with findings associated with outcome (%)
Functional Independence Measure	4	1 (25%)
Functional Assessment Measure	2	1 (50%)
Discharge destination	2	1 (50%)
Marital status	2	1 (50%)

3.2.8 Analysis of Shared Variance

The studies synthesised in this review that included multivariate statistics used either discriminant function analysis or a number of different regression analysis techniques. Discriminant function analysis is a useful statistical method for determining which variables can differentiate between two groups,(231) in this case employed and unemployed individuals following TBI. However, it does not explain the relative contribution of these variables in predicting outcome. The degree of variance explained by factors evaluated for associations with employment outcome is outlined in Table 20.

Table 20: Summary of Multivariate Studies Included in Synthesis of Studies

Author	n	Variables explaining variance in outcome	Total variance explained
Sherer (196)	1083	Pre-injury productivity Race/age Education Functional Independence Measure Length of Stay	41%
Harrison-Felix (195)	803	Pre-injury productivity	23%
Vanderploeg (197)	626	Pre-injury intelligence Race/current region/Loss Of Consciousness interaction Psychiatric history	23.1%
Rosenthal (204)	586	Discharge Disability Rating Scales/family income Age Cause Race Alcohol abuse at follow up	25%
Bogner (194)	351	Age Pre-injury employment Functional Independence Measure Substance abuse history	15.9%
Fleming (200)	209	Age PTA Modified Barthel Index Pre morbid occupation	27%

Gurka (202)	79	Functional Assessment Measure	18%
Grosswasser (201)	74	Computed Tomography scan results	23%
Van der Naalt (61)	67	PTA Physical complaints	42%
Felmingham (199)	55	Age Pre-injury employment Follow up employment General Health Questionnaire	26.2%
Dawson (198)	47	GCS LOC PTA	34%
Stemmer (207)	35	Drive attention Processing speed Brain stem lesion Age	32%

The results in Table 20 are organised with the largest sample sizes listed first. Tabachnick and Fidell suggested that the appropriate sample size to achieve statistical significance for multiple regressions is N>= 50 + 8m, where m = the number of independent variables entered into the equation.(232) These guidelines indicate that many of the studies available have insufficient sample sizes to support the multivariate statistics conducted in their study. However, they have been considered here never-the-less in order to identify trends in multivariate research.

The largest study in Table 20, conducted by Sherer, reported the highest amount of variance with their model accounting for 41% of variance in employment outcome, with all other studies explaining between 20%-42% of variance in outcome.

3.3 Discussion

At the time that this systematic review was undertaken, a number of other reviews of the predictors of employment outcome following TBI had already been conducted.(102, 112, 114, 120, 121) As identified in Section 3.1.1, differences in how these systematic reviews were conducted and differences in inclusion/exclusion criteria led to conflicting evidence as to which variables were most consistently associated with employment outcome after TBI. The present review has addressed some of this variation by restricting integration of findings to the most rigorous (as verified by Ownsworth and Mckenna's categorical criteria) (112) and the most methodologically homogeneous of studies. Additionally, by assessing the multivariate findings of studies separately, this review has identified where a number of variables have been identified as independently associated with outcome, but have not explained novel variance in employment outcome when entered into linear regression models with variables with which they shared associations with employment outcomes. This section discusses the main findings of this review, the implications of findings, methodological factors that limit the development of a predictive equation of employment outcome after TBI, areas for future research, and the limitations of this review.

3.3.1 Main Findings from Systematic Review

Evidence from this review supports two distinct pathways between predictors/indicators and employment outcome after TBI: a pre-injury demographic pathway and an impairment pathway. While previous reviews have identified other factors as predictive of employment outcome including psychosocial functioning, and involvement in rehabilitation services,(112, 120, 121) these were not identified in the present review once marginal and flawed studies were excluded and heterogeneity of studies methodologies were controlled for. However, age, preinjury productivity, education and levels of impairment have also been supported by a number of these reviews.(112, 120)

Within the pre-injury pathway, studies in this review indicated that those individuals who were employed/productive, younger, and better educated at the time of injury were found to have higher rates of employment/productivity at follow up. Pre-injury employment as a predictor may be explained as having a job before injury means an individual is more likely to have a job to return to after injury. Similarly, individuals with higher levels of education are arguably more likely to have skills that are sort after in the job market. Explanations for why older individuals have difficulty returning to work after TBI have been proposed to include; reduced ability to adapt to the work environment, reluctance of employers to hire individuals with a limited remaining working life,(233) and slower rates of neural recovery for older individuals.(124) Within the impairment pathway, individuals who had higher levels of impairment following injury as measured by the Functional Independence Measure, Functional Assessment Measure, Disability Rating Scale and a number of neuropsychological tools were identified as having lower employment/productivity rates at follow up. Evidence therefore suggests that those with the highest levels of impairment are indeed more likely to experience work disability following injury.

While this review found a number of variables were related with employment outcome, it has also highlighted the inter-variable relationship between a number of proposed predictors/indicators. Assessment of the studies in this systematic review conducting multivariate analysis identified that a number of variables independently associated with employment outcome after TBI do not explain novel variance when entered into predictive equations together. For example, the findings of this review suggest severity of injury is not associated with employment outcome once levels of impairment are controlled for. This finding is supported by studies using structural equation modelling that found that there was a non significant relationship between injury severity and employment outcome once the relationship between cognitive and functional status with employment outcome were accounted for.(234, 235) These findings highlight the importance of identifying not only the association between a variable of interest and outcome, but also the relationship between the variable of interest and other variables being tested for an association with outcome.

The maximum amount of variance explained by multivariate studies included in this review was 42%,(196) indicating that much of the variance in employment outcome remains unexplained in the studies synthesised. The unexplained variance in outcome from studies synthesised may however be accounted for by the gaps in the current literature. As identified in the context chapter of this thesis, Krause et al argue that there are seven major groups of factors that influence employment following injury, (i) worker characteristics, (ii) injury descriptors, (iii) medical and vocational rehabilitation, (iv) job task level physical and psychosocial job characteristics, (v) organisational level employer characteristics, (vi) employer or insurer-based disability prevention programs, and (vii) societal level legislation, social policy and macroeconomic factors.(93) Only the first two of these factors have been investigated comprehensively in the quantitative research identified in this systematic review. As such, the influence of the workplace, employer's expectations, and the dynamic relationship between the individual with TBI and their environment on employment outcome have not been comprehensively investigated. As identified in a number of other reviews of the predictors and indicator of employment following TBI,(112, 113) quantitative research to date has therefore mostly focused on levels of impairment and preinjury demographic variables without sufficient attention to the environment that the individual exists or where intervention influences their likelihood of gaining sustainable employment.

It is noteworthy that since the review was conducted, a number of new studies have investigated factors associated with employment outcome after TBI, (236-264) at least partially addressing the gaps identified here. For example, a number of studies have assessed the influence of rehabilitation programmes on outcome following TBI.(254-256) While results were promising, these studies have small sample sizes (n= 19, 26, 69 respectively), limiting inferences that can be drawn from findings. The majority of studies published since this systematic review was conducted have however followed fairly closely to those evaluated in this review by assessing factors intrinsic to the individual, either at pre-injury or soon after injury for an association with employment outcome. Because of the lack of attention to environmental conditions, research evaluating the predictors of employment after TBI can be criticised for too closely following the medical model explanations of disability.

3.3.2 Implications of Findings

Although a number of variables have been found to be associated with outcome in this review, these variables are unlikely to accurately predict who will be employed and who will not following TBI for a number of reasons. Firstly, the presence of impairments does not guarantee that an individual with TBI will be unable to become competitively employed. For example, individuals may learn compensatory skills to adapt to impairments in work function or return to employment in roles not influenced by impairments. Additionally, as noted by Brooks, while a number of factors have been found to be associated with outcome, absence of these factors does not guarantee employment.(103) This can be attributed to factors that have nothing to do with TBI that influence employment outcome such as an individual may choose to return to education or become pregnant.

The variables identified as being most consistently associated with outcome do not lend themselves to designing interventions. For example, of the pre-injury variables most consistently associated with employment (age, education, and pre-injury employment), none could actually be influenced by intervention as they are all fixed factors intrinsic to the individual with TBI that cannot be modified. These findings highlight the difficulty in using epidemiological research to guide interventions. For example, Main et al argue that while statistically significant relationships identified in empirical research are useful for informing social policy or the re-direction of resources, they are seldom sufficiently powerful enough to be used on a individual clinical decision making basis for socially based interventions.(265)

3.3.3 Methodological Reasons for Difficulty Predicting Employment Outcome

A number of methodological and pragmatic issues can be argued to contribute to difficulties in predicting employment after TBI including; the ways in which employment is measured, temporal aspects of employment outcome following TBI, and difficulties quantifying a number of identified influences of employment.

As identified in Section 3.2.1 of this chapter, research evaluating the factors influencing employment after TBI have been inconsistent in the way employment is measured, with many studies including study, volunteering, or homemaking as forms of vocational engagement and others not. As such, it can be identified that research has evaluated different aspects of how TBI influences productivity following injury. Within this literature, RTW exists as a subset of possible employment outcome following injury. However, the evaluation of RTW can be problematic in itself for a number of reasons. Firstly, research evaluating RTW as an outcome assumes that the individual was employed prior to injury, thereby excluding individuals who were unemployed prior to their injury. Because pre-injury employment status has been identified as one of the most consistent predictors of employment following injury in this review, exclusion of individuals not employed before injury presents as a significant bias that influences the generalisation that can be drawn from findings. Secondly, RTW has been identified as having multiple categorisations. As Franche, Frank, and Krause identify, RTW after injury can be subcategorised as return to the same employer, the same work team, the same role, same number of hours, level of income, and consequent occupational identity.(266) As with the term

employment, RTW can therefore be identified as being a heterogeneous outcome which can potentially be used non consistently in research. Because a predictive model must have a fixed, quantifiable, tangible outcome, the different conceptualisations of what constitutes employment following injury presents as a conundrum in developing a predictive model of employment following TBI. While an obvious outcome would seem to be the difference between employment and unemployment, as Ownsworth and McKenna's review suggested,(112) there is also a need for predictive studies to investigate the time spent at work, number of jobs held, job stability, or quality of performance as employment outcomes after TBI. Research predicting employment outcome after TBI can also be criticised for conceptualising RTW as being an all or nothing process, where individuals either RTW or not. In comparison, Young et al argue that the RTW process following injury occurs over four stages; off work, re-entry, maintenance, and advancement.(267) There is therefore a need to understand what factors contribute to an individual's progression through each of these stages of RTW.

Another pragmatic problem with predicting employment after TBI is that quantitative research has mostly only taken cross sectional measurements of employment outcome. When applying this to a predictive model, the question must be asked, what timeframe after injury is the most appropriate to predict employment outcome? Evaluation of longitudinal studies identified in this review revealed that severity groups (mild, moderate, severe) had different patterns of RTW following TBI. Whereas MTBI cohorts appear to plateau in RTW at around one year post-injury,(4, 198) progressive gains in RTW were seen up to four years post-injury for moderate and severe TBI cohorts, suggesting different sub populations.(4, 5, 198) Therefore, predictions in the first couple of years after injury may not account for the individuals in which vocational outcomes are a possibility when further recovery has occurred.

3.3.4 Future Research Areas

Because of the heterogeneity of research evaluating the influences of employment following TBI with regards to sample characteristics, timeframe of follow up, and the way in which employment outcome is measured, it is possible that different reviews can come to different conclusions. Since this review was undertaken, the Cochrane Group has released a guideline for the review of prognostic studies.(116) By using these guidelines, it may be possible to have consensus among researchers as to which are the most consistent set of predictors of employment outcome following TBI to guide future studies and avoid redundant replication of research efforts. It is acknowledged that there may be a need to undertake more than one review to reflect potential TBI sub populations. For example, it may be necessary to conduct a review of MTBI predictive research separately to moderate and severe TBI literature.

As identified in the discussion of this chapter, research evaluating the influences of employment following TBI can be criticised for over emphasis on factors intrinsic to the individual with TBI, without enough emphasis on the interaction of the individual with their environment. Because environmental factors, such as workplace factors, can be addressed by intervention efforts (as opposed to the

majority of factors consistently identified as predictors) they remain essential areas of investigation to inform interventions to improve employment outcomes following injury. Future research evaluating variables for associations with employment outcome following TBI therefore need to include the variables identified in this review as most consistently associated with outcome to ensure that predictors or indicators being evaluated are not explaining variance already accounted for.

3.3.5 Limitations of Review

This systematic review had a number of limitations potentially influencing the generalisations that can be drawn from findings. Because the review was conducted on a limited budget, only articles published in English were included and no grey literature searches were conducted. This means that some studies that remained unpublished due to lack of statistical significance may have been missed. (268) (268)(268)(268)(268)(268) However, the studies identified in this review were checked against the more recent review by Nightingale in 2007,(113) which indicated that no studies eligible for the synthesis in this review were missed.

It is also possible that the quality screening meant some studies that do in fact show associations with employment outcome were not included for evaluation and synthesis. For example, a number of studies evaluating the influence of rehabilitation intervention were excluded due to their methodological rigour. However, as identified in a number of reviews of vocational rehabilitation and further discussed in the overall discussion of this thesis, studies evaluating the influence of vocational outcome following TBI generally have small sample sizes. Perhaps in omitting these studies, some predictors or indicators have been missed. This decision was however taken to ensure the findings were rigorous and defensible. As Table 65 in Appendix 2 indicates, the studies that were synthesised in this review do not represent all of the variables that have been investigated for an association with outcome in published literature. Marginal and flawed studies suggest a number of variables in univariate analysis as associated with outcome including depression,(166, 199, 205, 217, 222, 228, 230) and aggressive behaviour.(213, 222, 228) However, because these studies did not control for variables identified as most consistently associated with outcome in this review (age, educations, and pre-injury employment), their contribution to explained variance in outcome is unknown.

3.4 Conclusion

The literature systematically reviewed in this thesis has indicated that accurate prediction of employment after TBI remains problematic. This is especially evident when trying to predict long term employment outcome based solely on demographic and injury severity variables. When assessing the literature that has investigated the influences of employment after TBI, it can be identified that literature has followed closely to the medical model of disability by without attention to the environment in which the individual exists. As identified in the discussion of this review, key factors proposed as influencing employment outcome after injury including the motivations of the individual, the workplace, and rehabilitation interventions have not comprehensively been evaluated. Future research is therefore needed to investigate how these factors influence employment outcome after TBI.

4 Influences of Employment after Traumatic Brain Injury from the Perspectives of Rehabilitation Stakeholders

This chapter presents the rationale for and findings of a qualitative study investigating the factors that stakeholders in the vocational rehabilitation process perceived to influence employment outcome following TBI. In addition to individuals with TBI, rehabilitation stakeholders interviewed included Vocational Rehabilitation Practitioners, case managers, psychologists, and medical assessors. Interviews were undertaken with the intention of extending what was known about predictors of employment outcome after TBI from the systematic review of this thesis from the perspectives of those involved in vocational rehabilitation.

4.1 Justification and Purpose of the Study

The systematic review of this thesis identified that the majority of research evaluating the influences of employment after TBI focused on associating levels of impairment or pre-injury skills and/or liabilities with employment outcome. This was identified to have typically been achieved by quantifying demographic variables or levels of impairments and investigating their relationship with employment outcome following injury. In conducting this type of deductive research, investigators can be indentified as having made assumptions as to which characteristics of the individual with TBI they believed influence employment, how these characteristics should be measured, and which aspect of employment they believed to be influenced by the characteristic of interest.

Rather than making assumptions as to what the influences of employment after TBI were, it seemed probable that the perspectives of stakeholders in the vocational rehabilitation process would be essential sources of information to address the gaps of the influences of employment identified in the systematic review. Qualitative research was considered the most appropriate approach in regard to this aim, it being argued to help bring to the surface hidden theories and assumptions and suggest new possibilities and connections for areas in which quantitative research already exists.(269) Additionally, Pope and May (270) and Sale et al (271) argue qualitative investigation can be used as a complementary methodology to quantitative enquiry to explore different aspects of the same research problem to produce an additive outcome.

Individuals with TBI and professionals delivering rehabilitation were identified as key informants for this study. At the time that this research was undertaken, a number of researchers had suggested that research was lacking concerning what individuals with TBI perceived to be key influences of their employment status. For example, Crisp concluded a review of the predictors of employment after TBI by highlighting that many researchers have discounted the perceptions of individuals with TBI or focused on lack of awareness, rather than considering TBI survivors' views and perceptions as viable sources of information.(120) Levack et al also comment that the TBI literature had relied on the opinions of clinicians, researchers, and carers/family members rather than investigating the experience and perceptions of TBI clients themselves.(272) Qualitative research with individuals with TBI related to social outcome published at the time of undertaking this research included perceptions

of vocational success or failure of TBI survivors (272) and the effect of TBI on social participation.(273-275) This research found that participants reported that they felt that TBI had limited their ability to engage in social activities or that the process of RTW had lead to difficulties elsewhere in their lives. However, evaluation of what individuals perceived to be the influences of employment outcomes following TBI remained a gap in the literature at the time that this research was undertaken.

Professionals with clinical expertise in the TBI rehabilitation process were also identified as potentially having a useful contribution to make to the aims of this research as clinical expertise has been argued to be the integration of theoretical knowledge, clinical reasoning and judgement, reflection on practice, and skills acquisition.(276) It was therefore anticipated that insights into the influences of employment following TBI may be developed by interviewing practitioners who had high levels of clinical expertise contributing to rehabilitation interventions for individuals with TBI. Rather than seeking to conflict with or undermine the perceptions of individuals with TBI, a number of disciplines and those with responsibilities and roles in the rehabilitation process were interviewed to establish "fair dealing" so that one groups viewpoint was not represented as the sole truth about the factors that influence employment after TBI.(277)

Given the findings of the systematic review, and the lack of research evaluating what stakeholders in the rehabilitation of individuals with TBI consider to be the influences of employment, the aim of this study was to investigate:

- What do stakeholders in the rehabilitation of individual's with TBI consider to be the influences of employment following injury?

The following section of this chapter outlines the justification and rationale behind choosing descriptive inquiry with grounded theory methods to guide research design, how evaluation of relevant epistemologies informed the selection of methods used, the methods used for data collection and analysis, and the findings of interviews with stakeholders in the rehabilitation of TBI. A third person perspective is maintained throughout this chapter. While some authors have argued that this implies silent authorship, or a neutral/objective take on the undertaking of research,(278) this was done to maintain a consistent approach to authorship throughout the thesis.

4.2 Methodology

When evaluating which qualitative methodology would be most appropriate to guide this research, it was first important to clarify the type of question to be considered. Given the question 'what do stakeholders in the rehabilitation of individual's with TBI consider to be the influences of employment following injury' the purpose was identified as being to give rich descriptions of stakeholders' perspectives. Accordingly, a descriptive qualitative research methodology was chosen. Sandelowski defines qualitative descriptive studies as the 'method of choice when straight forward descriptions of phenomena are desired' and that have as their aim 'a comprehensive summary of events in the everyday terms of those events' (pg. 334).(279) Because little was known about what stakeholders might think were the influences of employment following TBI, methodologies that involved high levels

of interpretative analysis would have been inappropriate. Alternatively, descriptive qualitative inquiry was chosen to allow for the investigation of the influences of employment following TBI without placing high levels of inference of the intended meanings and motivations of participants' stated opinions.

One of the major criticisms of descriptive qualitative enquiry is that it is argued to be one of the least theoretically based of all of the qualitative methodologies, with little guidance as to which research methods best suit this area of investigation.(279) However, descriptive studies may also draw upon other qualitative methodologies to guide appropriate choice of methods, or as Sandelowski described, "have hues, tones, or textures" (pg. 337) of other research designs.(279) Rather than mixing and matching qualitative research methods, qualitative methodologies were evaluated for fit with the research question and context to further inform the methods that would be appropriate in investigating the aim of this research.

Crotty has suggested that there are four elements inherent to all social science research: epistemology, theoretical perspective, methodology, and methods.(280) Although descriptive qualitative design was already identified as the most appropriate methodology given the research question, it was important that each of the four elements identified by Crotty were explored in evaluating which research methodology would best inform the choice of methods for this study. This evaluation was carried out in the following sequence: epistemological frameworks were evaluated for relevance to the research question; theoretical perspectives for the identified epistemological framework were evaluated for fit with the research question; and the chosen theoretical perspective was used to inform the choice of research methods. As explained in the following section, this evaluation identified that social constructivist grounded theory (281) was the methodology with the best fit with the research purpose. Although a full grounded theory study was inappropriate given the purpose of describing stakeholders' perceptions, rather than to derive a theory of RTW after TBI (as is appropriate for grounded theory studies),(282) social constructivist grounded theory methods were chosen in this descriptive study as they allowed for descriptions of social processes from a number of different perspectives. Section 4.3 highlights how these approaches were integrated within a qualitative descriptive methodology.

4.2.1 Assessing Qualitative Methodologies to Guide the Choice of Methods

Epistemologies have been defined as the assumptions made about how knowledge of reality can be achieved.(283) As such, epistemologies are the theoretical and philosophical foundations of all research. The evaluation of epistemologies are essential in the development of qualitative research as they not only influence how questions are asked, but also the methods used to obtain, analyse, and interpret data.(284) Crotty suggested that three distinct epistemologies exist; objectivism, constructivism, and subjectivism (see Table 21).(280)

Table 21: Comparison of Epistemological Frameworks

Epistemology	Description	Assumptions	Applications to research	Application to RTW research
Objectivism	Reality is objective and external to the mind.(280) Knowledge can therefore be reliably derived through observation of objects and events.	The researcher takes an objective and neutral stance and discovers social and physical reality by observing and measuring the external reality of the phenomena being studied (285)	Used to develop reductionist theory with the intention of explanation and prediction of phenomena. (285) Over arching framework for positivist quantitative research.	Places emphasis on the replicable quantification of prediction while controlling for contextual factors
Constructivism	Reality is individually constructed through the interpretation of the natural world.(286)	Multiple realities exist. As such, the researcher must consider many possible explanations when constructing meaning associated with the phenomena being studied.(280)	Used to study how and why participants construct meaning and actions in specific situations.(285)	Places emphasis on the evaluation of individuals' experiences and their perceptions of phenomena with respect to the context within which they exist
Subjectivism	Reality is context free, exists within the individual and is constructed from "nothing".(280)	Assumes that meaning is not derived from contextual interaction but exists solely in the individual.(280)	Seeks to explore the derived meanings that individuals construct in a context free way.(280)	Places emphasis on the evaluation of individuals derived meanings, but in a culture and context free way

Evaluation of these different epistemologies (see Table 21) indicated that constructivism was a particularly good fit with the research question. Guba and Lincoln argue that constructivism denies an objective reality by asserting that "realities are social constructs of the mind, and that there exist as many such constructions as there are individuals (although clearly many constructions will be shared)"(p.43).(287) In comparison, the assumptions of objectivism, specifically that there is one objective reality, seemed to be at odds with the purpose and context of this study which intended to investigate influences of employment after TBI from different perspectives. Similarly, subjectivism was identified to be inappropriate because trying to derive 'context free' explanations of social processes seemed a fundamental mismatch with the research question.

Once constructivism was identified as an appropriate epistemology to guide the selection of research methods, a number of qualitative methodologies developed from constructivism were identified and evaluated for fit with the research purpose and context. In particular, phenomenology (280) and grounded theory (288) were considered because of their focus on the investigation of participants' experience and understanding of a particular phenomenon (see Table 22 for a comparison of grounded theory and phenomenology).

Table 22: Comparison of Constructivist Qualitative Approaches.

	Grounded Theory	Phenomenology
Description	An area of qualitative investigation dedicated to the development of theory about dominant social processes rather than description of a particular phenomenon.(289)	Investigates people's experiences in regard to a specific area of investigation and how they interpret those experiences.(283)
Data collection methods	Interviews, observations, documents, or a combination of these.	Interviews, observations, diaries, or videos.
Sampling strategies	Theoretical sampling is used whereby individuals are selected with respect to the relevance to evolving theory.(290)	Purposive sampling is most commonly used to select individuals with particular knowledge of a given phenomenon.(289)
Analytic strategies	Uses constant comparative analysis, and coding of data to deduce categories that are used to develop themes.(291) Researcher can take either an objectivist (292) or constructivist (285) stance on their involvement of data analysis depending on the type of grounded theory used.	The researcher transcribes data verbatim and becomes immersed in data to develop a number of statements. These statements are used to develop an exhaustive description of the phenomena of interest.(289)
Outcome of analysis	Themes are linked together to develop theories of social phenomenon.	A coherent story or narrative about participants' experience is developed.

Phenomenology has been defined as the study of situations in the everyday world from the viewpoint of the experiencing person.(293) As such, phenomenology was considered an appropriate qualitative approach to investigate the experiences of RTW efforts from the perspective of individuals with TBI. However, phenomenology appeared unsuitable for the investigation of the factors that rehabilitation stakeholders perceived as influencing employment after TBI because, rather than experiencing the factors themselves, they would be making inferences about their clients' circumstances and experiences.

Grounded theory is an area of qualitative inquiry that focuses on investigating the meanings and interpretations of social processes that individuals construct.(283) Additionally, grounded theory is argued to enable researchers to develop explanations of key social processes derived from, or grounded in, empirical data.(282) Grounded theory methods were considered to hold advantage over phenomenology methods with respect to the research purpose, as they would allow the investigation of the perspectives of multiple parties, in this case individuals experiencing TBI as well as other stakeholders in the rehabilitation process.

The following section describes the background/evolution of grounded theory as a qualitative methodology, the different types of grounded theory that have been developed and the decision making process in choosing a specific type of grounded theory to further inform the choice of methods.

4.2.1.1 Grounded Theory

Grounded theory has been defined by Strauss and Corbin as a research approach that develops theories "inductively derived from the study of the phenomena it represents. That is, it is discovered,

developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomena" (p.23).(290) In doing so, grounded theory methods adopt both inductive and deductive processes throughout research in that interpretations made from preliminary data analysis are 'tested' through subsequent investigation.

While grounded theory has been identified as one of the most commonly used qualitative methodologies in clinical studies,(294) there are significant differences in the theoretical perspectives that guide grounded theory methods. These differences stem from the philosophical roots of grounded theory. In their seminal work, *The Discovery of Grounded Theory*,(292) Glaser and Strauss argued that grounded theory research should be informed by both objectivist and constructivist epistemological frameworks and adopt a critical realist theoretical perspective.(291) Critical realism attests that social phenomena exist in an external reality and can only be partially measured through research due to each individual's inability to fully comprehend the phenomena being studied.(295) However, as the following section describes, Glaser and Strauss diverged in their opinions as to which theoretical perspective should guide grounded theory methods following their original collaboration.

Glaser continued to adopt critical realism (296) whereas Strauss and Corbin (290) considered that a subset of the interpretivist theoretical approach, known as symbolic interactionism, should be used to guide grounded theory research.(291) Symbolic interactionism asserts that people not only derive meaning from social interactions, but they also modify their derived social interactions as a result of the interpretive process.(297) Derived meanings are therefore not considered static, but to evolve through interaction with environmental factors. In this way, and in this particular study, a symbolic interactionist stance would allow for the interpretation of both the social influences of employment following TBI, and how they interact with the individual with TBI to influence their employment outcome as they changed over time. In comparison, it seemed that Glaser's more positivistic framework placed too much emphasis on the existence of an external reality to accommodate the investigation of not only the social factors influencing employment, but the way in which these environmental factors interact with the individual to influence employment outcome.

One of Strauss and Glaser's students, Kathy Charmaz, has further developed Strauss and Corbin's approach to grounded theory. Charmaz has argued that despite their philosophical stance, Strauss and Corbin still maintain elements of positivism in their guidelines for grounded theory by placing emphasis on the researcher describing "an objective reality… [and] giving voice to their respondents, representing them as accurately as possible" (p.250).(281) Charmaz also argued that researchers are not passive during investigation but are themselves contributors to the development of discovery through their interpretation, rather than strictly reporting observed social processes.(281) This approach has a similar interpretative theoretical perspective to Strauss and Corbin, but differs in application by giving more emphasis on the evaluation of the researcher as a member of the development of emerging findings.(281) This stance, known as social constructionism, maintains that reality is constructed not only by participants, but also actively by the researcher, through their participation in the research.(285) On reflection, the researcher's background, which is discussed in

the trustworthiness considerations of this chapter, was judged likely to influence interpretations of participant responses (as would be expected given Charmaz's argument). Charmaz's social constructivist theoretical perspectives were therefore adopted to guide the research methods used in this study.

4.3 Grounded Theory Informing Choice of Methods

The following section describes the decision making process about the methods used during this study including sampling, data collection methods, data analysis, and trustworthiness assessment. The ways in which these methodological considerations were translated into the actual conduct of this study is described in the methods section of this chapter.

4.3.1 Methodological Considerations for Sampling

Theoretical sampling is central to all forms of grounded theory. Green suggests that theoretical sampling involves "including interviewees in the sample on the basis of both an understanding of the field, emerging hypotheses from ongoing data analysis, and a deliberate attempt to 'test' such a hypothesis" (p.103).(298) Through this process, the researcher interprets responses and then seeks further participants so that interpretations can be tested. Theoretical saturation is argued to occur when "gathering more data about a theoretical category reveals no new properties nor yields any further theoretical insights about the emerging data" (p.189).(278) However, as this section describes, theoretical sampling of different groups often calls for a number of different sampling strategies within the process of theoretical sampling.

Charmaz's suggestion that qualitative investigation should be initiated by purposive sampling to identify key informants based on characteristics identified by the researcher was followed.(278) Key informants have been defined as being "knowledgeable individuals with connections to the research setting" (p.85).(283) It was considered that interviews with individuals with TBI and professionals delivering vocational rehabilitation (referred to throughout this thesis as Vocational Rehabilitation Practitioners) would yield essential insights as they would both be knowledgeable in regards to the influences of employment after TBI (as discussed in the justification of this study). As themes from findings emerged, a number of other health and social professionals involved in intervention (referred to throughout this thesis as Other Professional Stakeholders) were also interviewed to ensure a range of perspectives were considered and to test the investigator's assumptions and interpretations, as appropriate during constant comparative analysis (see methodological considerations for analysis). As Mays and Pope suggest, this process of taking multiple perspectives from different stakeholders during data collection is vital to the corroboration and overall interpretation of qualitative results.(277) Participants were therefore deliberately sought from different clinical backgrounds to test perspectives of the influences of employment identified by Vocational Rehabilitation Practitioners and TBI participants. Other Professional Stakeholders sampled to test emerging findings included medical specialists (to test findings from the perspectives of participants with knowledge of the biological pathways involved in TBI), psychologists (to test findings from the perspectives of individuals with knowledge of the cognitive processes involved in the recovery from TBI) and case mangers (to test

findings from the perspectives of individuals involved in designing and co-ordinating vocational rehabilitation interventions).

As opposed to theoretical sampling being continued until theoretical saturation (anticipated to be beyond the scope of a nested qualitative study within the overall thesis), Guba's guidelines of ceasing data collection when regularities of themes emerged across participant's interviews were followed.(299) As identified in the systematic review, employment after TBI is theorised to be the product of many different interacting variables and stakeholders. The concept of theoretical saturation with respect to these interacting variables that could potentially influence employment after TBI was identified to be problematic. Likewise, the concept of saturation with respect to stakeholders in the rehabilitation of TBI was identified to pose a problem as a number of non clinical groups such as family members, employers, and workmates could all potentially influence employment outcome following TBI. Due to pragmatic constraints of ensuring that the number of participants was manageable for the doctoral timeframe, sampling was restricted to two groups: individuals with TBI and clinical stakeholders in vocational rehabilitation intervention. The implications of this sampling strategy on transferability of results are further explored in the discussion of this study (see Section 4.9.6)

4.3.2 Methodological Considerations for Data Collection

A focus group was chosen to initiate data collection. This allowed for an overview of the rehabilitation process from key informants who specialised in the delivery of community based vocational rehabilitation for individuals with TBI. All subsequent data was collected using semi-structured interviews to develop in-depth explanations from stakeholders' perspectives.

Focus groups have been suggested to be effective during the early stages of investigations as they provide an overview of a research area from the perspective of participants.(283) Rather than trying to construct meaning from a number of different stakeholders, a focus group allowed the researcher to gain an overview of the rehabilitation process, and to simultaneously collect data and check findings as the process was undertaken. As identified by Liamputtong and Ezzy,(300) a focus group enables participants to compare and contrast experiences, and to facilitate clarification of the themes identified during questioning. While focus groups have been noted as being useful mechanisms for exploring participant perceptions in a group setting,(301) they can also be criticised for potentially enabling one or more people dominate the group.(302) As such, the possibility existed that some participants' beliefs would become obscured if one or more individuals dominated the focus group. In order to minimise this effect, ground-rules for discussion were set and the researcher moderated the focus group to ensure that all Vocational Rehabilitation Practitioner members felt comfortable sharing their opinions (see Section 4.5).

In line with a social constructivist theoretical perspective, individual interviews were used with TBI participants and Other Professional Stakeholders after the Vocational Rehabilitation Practitioner focus group. This was done as individual interviews have been argued to give richer data than focus groups (303) and because, although it was anticipated that overlap in each individual's experience would exist, it was considered important that data collection represented each individual's unique

experiences and consequent perspectives. Additionally, semi structured interviews have been argued to allow for the interviewer to follow new lines of questioning as themes emerge from interviews.(283) This meant that while general areas of questioning were developed before the interview, interview questions could be open ended, allowing for investigation of a number of different areas, and to follow areas of developing findings as more interviews were undertaken.

4.3.3 Methodological Considerations for Analyses

Central to social constructivist methods is a cyclical or iterative process of analysis whereby theme development informs ongoing data collection to validate emerging findings by moving back and forth between data collection and analysis in a constant comparative method, with efforts to deliberately select groups that can test and/or substantiate emergent findings.(285, 298) During constant comparative analysis, data collection, coding, and analysis occur simultaneously to inform both ongoing sampling and emerging findings.(278) This process is argued to help check the researcher's assumptions during research conduct by seeking validation of interpretations from study participants. This was seen as particularly relevant to this study and the researcher's background, and was therefore chosen to guide data analysis during this study. Because the social constructivist stance of grounded theory was adopted, data analysis techniques advocated by Charmaz were used during analysis (see Section 4.5.5).

4.3.4 Methodological Considerations for Trustworthiness Assessment

Trustworthiness of qualitative research has been defined as the measures taken to help establish the validity and quality of qualitative research and thereby strengthen the assurance that can be placed on the assumptions made by the investigator.(270) Because the social constructivist framework acknowledges the involvement and impact of the researcher during investigation, it was important that the researcher was critical of how his background could influence conduct of the study. This process has been defined as researcher reflexivity, or the "researcher's scrutiny of his or her research experience, decisions, and interpretations in ways that bring the researcher into the process and allow the reader to assess how and to what extent the researcher's interests, positions, and assumption influenced inquiry" (pg.188).(285)

The researcher for this study had a number of background characteristics that influenced how this study was undertaken. The investigator's previous experience in qualitative enquiry had mostly focused on service improvement for disability services prior to undertaking this research. Therefore, he had some experience conducting focus groups, using probes to explore themes identified in interviewing, and exploring sensitive issues. Additionally, the researcher was working for a rehabilitation service at the time of data collection as a quality advisor, but he was not working as a clinician in the delivery of rehabilitation (although had health professional training as a Health Psychologist). The researcher's background also included teaching quantitative research methods to undergraduate allied health students and conducting a number of research and service improvement projects that largely used quantitative approaches. This background meant that at the time of

conducting research, the majority of the researcher's experience had been in positivist investigation. The influence of this background will be further explored in the discussion section of this study.

4.4 Ethical Approval and Considerations

Ethical approval for this study was sought and granted by the Northern Regional Ethics Committee. Because interviews with individuals with TBI included personal questions about people's lives and experiences, attention was paid during data collection to be as respectful as possible. This process was informed by consultation with a disability and cultural advisor prior to interviews, to ensure that questions were asked as non-intrusively and appropriately as possible. Attention was also paid during interviews with professional stakeholders to make sure that sensitive information discussed about their clients was done in a way that clients could not be identifiable.

Anonymity has been preserved throughout this chapter by using codes or pseudonyms instead of participant's real names. Because the rehabilitation industry in NZ is relatively small, a number of rehabilitation stakeholders interviewed could have been easily identified if their full demographic and clinical background were given. A number of stakeholder demographic and background characteristics have therefore been modified in minor ways to protect anonymity, while preserving information relevant to this study.

4.5 Methods

The following section describes the methods used to collect data, the procedures undertaken during interviewing, how data was analysed, and the strategies used to ensure the trustworthiness of findings throughout this study. Following is an outline of the strategies undertaken to recruit each of the three stakeholder groups interviewed: (a) Vocational Rehabilitation Practitioners, (b) individuals with TBI, and (c) Other Professional Stakeholders.

4.5.1 Vocational Rehabilitation Practitioner Sampling

The Vocational Rehabilitation Practitioners interviewed in the focus group were members of an experienced multidisciplinary team specialising in community based vocational rehabilitation for TBI. This meant that they all met the inclusion criteria for having high levels of clinical experience in designing and delivering vocational interventions with TBI clients as registered health professionals. While a number of rehabilitation teams were identified as being suitable for being interviewed on the grounds of being multidisciplinary vocational rehabilitation services, the group selected were particularly appropriate as their team leaders each had over 20 years experience working as rehabilitation professionals in acute, residential, and community settings, delivering services exclusively to individuals with TBI. In comparison, other clinical services in the region did not have the same exclusive focus on vocational rehabilitation following TBI, did not have the same levels of extensive experience in vocational rehabilitation, or were not multidisciplinary.

Of the potential sample pool of eight clinicians, two members were unable to attend the focus group because of conflicting work commitments. While a total of six participants has been suggested to be an adequate sample size to conduct a focus group interview, (300) others have suggested that up to

12 participants can be appropriate.(298) The group were interviewed together in preference to including clinicians outside of their service, in an effort to ensure that participants felt comfortable communicating information.

4.5.2 Traumatic Brain Injury Participants Sampling

Snowball sampling was used to identify individuals who had sustained TBI and received intervention from the Vocational Rehabilitation Practitioner participant's service. Snowball sampling is defined as the process where study participants are asked to provide the names of other individuals who meet study criteria.(304)

During snowball sampling, Vocational Rehabilitation Practitioner participants were asked to identify clients who they believed had a set of circumstances which had either greatly impeded or facilitated vocational rehabilitation. In this instance, those with distinctively difficult or supportive environmental conditions with respect to RTW were sought to help to identify factors influencing employment after TBI. Rather than being representative of the TBI population, it was anticipated that this group of extreme cases, or "deviant cases",(300) would highlight the social factors that influenced employment outcome from the perspective of individuals with TBI.

Inclusion criteria for TBI participants were a documented TBI of any severity, of working age at time of injury and interview (between 16-65 years old), and being capable of engaging in an interview in English. Exclusion criteria were the individual with TBI having conditions other than TBI that were known to influence occupational function (as identified in the systematic review) such as psychiatric or drug abuse histories, co-morbid physical injuries, and amputation. This step was taken to control for potential confounding relationships between variables other than TBI that could influence employment. All clients approached by Vocational Rehabilitation Practitioner participants agreed to participate and for the researcher to contact them. However, one client could not be contacted despite a number of attempts. Vocational Rehabilitation Practitioners consequently identified another individual who agreed to participate.

4.5.3 Other Professional Stakeholders Sampling

Other Professional Stakeholders were sampled through a mixture of snowball recruitment, through professional networks available to the investigator, and by the investigator's supervisor at the time (Professor Des Gorman). Other Professional Stakeholders were purposively sampled as being individuals with high levels of clinical expertise regarding TBI and RTW in their respective professional field.

Other Professional Stakeholders meeting the criteria above were sent an email by the researcher inviting them to participate. One medical specialist (a psychiatrist) and one neuropsychologist who were invited to participate declined because of work commitments. All other rehabilitation professionals (n=9) approached agreed to participate.

ACC was approached to seek permission to involve ACC case managers in the study, given that their perspective was likely to be different to both individuals with TBI and professionals delivering rehabilitation services. However, ACC declined this invitation. Although a number of case managers were interviewed, they were not employed as ACC case managers at the time of interview.

4.5.4 Interview/Focus Group Procedures

An information sheet was sent to focus group and interview participants explaining the study (see Appendix 3) along with a consent form (see Appendix 4) before they were interviewed. All participants signed consent forms and agreed to interviews being audiotaped prior to interviews being undertaken. All interviews and the focus group followed the interviewer guidelines suggested by Green (298) with general discussion as an ice-breaker, followed by more focused questioning and discussion.

4.5.4.1 Vocational Rehabilitation Practitioner Focus Group Procedure

The Vocational Rehabilitation Practitioner focus group followed a semi structured format with an introduction of the research process before inviting participants to introduce themselves and give details of their clinical background as an interview ice breaker (see Appendix 5 for script and Table 23 for the stages of questioning). As Speziale and Carpenter argue,(289) ice-breakers are useful in the early stages of qualitative research to develop rapport with research participants, engage them, and help them to feel comfortable revealing information.

Table 23: Vocational Rehabilitation Practitioner Focus Group Procedure

Stage of focus group	Purpose of stage
1. Introduction	Introduce moderator and purpose of research, assure confidentiality, set ground rules for group, and make sure that participants agree to be audio taped
2. "Ice-breakers"	Record participants' background and get everybody comfortable with talking in a group setting
3. Brain-storming	To elicit participants' perceptions of all of the factors they believe influence employment after TBI
4. Exploration	To gather descriptive accounts of how participants believed the factors they indentified during the brain-storming session influenced employment from their perspective
5. Conclusion	To give the participants the option of raising ideas which were not covered in the semi-structured group interview.

Vocational Rehabilitation Practitioner participants were invited to collectively identify all the factors that they perceived to influence employment after TBI during the brain-storming phase of data collection. As Hansen suggests, brainstorming can be used early on in group interviews to help prevent patterns of respondent domination and to get all participants talking freely.(283) All facilitators of and barriers to employment after TBI identified by the Vocational Rehabilitation Practitioner group were written on a whiteboard during brainstorming to serve as a visual cue during the focus group (see Appendix 6 for a list of factors recorded during the focus group). Participants were asked to elaborate on the factors identified in the brain storming session and how they perceived them to influence employment outcome after TBI during the exploration phase of the focus group. This led to the refinement of factors identified during the brain-storming session with other factors that hadn't been covered during the

focus group being added to the white board. Participants were asked to comment if there were any other factors that they believed influence employment following TBI that hadn't been covered during the focus group in the conclusion of the interview.

The Vocational Rehabilitation Practitioner focus group was conducted in place of their regular weekly team meeting. The role of the researcher was to make sure that all participants were encouraged to contribute opinions, asking non-responsive participants for input where necessary, and to make sure that the focus group stayed on topic. Moderator guidelines were followed that suggest that the facilitator encourages all individuals to have input and to indicate where they do not agree with a stated opinion during the interview.(302) The moderator therefore constructively questioned participants to identify where differences in opinion existed and explored each instance from the different participants' perspectives.

4.5.4.2 Interviews with Individuals with Traumatic Brain Injury

Interviews with individuals with TBI followed a semi-structured format with an introduction of the purpose of the research, followed by questions around their injury and employment history as an opportunity to develop rapport before more direct questioning (see Table 24). During questioning, participants were asked to identify the factors that they believed to have been facilitators of or barriers to their employment following TBI (see Appendix 7 for script).

Table 24: Traumatic Brain Injury Participant Interview Procedure

Stage of interviews		Purpose of stage
1	Introduction	To introduce interviewer and purpose of research, assure confidentiality and make sure that participants agree to be audio taped
2	Case history/ice breakers	To gather information about the cause and severity of injury, employment history prior to injury and employment status at the time of the interview
3	Exploration	To investigate what participants believed to have influenced their employment following their injury, how they believed this to have changed over time and how they believed that they may change in the future.
4	Conclusion and member checking	To seek feedback on interpretations of responses given during the focus group and to discuss the findings of interviews with other individuals with TBI

Further questions during interviews focused on participants' beliefs of how and why the factors that they had identified as facilitators of or barriers to their employment had influenced their employment outcome from their perspective. Findings of the Vocational Rehabilitation Practitioner focus group and preliminary analysis of other TBI participant interviews were explored to seek feedback on the researcher's interpretation of findings during the member checking stage. Interviews took between 45 minutes and two hours, depending on time taken to reach the point where participants felt their story had been conveyed.

Because a number of participants lived in rural areas, or areas not accessible by public transport (the researcher not having a car), phone interviews were chosen to keep data collection as consistent as possible. Of the seven TBI participants interviewed, six participants agreed to be interviewed by phone

and one requested a face-to-face interview to be conducted at their home. It is acknowledged that phone interviews may have influenced developing rapport with TBI participants and thus data collection. The possible implications of conducting telephone interviews with TBI participants are further explored in the discussion of this chapter (see Section 4.9.6)

4.5.4.3 Interviews with Other Professional Stakeholders

Semi-structured interviews were used for all Other Professional Stakeholder interviews (see Table 25 for the stages of questioning and see Appendix 8 for a script of rehabilitation professional questions).

Table 25: Semi-structured Interview Procedure for Other Professional Stakeholders

Stage of interview		Purpose of stage
1	Introduction	Introduce interviewer and purpose of research, assure confidentiality and ensure that participants agree to be audio taped
2	Role investigation/ice-breakers	To investigate the role of the professional in the rehabilitation process and the assessments they used during rehabilitation
3	Exploration	To investigate participants perceptions as to the factors influencing employment after TBI from their perspective
4	Member checking and conclusion	To member check findings from all previous stages of data collection and to guide development of emergent findings/themes.

Interviews with Other Professional Stakeholders were conducted face-to-face with all participants at their offices of practice. This was possible as all rehabilitation stakeholder participants had offices located in central Auckland and could be accessed by public transport. Other Professional Stakeholders were first asked to describe their role in the rehabilitation/assessment of TBI patients before describing the assessments they used in their clinical practice as an ice breaker and to give context for questioning in the interviews. Further questioning was directed towards identifying factors that they believed to be facilitators of or barriers to employment outcome following TBI. Member checking was then performed, once participants had identified and described what they felt were the influences of employment after TBI. All interviews took between 45 minutes and one and a half hours, depending on time taken to reach the point where no new factors perceived to be influences of employment were being identified.

4.5.5 Data Analysis

Data analysis was performed in three stages, as appropriate for a constant comparative methodology.(278) Data from the Vocational Rehabilitation Practitioner focus group was analysed in the first phase, followed by TBI participant findings. Lastly, the finding of the interviews with Other Professional Stakeholder groups were analysed together.

For all phases of data analysis, audio recordings of interviews were transcribed using digital transcription hardware and typed out in full in Microsoft Word for Windows. All transcripts were then re-read to check for typos and possible misinterpretations of participants comments. The techniques for data analysis suggested appropriate for social constructivist investigation by Charmaz of line by line and focused coding were followed once data had been checked.(278)

All analyses were performed by taking the Word for Windows file and creating a table so that initial codes could be written next to raw text. During line by line analysis, each line was read and interpretations made by the researcher about how the data explored the influences of employment to develop initial codes. As suggested by Charmaz, initial codes are developed by moving quickly through the data, comparing data with other data and remaining close to the statements given by participants.(278) Where appropriate, initial codes were written as “in vivo codes”, which involved writing out the exact phrase to reflect interpretations directly derived from participants responses.(278) Once all transcripts within the respective stakeholder group (Vocational Rehabilitation Practitioners, TBI participants and Other Professional Stakeholders) had undergone line by line analysis, they were all reread to ensure that codes represented participant’s comments as accurately as possible. All transcripts that had undergone line by line initial coding were then printed out and focused coding was performed. Once again following the process suggested by Charmaz,(278) focused codes were developed by selecting the most relevant initial codes and testing them against data within each transcript and other participants within the participant’s respective group (TBI participants, Vocational Rehabilitation Practitioners, and Other Professional Stakeholders). Focused codes were written in the margin next to the initial codes and were derived by comparing and contrasting participant feedback both within one individual’s transcript, but also within their respective stakeholder group. Line by line codes were then deleted from transcripts and replaced with focused codes and saved as separate Word for Windows files. Once focused coding was performed on all transcripts of a stakeholder group, they were compared and contrasted with one another to ensure that they were consistently used across transcripts and that they reflected participants’ quotes. Participant quotes relating to focused codes were then cut and pasted into a Word for Windows file under headings reflecting focused codes and written into findings chapters.

Data analysis also occurred while writing up findings whereby emerging themes were checked with data to ensure that they reflected the content of participant’s comments. Once findings had been written up, all interviews for appropriate sections were re-read to ensure that interpretations had not taken participants’ quotes out of context.

4.5.6 Trustworthiness

Trustworthiness assessment for this study included methods suggested by Mays and Pope such as; triangulation of results from more than one stakeholder group or ‘fair dealing’ (as described in the sampling section of this chapter), respondent validation or ‘member checking’ (as this section describes), reflexivity (as mentioned in the methodology section), and clear exposition of methods of data collection and analysis to allow for critique and replication (as described in the methods section).(277)

Member checking has been defined as the process where preliminary data analyses are presented to participants to comment on the accuracy of the investigators interpretations.(277) These interpretations are then incorporated into another round of data analysis (283) with the intention of

establishing the degree of correspondence between the researcher and participants views.(277) This process was deemed important to ensure that the researcher's interpretations of participants' responses aligned with participants' intended meanings.

Member checking for the focus group involved the researcher meeting with the Vocational Rehabilitation Practitioner participants to discuss the researcher's interpretation of findings. Participants provided feedback about the investigators interpretations over a one hour session, which was documented and theme amendments undertaken. These themes were then written into research findings that were once again submitted to the Vocational Rehabilitation Practitioner group for member checking. The group chose a representative to critically read research findings, facilitate discussion within the group, and report back to the researcher.

Member checking was also performed by giving one of the participants of each Other Professional Stakeholder group (case managers, psychologists, medical specialists) a written analysis of findings and asking the participant to comment. Each participant who member checked results was chosen on the grounds of providing insightful input into findings and keenness to further participate in research. In each instance, nominated participants read the report and gave the researcher written or verbal feedback. Respondent feedback was used to refine thematic analysis and to make any necessary amendments. One TBI participant was also sent written findings of the researcher's interpretations of TBI participants' responses given during interviews. This participant discussed these with the investigator in a telephone conversation, at their request.

Another form of member checking was conducted throughout data collection where the researcher's interpretations of data collected were discussed with subsequent participants. This was done at the end of each interview to avoid biasing individuals' responses throughout interviewing (see data collection methods). This allowed for feedback not only on the researchers interpretation of findings from the member checker's respective group (ie. TBI participants, case managers), but also allowed for feedback on perspectives of other groups interviewed as to the influences of employment after TBI. In all cases, participants were asked to comment on whether interpretations made by the researcher were consistent with their perceptions and were asked to provide further input into thematic refinement.

Input from stakeholders external to the research process was also sought during trustworthiness assessment. This occurred during presentations of findings to TBI research and specialty rehabilitation groups including the Northern Rehabilitation Providers Group (which is a group of both publicly and privately funded providers who specialise in the delivery of residential and community rehabilitation to individuals with TBI in the North Island of NZ) and a speciality multi-disciplinary TBI group made up of clinicians delivering vocational rehabilitation services from a number of different TBI rehabilitation providers. Findings and interpretations from all qualitative investigations were presented to the groups and interpretations invited. These sessions were informal, with attendees commenting on the findings presented and discussing their own interpretations.

Following are three findings sections of stakeholders' perspectives of the influences of employment following TBI. These are presented in the order in which they were conducted:

1. The focus group with the Vocational Rehabilitation Practitioners (see Section 4.6)
2. Interviews with individuals with TBI (see Section 4.7)
3. Interviews with Other Professional Stakeholders (see Section 4.8).

Following the findings of the three groups interviewed, an integrated discussion of all data to identify key themes is presented. This explores implications of findings to both the prediction of employment following TBI and the framework of work disability (see Section 4.9).

4.6 Vocational Rehabilitation Practitioner Focus Group Findings

The following section describes the findings of a focus group interview with six participants from the vocational rehabilitation service interviewed which included two rehabilitation nurses, three occupational therapists, and a physiotherapist (see Table 26 for participant demographics). Generic participant codes are used in this section to protect the anonymity of study participants.

Table 26: Vocational Rehabilitation Practitioner Focus Group Participant Details

Participant code	Background
VR1	28 years experience in TBI rehabilitation including post acute, residential and community rehabilitation
VR2	20 years experience in TBI rehabilitation including post acute, residential and community rehabilitation
VR3	5 years experience in TBI rehabilitation including post acute, residential and community
VR4	7 years experience in TBI rehabilitation including case manager, residential and community rehabilitation
VR5	Approximately 3 years experience in community TBI rehabilitation
VR6	15 years clinical experience working predominantly in TBI community-based rehabilitation specialising in neuro-physiotherapy

Constant comparative analysis of focus group participants' responses suggested three themes with respect to the influences of employment after TBI from their perspective, namely; the process of intervention, working with families and their needs, and working with the individual in their work context (see Table 27).

Table 27: Themes Developed from Focus Group Analysis

Theme	Reported influence on employment
The process of intervention	Interventions were reported to need to be individualised to the needs of the client with TBI and be initiated as soon as possible after injury if they were to be successful in aiding RTW. Participants indicated that the individualisation process needed to take into consideration the individual's pre-injury strengths and weaknesses, their social context, and be balanced to match the process of recovery. Success of intervention was also reported to be dependent on the levels of skill of the rehabilitation stakeholders involved.
Working with families and their needs	A number of family factors were reported to influence how individuals with TBI engaged in rehabilitation such as their family roles and responsibilities. Family roles and responsibilities were also reported to sometimes change following injury and further lead to problems with engagement in interventions.
Working with the individual in their work environment	Return to work was described as a process that needed to be balanced in terms of what the individual could perform, the expectations of the employer, and maintaining the relationship between the individual with TBI and their employer. Some work places were suggested to be harder to return to following injury than others depending on the types of work demands that the individual needed to perform

Although themes are presented separately in this section, analysis indicated that the process of intervention was the central theme of findings from the Vocational Rehabilitation Practitioner focus group. This was apparent in that the themes of working with families and their needs and obligations and working with the individual in their work environment were reported to be important considerations in the development and delivery of interventions designed to help facilitate RTW after TBI. The

following findings section reports each of these themes and their relationship to the central theme of the process of intervention.

4.6.1 The Process of Intervention

Focus groups participants' responses indicated that they believed that intervention needed to be individualised in order to facilitate employment after TBI effectively. As this section describes, this process was reported to involve identifying characteristics of the individual with TBI that participants believed would act as either facilitators of or barriers to employment. This process of intervention individualisation was summed up by VR2 who stated:

> *I think every single person that I have returned to work, their plan has been quite different. It's been quite different and tailored to what they need.*

The process of intervention individualisation was further described by VR3 to involve incorporating the needs of the individual with TBI into the delivery of intervention and communicating these needs with other stakeholders in the rehabilitation process. This process was described as follows:

> *I'd like to think that everyone in this team looks at an individual as exactly that, an individual, and plan around them and what is right for them and then you negotiate that with the employer, you negotiate that with the funder, and you try and do the right thing… It's getting a bit of a balance of everything*.

When individualising intervention, participants' responses suggested that they felt that they first needed to understand pre-injury characteristics that they believed would either act as facilitators of or barriers to, attempted RTW. Participants indicated that they had observed TBI clients with both skills and organisational habits which they believed facilitated RTW and pre-injury characteristics that they believed to negatively influence employment outcome. The pre-injury characteristics reported to negatively impact employment outcome by participants, which they referred to as 'red flags', included histories of psychiatric illness, transient work, drug and alcohol issues, and previous brain injury. When asked to identify what they felt the influence of these factors was on the individual's recovery, VR2 commented:

> *Huge, absolutely huge. So when they come through to us, we look at them and we think red flag. Red flag. These things are red flags.*

While participants indicated that they believed that a number of pre-injury characteristics could negatively influence employment outcome, they also suggested that they believed there to be a number of pre-injury characteristics that could positively influence employment outcome such as organisational skills. For example, VR2 commented:

> *So I guess that another positive predictor* [of employment outcome] *is the people who are organised, they're used to using a diary, they're used to using routines.*

To explain how they perceived pre-injury skills to influence impairments, VR2 gave an example of one of their clients who was a school teacher who they believed had highly developed organisational skills

which they felt to be instrumental in their client's RTW. VR2 described why they felt that working as a teacher was difficult following TBI and how their client's organisational skills had helped them to RTW as follows:

> *Teaching is a difficult job* [to return to after TBI] *because of the multi-stimuli of kids putting demands on you, it's a really difficult job to put people back into. Having said that, I'm dealing with a teacher who has exceptional organisational skills who is teaching in a secondary school and she puts everything in a book and marks it all off and we've got her back to work so much earlier than we would have expected.*

In this example, there was evidence that suggested VR2 believed that their client's pre-injury organisational skills had compensated for their TBI related impairments. Another pre-injury factor reported to influence employment outcome was the individual's cultural background, as this was suggested to influence how the individual with TBI engaged in rehabilitation. Rather than being related to ethnicity, this was reported to involve belief systems and cultural practices. VR2 gave the following example to explain their beliefs concerning the influence of cultural beliefs on rehabilitation intervention:

> *Korean families that we have worked with, you're not allowed to rest, you have to go hard until you crash. To stop before then would be a sign of weakness… Whereas in Polynesian families, a Tongan one I can think of especially, if you're a male… within that family, the woman's role is to do everything for you.*

In this section, participants' responses suggested that they believed intervention needed to work with a number of characteristics intrinsic to the individual with TBI for it to be effective. As the following subtheme of timing of intervention describes, participants' responses also suggested that they believed that intervention needed to be designed to take into account their client's changing needs by describing how they considered the timing of intervention to influence employment outcome.

4.6.1.1 Getting in Early with Rehabilitation: Sowing the Seeds

A number of the focus group participants reported that they believed that effective intervention needed to be initiated soon after injury and carefully timed to ensure that it matched the individual's recovery from TBI. By getting in early, participants stated that they felt that they could provide education and establish adaptive ways of dealing with impairments related to injury. VR2 summed up their belief of the importance of early intervention by stating:

> *The early diagnosis is one of the most critical factors* [to rehabilitation] *because then you get the early education and understanding of what is going on and the access to early intervention. So you're on the fast rehabilitation track.*

This participant commented further that they considered that effective early intervention involved developing good patterns of managing symptoms associated with TBI. This process was described as 'sowing the seeds', drawing a parallel to planting seeds that would later grow. VR2 explained what they believed to be the benefits of early intervention as follows:

Any intervention, any education or understanding of the symptoms that you are experiencing and getting in before it becomes an entrenched pattern and sowing the seeds of "okay we need to manage this so that we can get you back to work" tends to get people back to work faster than three months down the track…. You get a better recovery if people have the information and they act on it earlier.

There was consensus among focus group participants that intervention to support RTW needed to be carefully timed. Comments from focus group participants suggested that they believed that there was however no one guideline as to how intervention should be timed that would suit everyone, and that there was always a risk involved in attempting RTW. This sentiment was summed up by VR1 who stated:

It is about risk… as to when it is that is the right time to put you back in[to the workplace]*? Because a lot of it does come down to risk taking, because you don't know if it's going to work sometimes.*

In discussing which elements they believed influenced 'risky' timings of intervention, focus group participants' comments suggested they believed risk taking around RTW could occur due to both clinicians and individuals with TBI rushing the RTW process. In the case of rehabilitation professionals, focus group participants' comments suggested that they perceived that lack of stakeholder experience with dealing with clients with TBI could potentially detrimentally influence the individual's employment outcome. The following account was given by VR2 as an example of why they felt that case manager inexperience could lead to difficulties in the RTW process:

Some case managers look at the duration guidelines and think, it's just a minor injury, they should be back at work by now, so why aren't they? They'll ring up and put pressure on the [General Practitioner] *to clear them to go back to work, and they'll go back to work and crash. And then* [RTW] *is a hell of a lot slower after they have gone in and crashed.*

A number of the participants also commented that they believed General Practitioners could play a significant role in ensuring individuals with TBI received intervention that would facilitate RTW. This was reported to be especially evident in instances of individuals with MTBI whom they considered did not always receive information about the potential consequences of their injury. In these instances, General Practitioners with inexperience in dealing with TBI were also perceived as potentially causing difficulties in the RTW process, as VR3 commented:

[A client with TBI] *will go to their* [General Practitioner] *and their* [General Practitioner] *will say 'you should be back at work now, and what's all this fatigue?' I've had to ring up* [General Practitioners] *because the client has been in tears when they've walked out of the doctor's surgery, because he thinks that I should be back to work next week, and he doesn't understand what's going on.*

Additionally, participants indicated that they felt that individuals with TBI sometimes rushed back to work due to their financial situation and pressures to earn an income. This was demonstrated by

participants' reports that they felt that individuals who did not receive income felt more pressure to RTW earlier. As VR2 argued:

> *When their money is low, they are pushed to get to work fast… it's actually the earnings related compensation, so it's actually the income, whether you can create enough from ACC.*

In another example, VR3's comments suggested that they also believed that some individuals with TBI were motivated to RTW before they had recovered due to financial issues as follows:

> *For some that haven't worked the full year who are on minimum wage, they need the money to pay the bills that keep coming in and they would start tomorrow if we let them*

These findings suggest that participants believed that the process of intervention needed to be initiated early after injury and carefully timed so that individuals did not rush back to work before they had recovered sufficiently. As the next two themes of family roles and obligations and the employment setting suggest, participants also believed that this process needed to incorporate social influences and what was happening in the individual's environment.

4.6.2 Working with Families and Their Needs

In addition to work roles, focus group participants reported that they considered that there were often other responsibilities in the individual's life that influenced their employment outcome. VR1 commented that during the development and delivery of intervention they believed:

> *It is important to remember that work isn't the only aspect of that person's life. There are other things that are influencing what they are doing*.

As the following section describes, problems with RTW after TBI were reported to occur when family roles changed following injury, as this change was considered to influence how individuals with TBI engaged in rehabilitation. To give an example of how they believed that family roles could influence employment outcome, VR2 described one of their client's situation, where they believed that changes in family roles had lead to tensions with the client's wife as expectations to look after the household chores changed:

> *We had a guy in crisis last week… and I came away thinking, the wife's more a problem than this guy. You know, she's increased her work, she doesn't have to, but the house is an absolute bomb site, and she is cross that he isn't doing the house work. But he didn't do it before his injury but this is really, really bugging her now. The marriage is really rocky, because the roles have changed, and she's not supportive.*

In addition to being perceived as causes of family tensions, changes in family functioning were also believed to negatively influence employment by altering how the individual with TBI could engage in rehabilitation. This was reported by VR1 to occur as follows:

If they're at home too long, having [the individual with TBI] *there to look after the kids becomes an expectation, and they usually give up the child care that they had in place, and so going back to work you've got to put all that stuff in place again.*

In the instances where families were involved, participants indicated that they believed that their support also played a significant role in RTW as it allowed the individual to engage in intervention. As VR5 commented:

And also that family taking more responsibilities so that that person can go back to work, and come home and rest rather than to cook tea.

4.6.3 Working with the Individual in Their Work Context

Participants' comments during the focus group suggested that they believed that some jobs were easier to return to after injury than others, depending on the roles associated with their clients' employment. As VR2's comments suggested, this was reported to be dependent on the complexity of the job role and how safe they believed it was for the individual with TBI to be in their job. VR2 commented that they believed that:

There are a lot of issues in there [around RTW], *one is the safety to return, but also there are the cognitive demands* [of their job]. *You're going to return people to lower level jobs much quicker than you are to higher level jobs.*

To demonstrate their beliefs around safety in RTW, VR2 gave an example of one of their clients who was working in a role as a petrol station night attendant. As the following describes, this client was reported to be at risk because of their volatility and the effect it may have on interactions with customers:

We saw a guy yesterday who, initially his volatility was huge. He was assaulted at his job at a service station where abuse is apparently the name of the game on the graveyard shift that he works. So we organised a day trial for two weeks to see how he was going to cope with that before dropping him back into more risky situations where you've got the drunks coming through giving you a bit of lip.

When asked if they felt that the client's volatility would put them at risk in their work role, VR2 commented that:

Yeah, it certainly is an issue, they have to have that volatility under control before you can put them back in a customer service role.

In this instance, there was evidence that the focus group participant believed that they had organised intervention to manage impairments to enable RTW. In another example where impairments were reported to interact with job demands to influence job performance, VR2 gave an example of a client who had a brain injury 12 years before intervention. This individual was reported to have been functioning well in their job, but was reported to have had difficulty once they changed to working in an

area where their impairments were believed to limit their work function. VR2 gave the following account:

> *We have a guy who had… been doing really well at work, but, they changed him to the phones and he crashed. We dug out his neuropsych assessments* [and discovered], *he's got problems with auditory assessment.*

In this example, the VR2's comments suggest that they believed that impairments had influenced the client's ability to perform cognitive tasks associated with their role. Whereas these impairments had not caused difficulty in work performance before, it was once the individual's work roles changed that they experienced work disability. Furthermore, VR2's comments gave an example of how they believed assessment could be used to identify where impairments associated with TBI were likely to influence work function. However, participants' comments suggested that they did not believe that neuropsychological tests always gave accurate information as to how the individual was likely to perform in their job. For example, VR2 commented that:

> *We have had a lot of debate about how people function, better or worse, on psychometric testing, and if you do well in the neuropsychologist's room in a one to one situation. But then you put that person back into a noisy workplace, where there are lots of distractions and multi stimulus, that's no predictor.*

There was consensus among focus group participants that information on how an individual was likely to perform in their job could be gathered by observing them as they engaged with their work environment. For example, VR3 gave the following description:

> [We] *will do really practical things, before you are returning someone to a manual job, using power tools and things, we'll be looking at, the speed of information processing… observing them, whether they are safe, attention to detail, things like that.*

However, another participant commented that they believed that a worksite assessment was also limited in giving accurate information as to likely employment outcome in that it only gave a cross sectional indication of the individual's function. The limitations of a worksite assessment were reported by VR3 to be as follows:

> [Worksite assessments give a] *snap-shot of what we are observing and what they are reporting to us at the time and what we are reading from previous reports. But it actually takes us many weeks and sometimes months, to actually get a really good picture of how they are functioning.*

In these examples, there was evidence that participants believed that it was difficult to predict how the individual with TBI would perform in their work role because of the unknown elements of the individuals work environment. In addition, participants indicated that they considered that contextual factors could change over time and reported that professionals delivering intervention needed to pay

attention to ensuring that intervention was responsive to changes in the interaction between the individual and their environment. VR1 commented that they believed this process to involve:

> *Facilitating that return to work pathway… it's working alongside that person, seeing how it goes modifying that, listening, feedback, trying this one and saying you've gone too far too fast, or wow you could do more.*

To further describe this process, VR3 commented that they felt that it was important to ensure that intervention was adapted to the individuals changing capabilities and needs. As VR3 described:

> *It's making sure that their hours and their work tasks are balanced right in terms of whether they have any ongoing symptoms or whether the symptoms are managed.*

To ensure that intervention achieved the 'balance' between level of work demands and the individual's capabilities, participants reported that they felt that it was essential to engage the employer during intervention planning and delivery. This process was explained by VR3 as follows:

> *I think that if you provide a lot of communication and education* [to employers] *from the beginning, it's about making sure that they are kept in the loop all the way through*.

However, VR4 commented that they believed that employers were not always supportive of RTW and that they had had the following experiences dealing with employers:

> *There are some employers you come across who don't necessarily seem to value their staff, so they want performance out of them, they're not that bothered about the person. If they are not performing, they are not that interested in them*.

However, VR3 went further to indicate that they believed that employers' attitudes towards supporting individuals with TBI could be due to a number of factors including the ability of the employer to financially support the injured individual by commenting that they believed that some employers did not have the resources to support RTW by stating:

> *I think that there are a lot of dynamics at the work as well and whether they are short staffed and in general, whether the company is under pressure at the time.*

Additionally, a number of participants also suggested that they believed that the employer's engagement in the RTW process was dependent on the pre-injury relationship with the individual. VR2 commented that they gauged this by talking to the employer through the following process:

> *One of the interesting questions that I ask… is have there been any previous concerns in their work performance? And no, they are valued staff and we can't wait to have them back, fine, but oh well there's been this and there's been that and the other thing. You think, here we go. So the successful return to work for those are a lot more difficult.*

Where a history of aggravation was reported between an individual and their employer, VR2 reported that they sometimes intervened to do what they could to ensure RTW was possible. This was reported

to be facilitated by trying to understand the motivations of the employer and how intervention could be developed to also meet their needs. As the following example suggested, VR2 indicated that they believed that RTW was a possibility by working with what they believed to be the employer's motivations as follows:

> *We are going to a work meeting with a manager tomorrow and we know that there has been a long standing history of aggravation between this guy and his manager and he thinks that he's got too much to do and not enough support. They are wanting him back full time and he isn't managing with three days a week, and it's got trouble written all over it.*

VR1 further described the intervention for this client to involve working with the employer and giving incentives to encourage RTW as follows:

> *So we are going to talk to the employer, provide some education and see if he will take that step backwards, and point out that training someone else for this role will take six months by which time he will be back full-time, so we have to provide an incentive to keep this guy in the job and support him.*

Throughout the focus group, participants described the process of the development of vocational interventions and how they believed that individualised programmes aided in promoting RTW. Most importantly, these findings gave evidence to suggest that participants believed that intervention needed to incorporate elements of the individual's social environment, such as their family life and the work setting. By doing so, participants' responses suggested that they believed that this contextualisation would allow for accommodating not only the needs of the individual with TBI, but also others who they believed had influence on the individual's outcome, namely the individual's family and employer.

By conducting a worksite assessment, participants indicated that they believed that they were able to assess where impairments were most likely to influence the individual's function, as well as assessing where environmental factors could influence the individual's function (see Section 4.6.3). However, participants also stated they believed work roles are not static, can change and may be influenced by impairments at different times, such as was the example of the individual whose auditory impairments influenced their work function when their work role changed to answering phones (see Section 4.6.3). As such, participants reported that it was often hard to predict how the individual would perform in their work role until they were actually in their work role.

4.7 Traumatic Brain Injury Participants Interview Findings

Following the Vocational Rehabilitation Practitioner focus group, seven individuals with TBI were interviewed to investigate the influences of employment from their perspective. The following section reports the findings of interviews with seven individuals with TBI (see Table 28 for demographic information of study participants) as to what they felt were the influences of their employment following TBI from their perspective (see Appendix 9 for further participant details). Pseudonyms are used in this section to protect the participants' anonymity.

Table 28: Traumatic Brain Injury Participant Details

Pseudonym	Age	Injury information	Severity	Pre-injury occupation	Employment status at the time of interview
Andrew	45	Assaulted with hammer, Short period of LOC, no details regarding GCS or PTA 19 months post injury	MTBI	Quality control supervisor (racking systems)	Unemployed
Bill	50	Hit in head with flying gas bottle, PTA two weeks, unconscious several hours 20 years post injury	Severe TBI	Branch manager (Oil supply company)	Unemployed
Donald	42	Motorcycle accidents Two injuries. 20 years post first injury (six days LOC), five years post second injury (no LOC)	First TBI severe, second TBI mild	Print machine operator	Unemployed
Gail	52	Motorcycle accident Seven years post injury	Moderate TBI followed by subarachnoid haemorrhage	Office manager	Unemployed
Henry	Early 60s	Motor vehicle accident, PTA three days 18 months post injury	Moderate TBI	Mechanical engineer	Full time employment
James	Early 40s	Fall, PTA one week One year post injury	Severe TBI	Motor mechanic	Full time employment
Ruth	Late 50s	Motor vehicle accident, no recorded LOC, but evidence of cognitive impairments One year post injury	MTBI	Medical practice manager	Full time employment

Analysis of interviews with participants with TBI revealed three themes encapsulating the reported influences of their employment after TBI from their perspective: how TBI had influenced work function, getting support (the need for help when returning to work), and receiving rehabilitation (see Table 29). As the following findings section outlines, participants reported that they felt that the influences described in these three themes had both influenced their employment in the past or was likely to do so in the future. Analysis also revealed that how TBI had influenced their work function was the central theme of findings, in that levels of support and rehabilitation services were reported to help participants either compensate or manage how they believed TBI to have influenced their function. Following are explanations of each of the themes revealed during analysis and their relationship with the central theme of the influence of impairment on work function.

Table 29: Themes Developed from Analysis of Traumatic Brain Injury Participant Interviews

Theme	Reported influence on employment after TBI
How TBI had influenced their work function	Impairments associated with TBI, especially fatigue, were reported to influence work functioning by leading to individuals making mistakes in their work or not being able to meet the expectations of their employers. Individuals reported instances where they were no longer able to perform work roles that they could in the past, and that they believed that their impairments were likely to inhibit them from performing work roles in the future.
Getting support: the need for help when returning to work	Participants reported that supports that they had received from their families, from ACC and in the work place had helped them to both recover from injury and RTW. Whereas some supports were reported to help the individual engage in intervention by removing pressure, supports in the workplace were reported to help the individual perform their work role.
Receiving rehabilitation	Rehabilitation services were reported to be helpful by all participants in describing the process of recovery, informing when RTW could be appropriate, and the ways that impairments after TBI could be managed. For some individuals who had not returned to work at the time of interview, inconsistent rehabilitation services were reported to have caused problems with their recovery.

4.7.1 How Traumatic Brain Injury Influenced Work Function

There was evidence during interviewing that participants with TBI reported different levels of impairments following injury. Whereas some individuals felt that they were unlikely to ever RTW because of their impairments, James reported having no impairments after moderate TBI as follows:

> *I don't have any problem with the job I'm doing now…. They were quite surprised at the hospital how I did recover and didn't have any major problems with the injuries that I did have to my skull.*

However, other participants who were employed or unemployed at the time of interview reported that they had experienced situations where they believed that TBI related impairments had influenced their ability to perform their work roles. In a number of examples, participants described how they felt that difficulties with memory and levels of fatigue had negatively influenced their employment following TBI. These changes in work functioning were reported to be problematic when they had led to situations where individuals felt they could no longer perform their job to the level that was expected by their employers. For example, Bill commented that he had experienced the following difficulties when he returned to work after his injury:

> *It's twelve months after your injury, your legs healed, you should be able to perform the job and lift and drag things up and down ramps as before. That didn't happen. I was tired and fatigued and needed to go home all the time, keeping it to myself and of course things weren't getting done.*

In a similar example, Donald described where he believed that the mistakes that he was making in his job as a printer were associated with his TBI and had led to situations where his employers had become dissatisfied with his performance. Donald described how he believed that employer dissatisfaction had led to him being made redundant:

> *Mistakes kept happening in my job. We would have, as my boss put it, "disciplinary meetings". He said why is this happening? And he would have their lawyer, and they would say "why is this happening" and have some examples of the sheets from a job that weren't satisfactory.*

In these examples, participants' responses suggest that they believed difficulty maintaining employment occurred when their ability to perform their job role was influenced by impairments associated with TBI. There was also evidence that participants who were unemployed at the time of interview had avoided employment opportunities where they believed that their ability to perform their role was limited by the changes in their functioning following injury. For example, Bill described how he had responded to a case manager who had suggested possibilities for employment based on his pre-injury skills. In each of the situations, Bill explained why he felt that they were inappropriate because of his impairments as follows:

> *They said, you used to be a fitter welder, so therefore you can go back to welding. I told them, hang on, I have trouble with light, all the fumes and that's what welding is all about. They said,*

you love gardening, so you can work in a nursery, I said hang on, let's forget about the head now, the back and the knee, I can't squat too long.

In each of these scenarios, Bill indicated that he felt that his impairments would limit him in performing job roles in the future. To further explain how he felt that his ability to perform job roles could be effected by impairments associated with TBI, he gave the following comparison:

This guy with one leg saying he can be a tap dancer. For a guy with a stutter, you can be a sales rep. It's that scenario.

In another example, Henry indicated that he also felt that his impairments could potentially limit him if his work demands of his job as a structural engineer were to change in the future. This was evident in that he acknowledged that his impairments may prohibit him from being able to perform in his role as follows:

At the moment I'm doing [two dimensional] *computer graphics…. I would like to get into* [three dimensional]*. It concerns me that I might have problems learning the new programme…. I would be keen to try it, but I bear in mind that failure is a possibility.*

In each of the examples in this section, participants gave accounts of how they felt that impairments had either limited their ability to RTW or how they believed that impairments would limit their ability to perform work functions in the future. When asked to describe which elements of their functioning they believed to have been influenced by TBI, many reported that they had experienced difficulties with memory and/or experienced problems with sustained activity because of levels of fatigue. Following are accounts of how participants believed that impairments in memory and fatigue had influenced their ability to perform work roles.

4.7.1.1 Difficulty Remembering Information

To explain how they felt that impairments with memory had influenced their employment after TBI, participants gave accounts where they had experienced difficulty recalling information while working. For example, Bill indicated that prior to his injury, he felt that he was good at remembering information related to his work, stating:

Prior to the accident I never used to use diaries. I had a very good memory. If I told someone I would be there in three months time at a certain time, I was there.

However, following his injury, he reported that he had difficulty remembering details related to his work as follows:

Everything the customers asked me to do or get information about, I kept forgetting.

In another example of how memory impairments were reported to influence work function, Gail described how she felt that changes in her memory had led to difficulties in performing work roles associated with being an administrator. In this example, Gail described how she had difficulty when she tried to answer phones at a community centre as follows:

> *I would get to answer the phones, and I would have to have written down what the name of the place was because, by the time I had picked up the phone, I couldn't remember the name of the place. That was even after I had been working there for four months. I had to have a piece of paper with* [the name of the workplace] *written on it. Because otherwise it just went blank.*

In both of these examples, difficulties with memory were reported to influence participants' ability to perform tasks related to their job roles. However, there was also evidence that Ruth had adopted a number of strategies to compensate for difficulties with memory and concentration. For example, Ruth commented that she had organised her work responsibilities as a manager for a medical practice so that she was in a quiet office away from situations that she found distracting. Ruth commented that by doing so, she was able to manage her impairments in concentration and attention. Ruth gave an example of her adaptive strategies by describing how she had asked her staff to communicate with her in a way that enabled her to process information as follows:

> *What I have said to my staff… don't tell me things, if you want me to do something, write it down, because I have too much to remember. It's one of my coping strategies if you know what I mean.*

Ruth also described a situation where she felt that she had accommodated situations in which she considered that her work environment limited her ability to perform her role. Ruth gave the following account to describe this process:

> *Because I am the general manager, I have my own quiet office. The quietness is essential. I don't have that answering heaps and heaps of phones. I could manage it better*. *So although I would quietly beaver away, I don't have all that noise and stuff.*

Ruth's comments gave examples of how she believed impairments could be managed and she could fulfil her work roles by adopting strategies to compensate for changes in function. In contrast, as described in the following section, fatigue was reported to be an impairment that participants felt limited their ability to perform their work roles and that they found very difficult to manage.

4.7.1.2 The Experience of Fatigue and Exhaustion

While fatigue was not universally reported by interviewees, participants who were unemployed at the time of interview commented how they felt that fatigue was the single most significant barrier to their RTW from their perspective. Reported experiences of fatigue did not however appear to be related to the cause, severity, and time since injury among study participants. For example, Henry and Ruth reported experiencing fatigue in their early recovery, which was reported to reduce over time, whereas James reported no experience of fatigue following TBI. In contrast, all participants who were unemployed at the time of interview reported high levels of fatigue which they felt to considerably influence their ability to engage in employment in the future. For example, when Gail was asked what she believed to be the most significant barrier to her RTW, she commented:

> *For me, fatigue is the biggest thing… I feel like I've been out partying all weekend. And drunk several bottles of whisky. It's just so extreme and I would have never believed it possible.* G

A number of participants gave reports of where they believed fatigue had influenced their functioning or where they believed it would do so in the future. For example, Bill reported that fatigue led to situations where he had been secretly having naps when he became tired at work as a travelling sales person:

> *I was experiencing problems all the way through and I would leave before I felt that I was going to be sacked because I wasn't doing the job or I was sneaking away and having rests and all that sort of thing.*

In another example of fatigue influencing work function, Gail commented how she felt that fatigue had influenced her ability to function in a voluntary position as an administrator because she felt that she could not work for more than two hours before becoming exhausted. In describing her experience, Gail indicated that she felt that fatigue had limited her ability to work for extended periods of time:

> *I was down there for four months working two hours a day on Monday, Wednesday, and Friday…. I thought, once I get used to it, their paper work system and the rest of it, it won't be a problem, but it never improved. If I did any more than half an hour over that two hours I could barely drive home. I was absolutely knackered.*

In addition to restricting their ability to work, a number of participants commented that they felt that fatigue had limited their ability to travel to work. For example, Judy commented that she felt that fatigue from driving made her exhausted after injury as follows:

> *I can only drive now, only relatively short distances… Normally you just get into a car and go. Now I get in the car and I actually have to think about what I'm doing. Even the smallest detail, and I think that that is one of the things that makes me tired, with the driving, having to concentrate so hard.*

Similarly, when Bill described the influence of fatigue on his ability to drive, he gave the following account:

> *When I was working, I was driving around, after about an hour, two and a half hours driving, I was a danger on the road. I was exhausted…. By the time I would reach my destination, instead of working, I would spend half a day to a day recovering from it.*

Participants therefore described how they believed that fatigue not only influenced their work performance, but also created barriers to them getting to their job. Gail reported that she felt that she would not be able to engage in voluntary work because of her fatigue. Gail gave the following account of being taken to a community centre to investigate potential areas of voluntary work, but felt that she would not be able to engage in these roles due to fatigue limiting her ability to travel:

> [An occupational therapist] *took me into the volunteer centre in Epsom and we told them what I had done before and they wanted me to work for them there. I said that there is no way I could drive from Swanson to Epsom in traffic and still be capable of doing something and still be capable of driving home.*

The reported barriers to employment caused by fatigue were considered to be so significant by both Bill and Gail that they felt that they would never engage in full time work again. For example, when asked if he felt that he would ever return to full time work, Bill commented that:

> *I think basically the doctors are saying now that 15 hours, and if you can get some of these things in process, you might stretch them to 20-25* [hours work a week] *maximum. Really, that's about it. I do more than three hours in one hit. If I do more than that, I am totally exhausted. I'm a zombie.*

Similarly, when Gail was asked what conditions she believed would aide in her RTW she commented:

> *I can't see any business being able to provide me with any help unless they can wave a magic wand and fix my head and stop me being so tired.*

In this section, participants described how they believed that impairments had not only influenced their ability to perform their job roles, but also how they were likely to do so in the future. As such, the experience of impairments was reported to also limit future potential areas of work. As the following themes discuss, the influence of TBI on work function was not reported to be a simple relationship, but to be contingent on a number of social influences such as practical supports (as with funding from ACC) or by vocational rehabilitation services providing insight into how to compensate for impairments.

4.7.2 Getting Support: The Need for Help When Returning to Work

A number of participants with TBI felt that the supports they had received following their TBI were instrumental in aiding their RTW. Initially after injury, participants' responses suggested that they considered that the support that they received from their family and financial support from ACC helped to remove pressure from their situation so that they could focus on recovery. Additionally, participants reported that they felt that levels of support in the workplace during RTW had influenced their employment outcome. This was evident in that a number of individuals felt that the lack of support from their employers had led to difficulties in their employment after injury.

In a number of examples, participants described situations where they considered that support soon after injury had helped them cope with the changes related to their injury and therefore focus on recovery. For example, when asked how he felt that his family had helped with his recovery, Henry commented:

> *They were just trying to help me cope with life. No pressure, the lack of income wasn't an issue. The thing was, get well.*

The importance of family support during recovery was also reported by Ruth who commented that she felt that she would have had difficulty in attempting RTW if her husband had not supported her through the process:

> *My husband had been good.… But he always has been, that's just the way he is. That's pretty lucky. If you were just trying to deal with it on your own, it would be pretty hard. It would be impossible.*

Additionally, James, Henry, and Ruth commented that they felt that support from ACC had also allowed them to focus on recovery. For example, while Henry reported that he had had some difficulties with ACC regarding the amount of compensation that he was entitled to following injury, he also acknowledged that the compensation that he had received helped to alleviate stress of having to provide for his family. James and Ruth also felt that they had had positive experiences in RTW, aided by receiving compensation from ACC. For example, when James was asked how he felt ACC had supported him in his RTW he commented:

> *Being there financially I suppose. If there were any problems, you could ring them, the woman I had was really good. I was very happy with them.*

A number of participants' reports suggested that they felt that support in their workplace was also important once they had recovered to the level where they could attempt RTW. In an example where workplace support was reported to have led to a successful outcome, Henry gave the following account of where his employers were reported to have been flexible in their ability to allow his RTW. As he described:

> *There was no problem. They were very understanding. Basically, the company is now moving into a new field and so having me* [returning] *in stages actually suited them very nicely…. There wasn't any financial or work pressure for me to get things done. I was very lucky from that point of view.*

Henry further commented that he felt that this support was important in allowing his RTW, as he stated:

> *I knew that from myself, I wasn't in a fit state to take pressure.*

In comparison, Bill, Donald, and Ruth reported that they had felt that the lack of employer support had contributed to them having difficulties in their jobs after TBI. For example, Ruth gave an account where she had experienced conflict with her employers which she felt made working in her situation difficult. Ruth commented that this had started when she had discovered inconsistencies in the accounting system at her work. This was reported to escalate to a confrontation when she bought these issues to the attention of her employers. Ruth described the sequence of events of her RTW from her perspective as follows:

The second day I was there, I asked to see the accounts. As soon as I looked at it I told him there are lots of things wrong here. We found that the accounts person had no idea what she was doing. We had a huge confrontation with the Board.

Ruth commented that this confrontation had lead to her being asked to resign from her position, but that she had stayed in the job due to the levels of support that she received from her staff following this altercation. Ruth described that when her staff had received information of her situation, the following occurred:

The staff went out on strike, 'we want [Ruth] *back. She is the best manager that we have had for years.' It was really good having the staff behind me. That has been a huge thing.*

In addition to supporting her with her employers, Ruth also commented her workmates had also supported her in performing her work role. For example, she gave the following description of how she had found her staff as helpful:

My staff have been really good. A couple in particular have realised what I have on my plate and have actually offered solutions "can I do that for you" and "can I take that off your plate"…. That has been helpful. They don't want to lose me basically.

Ruth further commented on how she found their support as helpful:

It's a huge incentive, if it wasn't for that, I don't think that I would still be there. I know that I wouldn't.

Participants who had not returned to work at the time of interview indicated that they felt that potential employers would need to be understanding of their TBI if they were to RTW. For example, when Donald was asked what conditions he felt would be necessary for him to RTW, he commented:

If it was with the right company. If it was with people who understood that I have a head injury… If they said they understood about head injuries, I would say when do you want me to start?

Other participants also felt that it was difficult to find an employer who understood and were sympathetic to the symptoms of TBI. In the following example, Bill gave an account of why he felt that it would be hard to find employers who were supportive to how he felt fatigue influenced his work performance:

The problem I have [in returning to work] *is finding an employer that you can go to after working an hour and you can say "look, I gotta go, my heads stuffed up, I need a rest, and whatever". It's hard to say to me or any person in the same situation, your hours are 8-11 and you are going to perform 8-11, it just doesn't work.*

4.7.3 Receiving Rehabilitation

Participants who were either working or unemployed at the time of the interview gave accounts to suggest that they felt that the vocational rehabilitation services they had received had supported them

in recovery. For example, Andrew, who was unemployed at the time of the interview, indicated that he felt that the vocational rehabilitation services that he was receiving where instrumental in helping him in his recovery by stating:

> *I'm relying on them to guide me through the muddy water. I'm hanging onto* [their] *hand, but I got no vision. I'm just relying on* [these] *guys to keep me and help me through it. That's all that can be done at this present moment.*

Specifically, participants' responses suggested that they found vocational rehabilitation services advice on how to compensate for impairments related to TBI and suggestions of when to RTW had aided them in successful employment outcomes. For a number of participants, this was reported to have led to situations where they felt they had been re-assured on what to expect and therefore reported that they could recover from injury. For example, Ruth commented that following a period of time where she had not received intervention, vocational rehabilitation services involvement had given her information on what to expect and how recovery could occur, and referred to their involvement as a 'breakthrough' in her recovery:

> *It was several months down the track before* [vocational rehabilitation services] *became involved. And that was really where the break through started to happen. It is very frustrating, and you get someone who actually identifies what is going on and starts to put some things in place like a rehabilitation plan, you start coping with problems.*

Other participant's commented on how they found services to be helpful, stating that they felt that intervention had enabled them to focus on recovery and allow themselves to rest, rather than pushing for rapid recovery. For example, Henry indicated that he felt that the advice that he had been given during vocational intervention had allowed him to understand that recovery would take time. In the following comments, Henry described that he felt that rehabilitation services had helped his RTW by:

> *Explain*[ing] *what was going on, by talking about it, how the mind copes with things, how I will feel about it, particularly what people do about it, and don't panic. It will all get better. It's very important message to get across. It took time.*

In another example, Gail commented that she wished that she had received intervention sooner after injury than she did. Gail said that she felt that the intervention that she had recently received had increased her chances of RTW as follows:

> [The services delivering intervention] *have been quite a big help for me. One of the regrets that I have had is that if I had had* [them] *right from the start.*

When asked why she felt that these services would have helped her in her RTW she gave the following account:

> *There were so many small things that I had problems with that looking back on it would have been the concussion. Which I think* [the vocational rehabilitation service] *would have picked*

up. So many small things that [the vocational rehabilitation service] *has suggested that have made a big difference. That I would never have thought of.*

In a similar circumstance, Henry commented that he also believed that it was the explanation of how to compensate for the symptoms of TBI that had helped in his RTW. He reported a psychiatrist gave the following advice:

He just pointed out that I may never get back to work, I may have to work part time. You just don't know, you have to try these things and see. He was quite helpful talking about various things and giving strategies for coping with the problems.

In addition, Henry commented that another aspect that he found helpful was the explanation of his symptoms to his employers, as he felt that he himself didn't understand his symptoms at the time. Henry described this process of sharing information with his employers to educate them about his symptoms as follows:

It made them understand what was going on. Otherwise they would have had to listen to me, and think does this guy really know what he is talking about?

In particular, Henry commented that he found the explanation to his employers of how his performance was likely to be influenced by his impairments was helpful including:

The whole concept of fatigue, and not pushing it. The memory loss, the stuff is still in your mind, it's just that you can't find the flaming draw in the filing cabinet to get it out.

Another aspect of intervention reported by all participants who were employed at the time of the interview to aid RTW was the explanation of the need to time RTW in parallel with recovery. In each of the following examples, participants gave accounts of where they had wanted to RTW, but were advised not to until vocational services believed that they had recovered sufficiently. For example, James gave an account of how he felt that advice not to RTW too soon after injury had helped in his employment outcome:

I wanted to go back to work, but the woman from [the vocational rehabilitation service] *wouldn't let me. I was in my own mind ready to go back, but after thinking about it, being off work for the amount of time that I was, I did realise that I wasn't ready to go back to work.*

Henry also felt that taking time to RTW was helpful in fostering a positive employment outcome:

I started off part time, I think 2 or 4 hours. Sort of short mornings two or three times a week is how I started off. And then it gradually increased until it was full time…. I found that what [the vocational service had] *advised was quite right. They had a habit of always being right.*

While there was evidence that participants had found vocational services helpful, a number of participants who were unemployed at the time of interview also indicated that they believed that elements of their intervention had been mismanaged. Bill, Donald, and Gail all reported instances where they believed that they had not received sufficient information nor appropriate intervention for

their TBI. In particular, these participants indicated that they felt that inconsistencies in delivery of their rehabilitation had detrimentally influenced their chances of RTW. For example, Bill considered that the intermittent services that he had received from ACC, where they had funded intervention and then removed funding, was akin to them, as he put it, *"pulling the plug".* Bill gave the following example to explain his experience of receipt of inconsistent service:

> *Things will go well, then they will stop the support, then because you don't have the monthly, 2 monthly support in between that to draw on, you start going blindly again and I lose track of things and how to piece it all together and I end up in a big mess.… For them to come along with a 3 month thing doesn't work… They can't keep pulling the plug.*

Bill considered that this cycle concluded with ACC conceding that there was not much that they could do for him and not delivering any more rehabilitation for what he reported was a significant period of time following injury. Because of this, Bill felt that any intervention given now was too late to be truly effective in enabling him to RTW. Bill's comments suggest that he believed that this had now come to the point where he was sceptical of attempts to aid his RTW by stating that when services came up with suggestions, the following occurred:

> *My mind keeps on saying, but I've tried that, it failed. It's very hard to accept it. My mind keeps rejecting it. All my mind does now is find the problems with doing it. I look at the fatigue level and the frustration around trying to do it. I keep getting blanked out. I think, had that of been there in the beginning, my mind would have been more in tune with it.*

In this section, participants with TBI gave examples of how they believed impairments associated with their injury had limited their ability to perform work roles. However, there was also evidence that some participants had developed strategies to accommodate for these impairments so that they did not eventuate in work disability. In particular, fatigue was perceived to pose significant problems by a number of individuals as they believed that it influenced how they could engage in sustained activity and therefore would be the reason why they would never return to full time employment. In addition, participants also reported that the anticipated influence of impairments had meant that they had avoided some employment situations or felt that some vocations would be unsuitable if they were to attempt to RTW. In particular, while participants felt that intervention was helpful in aiding their RTW, they also felt that it was important that it needed to be given at the right time with a number reporting that they felt it was 'too late' for them now. Along with vocational services, participants reported a number of factors that they believed to have helped them in RTW including provision of support by helping organise their social responsibilities or reducing social pressures.

4.8 Other Professional Stakeholder Interview Findings

Following the Vocational Rehabilitation Practitioner focus group and TBI participant interviews, Other Professional Stakeholders were interviewed to further investigate themes developed from analysis. The following section describes the findings of semi-structured interviews with case managers, psychologists, and medical specialists (see Table 30 for participant demographic information).

Table 30: Participant Details of Other Professional Stakeholders

Participant code	Area of clinical training	Background
CM1	Case Manager	3 years experience working mainly in acute TBI case management. This included liaison with family, employers, onsite clinicians, and rehabilitation providers. Clinical background in psychiatric nursing.
CM2	Case Manager	17 years in TBI rehabilitation facilitation. Background in psychology with post graduate qualifications in rehabilitation (vocational and counselling).
CM3	Case Manager	10 years experience in case management with a background in general hospital nursing, clinical tutoring, and public health nursing. Registered nurse with a post graduate diploma in case management
P1	Psychologist	20 years experience as a psychologist, with specialist experience in clinical psychology intervention and neuro-behavioural rehabilitation following mild to severe brain injury
P2	Psychologist	10 years experience working as a neuropsychologist specialising in psychological conditions with TBI clients such as anger, anxiety, depression, and neurological conditions.
P3	Psychologist	10 years experience in the field of neuropsychology in community and outpatient settings
MED1	Neurologist	18 years experience as a neurologist with specialist expertise in epilepsy and headaches/migraines following TBI.
MED2	Rehabilitation medicine consultant	Consultant in rehabilitation medicine with 10 years experience working in TBI (severe, moderate and mild), stroke, and other neurological disorders such as hypoxic/toxic brain injury, multiple sclerosis and, Parkinsonism.
MED3	Occupational medicine physician	17 years experience as a doctor, working as a consultant occupational physician at the time of interview.

Analysis of interviews with Other Professional Stakeholders revealed three major themes with respect to the factors that they reported to influence employment after TBI; the influence of impairments on workplace function, the process of intervention and recovery, and understanding and working with stakeholders in the RTW process (see Table 31). Participants' responses indicated that the process of recovery and intervention was the central theme of findings in that both impairments and stakeholder involvement were reported to need to be carefully managed throughout the rehabilitation process. The following section explores these themes and their relationships with one another from the perspective of case managers, medical specialists, and psychologists.

Table 31: Themes from Other Professional Stakeholder Participant Interviews

Theme	Reported influence on employment after TBI
Influence of impairments on workplace function	The ability to perform work roles was reported to be contingent on the influence of impairments on work function. In particular, fatigue was reported to limit injured individuals' ability to engage in sustained activity. Rather than being solely related to TBI, depression was reported to play a significant role in the development of fatigue and impairments in cognitive functioning following injury. Where TBI survivors were not able to return to a job, participants reported looking at the transferrable skills that the individual had and pre-empting where these may be used to perform potential jobs.
Process of recovery and intervention	Intervention following TBI was reported to need to coincide with the process of recovery from TBI. Participants believed that this process needed to start in acute rehabilitation so that intervention can be informed by a diagnosis that identified levels of pre morbid function. This diagnosis was reported to inform the development of intervention to address issues related to TBI rather than assuming that functional levels were directly related to injury. The process of recovery was reported to be aided by individual's becoming involved in work place intervention, even with reduced responsibilities, because it allowed individuals to remain actively engaged in the workplace.
Understanding and working with stakeholders	Participants acknowledged that the process of RTW involved the input from a number of different stakeholders including the individual with TBI, their employers, their workmates, their case manager, professionals providing intervention, and their social supports, such as their family. Effective intervention was reported to involve clear communication between all stakeholders rather than each working in isolation and sending the individual with TBI conflicting messages. Participants felt that in order for interventions to be effective, it was important to understand the individual's circumstances and motivations when developing interventions. This included an understanding of the meaning and centrality of work in the individual's life

4.8.1 Influence of Impairments on Workplace Function

While participants reported they believed a wide variety of cognitive, physical, and neurophysical impairments could potentially influence function following TBI, their responses during interviews suggested they believed the influence of impairments on work function was dependent on the specific demands of work roles. To identify how impairments were anticipated to influence function, participants reported that they first investigated the demands of the individual's work role by getting an occupational therapist to conduct a worksite assessment. Worksite assessments were reported to include the identification of the demands of the injured individual's job, their relationship with their employer and workmates, and any other aspects of the working environment that were considered to be either safety concerns or problematic to the individual performing their role. As MED2 described, the process of worksite assessment was believed to assist professionals working in vocational rehabilitation in the development of an intervention and to understand what the job role involved through the evaluation of:

> *The nature of work, the physical and cognitive side of it, hours, flexibility, possible alternative tasks and jobs,* [the work] *environment, whether its conducive or going to be deleterious and whether there is a possibility for some modifications and some additional rest time and rest space.*

In their statements, MED2 suggested they believed worksite assessments not only included the demands of the individual's job, but also the environment in which the work was conducted. When asked to describe how they believed impairments influence employment after TBI, MED2 responded by saying:

> [RTW after injury] *really depends on the residual deficits, both physical and cognitive, and the nature of work itself that can determine whether these people can go back to the same kind of job. Or it's impossible basically because they are physically now different from the kind of role that they were doing before. They can't fulfil that or they are cognitively not up to scratch to resume that same highly executively powered job.*

As identified in the previous example, the influence of impairments on workplace function was reported to be an interaction that was affected by a number of environmental factors in the injured individual's workplace. CM1 also described how they believed that impairments lead to disabilities after injury in instances where environmental influences were not conducive to work function:

> *It's the environment that disables the person, and it's understanding that. And that in returning a person to work, if the environment is disabling then you will disable the person… If a person had an impairment and the environment is not disabling, then you have got a win win. You have the opportunity for somebody to rehab.*

When asked to identify situations where work place demands were believed to lead to work place disability, participants gave examples of jobs that called for multi-tasking in the presence of distracting stimuli. In these circumstances, disability was reported to occur when environmental factors were said to limit the individual's ability to perform their work role by a number of participants. An example that summed up these characteristics was given by MED1 describing the work environment of one of their patients who was primary school teacher*:*

> *A classroom full of five year olds who are really noisy.… its quite hard to be a part time primary school teacher so to RTW cognitively is demanding because of the classroom environment.*

Similarly, P2 stated they believed school teachers sometimes had particular difficulty in RTW after TBI because of the way impairments can limit their ability to perform in their role, and that the impact and duration of work disability was exacerbated by employers being reluctant to gradually increase their work role:

> *You can't graduate someone back to work who has got post concussion symptoms, dizziness, headache, fatigue, irritability, to a classroom of 4-5 year olds for 45 hours a week. You can't start like that. You can go and sit in a few hours a day and work out, but the schools often won't allow it. They want a teacher or not.*

Worksite assessments were believed to be important by many participants with one reason being the heterogeneity of work roles they saw. In particular, a number of participants reported that a worksite

assessment was essential because they believed that it could not be assumed that given vocations had defined job roles. For example, CM2 described why they thought that it was important to get a worksite assessment to inform intervention as follows:

> *A plumber working for a plumbing crowd performs plumbing. The person who owns that plumbing company might also perform plumbing but he has to run that business. Now we take those 2 people, 2 essentially plumbers, same problem, maybe making the same kind of money, the return to work for either of them is different.* [The first] *person is easier probably to deal with because he's only collecting his salary.* [The second] *person has a lot of other factors impacting on what might present for his recovery.*

CM2's statements suggest they believed worksite assessments were seen as a method of gaining information not only about the specific demands of a job, but also the environment in which the individual was expected to perform their work role.

In their descriptions of worksite assessments, a number of participants reported they believed they could anticipate where clients' impairments were likely to influence work function by matching them with clinical assessments. For example, P3 commented that their process to establish the anticipated influence of impairments on work function was as follows:

> *I would also look at the medical assessment and the occupational assessment as well, just to look at what's been proposed here in terms of this is this person's skill set and this is what the initial occupational assessment is saying… If I am doing a neuropsych assessment, then I can make some comment on what* [job] *would fit* [the individual's level of cognitive functioning].

However, P3 went further, saying they considered the influence of impairments on function was not always easy to predict because they felt other factors intrinsic to the individual with TBI can interact with their impairments to influence work function. To illustrate this point, P3 gave an example of high achieving individuals who they believed to have difficulties with function following injury due to motivations and expectations of recovery by commenting:

> *There is a sub group of individuals and they tend to be the higher functioning group, so the managers, the sports people, who have milder injuries, where any drop in their performance is a significant issue for them. So they are often perfectionists or really high achieving people…. So even if it was just a 5% drop* [in their performance] *it is significant for them.*

A similar process to that of matching clinical assessments of impairment to worksite assessments was also reported by CM2 in instances where it was believed the individual with TBI would not be able to return to their pre-injury job. CM2 gave the following description of a process where potential job options were assessed to identify where individual's capabilities would match the demands of the given occupation:

> *A career practitioner takes a look at* [the individual with TBI] *and says, well with the type of jobs you've done, your experience, your qualifications, these are your transferable job skills* [to

identify where] *transferable skills, could be turned into occupations that are within their capabilities. That's then sent to a medical assessor who identifies the jobs within the occupational assessment as being practical in relation to the injury.*

In the previous example, CM2 suggested an individual's employment after injury was not only dependent on the ways in which impairments influenced their workplace functioning, but also on the ways in which their transferable skills could be used to perform occupational roles. Additionally, Other Professional Stakeholders' comments suggested they felt the influence of impairments on workplace function was dependent on the individual's specific job roles. Other Professional Stakeholders' comments also suggested transferable skills and other capabilities meant functioning in other areas could be used when seeking future employment. As such, participants indicated that they believed the same impairments would influence some individual's work function and not others depending on what their job was.

4.8.1.1 The Influence of Fatigue and Depression on Cognitive Function

As in the interviews with individuals with TBI and the Vocational Rehabilitation Practitioner focus group, all Other Professional Stakeholders interviewed indicated they believed fatigue posed significant barriers to functioning following injury by reducing the ability of an individual to engage in sustained activity. When asked to identify why fatigue was difficult after TBI, there was consensus among participants that they believed fatigue reduced individuals' ability to engage in sustained activities in the workplace. As P2 explained, this was evident in occupations where the individual was expected to work for long periods of time by their employers. P2 stated that they believed that some employers had the following expectations:

> *They want someone to fill the roster or not. They don't want someone part time. They would rather not have you…. It's pretty hard to get someone back to four 12 hour shifts in a row and alternating shifts…. With a brain injury when they've got a disrupted sleep wake cycle, headaches, fatigue, dizziness, and their colleagues are sort of like feeling that you are letting the team down,* [if] *you only want day shifts for 8 hours or 4 hours.*

Rather than the symptoms of fatigue being a direct result of TBI, there was also consensus among Other Professional Stakeholders that they believed there was an overlap between the symptoms of fatigue and depression in the post acute stages of TBI. While the experience of fatigue seemed to be generally perceived to be related to injury in the early stages of recovery, ongoing fatigue was reported to potentially be a symptom of depression. As demonstrated in the following examples, depression was deemed to be problematic when developing interventions to facilitate RTW in that it was reported to overlap and exacerbate other conditions such as fatigue and sleeplessness, and potentially mimic the influences of TBI on cognitive function. When asked what they thought the neurological cause of fatigue after TBI was, MED1 gave the following answer:

> *For most people, they're fatigued initially after the brain injury. They may sleep a lot, and that gradually improves and their levels of energy improve and as the brain recovers, they can*

concentrate for longer periods…. But for some people it just never recovers and I don't know why that is and some of that you always worry have they become depressed? Because a lot of the physical manifestations of the brain injury can be mimicked by depression so when I'm assessing people I'm going, ok, could this person be depressed is that why? And depression is probably one of the commonest reasons why people just don't recover as they should do.

A number of participants felt that depression could also lead to sleep troubles, which in turn they believed exacerbated levels of fatigue. As CM1 described:

If you are depressed and for example you are not sleeping, and you are irritable from your TBI… It compounds on each other. If you actually have no energy, you can't motivate yourself, you can't concentrate and you can see that some of these can be TBI and some can be depressive signs.

This sentiment was shared by CM3 who felt depression had the following influence on cognitive function following TBI:

Depression influences any return to work, because you've got a person who is clinically and cognitively not able to do their job.… Depression will cause people to act in a way that people act when they've got a brain injury. They're actively not functioning properly. CM3

These findings indicate the stakeholders interviewed not only saw fatigue and depression as significant symptoms of TBI, but also as conditions that can potentially exacerbate cognitive impairments associated with TBI. Participants' responses indicated that rather than solely being a consequence of injury, depression was believed to compound symptoms of fatigue, therefore having an even greater impact on the possibility of RTW. As the following section discusses, participants felt that intervention to address these impairments needed to be carefully timed to match the process of recovery from TBI.

4.8.2 The Process of Recovery and Intervention

Other Professional Stakeholder participants reported there were a number of elements in the process of intervention that they felt influenced how effective rehabilitation efforts were in promoting RTW. As this section describes, analysis of participants' responses suggested they believed effective rehabilitation involved: an accurate diagnoses of symptom causation; early initiation; and a match to the timing of the individuals' recovery from injury. Participants also commented about what they believed to be 'missed opportunities' in rehabilitation when intervention efforts did not meet what they believed to be the recovery needs of the injured individual. As discussed in this section, effective intervention was therefore reported to be dependent on the timely delivery of rehabilitation services.

4.8.2.1 Getting in Early with Intervention

Participants were in general agreement that the initiation of intervention to promote employment was best started while the individual was in the acute rehabilitation setting. In particular, interviews indicated participants believed one of the elements of early intervention that could maximise the

individual's ability to RTW was organisation of social factors in the individual's life that were perceived to be either facilitators of or barriers to employment outcome. CM1, who had worked as a specialist in the initiation of community services in the acute setting, commented that they felt that their previous role in acute rehabilitation had fulfilled this function by giving individuals with TBI:

> *The opportunity for people to get better, to rest, to recover, to regain their health. If they are worried about not getting paid from work, partner and kids having nothing to eat, you know… then you are not maximising that opportunity to rest and recover.*

While participants reported a belief that early intervention needed to ensure that the individual with TBI could focus on recovery, responses also indicated they believed that early intervention allowed for the initiation of preventative measures that they believed would avoid issues later on in recovery. As P3 reported:

> *So it's something that actually gets in there early… and if that is done in the early phases, people tend to do a lot better.*

Additionally, early intervention was reported to allow for identification of potential barriers to employment outcome to make sure they did not become significant barriers to RTW efforts in the future. The following example was given by CM2 to describe how they thought barriers to RTW became progressively worse with time:

> *If it's a financial problem, but a minor one the person has at this point, if you can identify it and get some sort of assistance and involvement… It's less likely to be of impact at that point than it is 2 or 3 months down the track when it's really out of control.*

One area of intervention a number of participants felt was important to establish early after recovery was communication with the injured individual's employer. Participants believed that communication made it possible to negotiate options going forward and set expectations about what the recovery of the individual was likely to involve. CM1 explained the importance of working with employers as follows:

> *Often where we are missing out with… we don't allow the employer to get on board with it early enough. We don't assess the relationship that the person with the TBI has with their place of employment.*

In this example, early intervention was reported not only to involve evaluating impairments and how they may influence functioning, but also to include aspects of the individual's workplace. As further described in the working with employers sub theme of these findings, it was reported that discussion with employers in the initial stages of recovery from injury were reported to allow for options to be explored for alternative duties while the individual recovered and to evaluate where employer expectations may influence RTW.

4.8.2.2 Clarifying the Diagnosis of Traumatic Brain Injury

Once the individual with TBI was reported to have left acute services and started to engage with community services, participants stressed the importance of identifying and clarifying the diagnosis of TBI and any other pre-injury factors that they believed may influence function. Participants reported this to be important because assumptions may be made that an individual's functioning could be attributed to TBI regardless of the cause, leading to interventions informed by a misdiagnosis. As the following examples show, a number of participants felt that it was therefore essential to get a comprehensive background of the individual to identify what conditions other than TBI may be causing symptoms assumed to be related to TBI. The process and importance of diagnosis was described by CM3 who stated:

> *Okay, well the first thing we really want to do is clarify the diagnosis… That's one thing that case managers miss in the process, is they think oh yes this is a claim for brain injury, then this is a claim for brain injury. I've got a hammer, so I'm looking for the nails, yeah? Whereas is this a claim for brain injury, or has this person got a number of other co-morbidities that will also impinge on their rehabilitation such as diabetes, depression, you know, any of those other medical things, or anything else?*

The process of eliminating factors other than TBI that could potentially influence function was also supported by CM2 who reported:

> *The amount of input, diagnosis and assessment right across the board is done at the beginning. And as we decrease our problem down to the point at the bottom we eliminate each facet which may be impacting on the recovery whether it's directly related to injuries, peripheral to it and all those other issues that might be.*

In summing up their opinion of the importance of pre-injury characteristics on functioning, CM2 indicated that they also considered that individuals providing rehabilitation do not always look at the root cause of impairments by stating:

> *We often look at symptoms not causes and I think that's very important and that's what happens in TBIs. Symptoms, great. Got all the symptoms, but what caused them? Is this TBI? Is this the result of the injury?*

A number of participants reported that they felt that it was essential to determine the level of the individual's pre-injury functioning to determine which elements of the individuals functioning could be attributed to conditions other than TBI. This assessment was considered to be necessary to determine whether interventions should be designed to address symptoms associated with TBI or a pre-injury characteristic. As CM3 commented:

> *Often these people have had performance issues before they've come on claim. Now with a brain injury you can say that's got nothing to do with it… So if they have been difficult before. When I say difficult, if you have issues that are difficult in your employment, there will probably be issues later on.*

A number of participants reported they would interview an individual who knew the person with TBI before their injury in order to determine pre-injury functional levels. The following example was given by CM2 to demonstrate their belief of the importance of establishing pre-injury functional levels by interviewing someone who knew the individual with TBI before their injury:

> *What you can do is sit down with those people, talk to the family* [and ask] *what did they do before? Oh hell he was out fishing every day, he'd do extensions in the house, rewired the place, now he won't get out of his bed. You've got to say that something's happened in the meantime. If they say, oh no, he hasn't changed that much, that's what he used to do. Okay, what else is going on?*

In addition to early initiation, as the following section discusses, participants considered that intervention also needed to address social factors, especially within the workplace, if it was to lead to a successful employment outcome.

4.8.2.3 Workplace Reintegration and Getting Back on the Ladder

Participants reported they believed participation in the workplace was preferably done as soon as possible to help progress the individual towards RTW. Alternatively, late workplace reintegration was considered to be a missed opportunity which could negatively influence the individual's psychological recovery. In the following example, MED1 described how they believed that recovery in the workplace could be facilitated by slowly increasing the individual's workload:

> *I generally look at when people can manage some work, not when people can manage the job they used to do before. So, I think most people, you want them to go back to work ideally 2 or 3 mornings a week. I mean, that's the ideal way to start…. Step 1 is being able to go to work and come home again and actually get there and talk to a few people and, even if you don't get a great deal done, that's the first step. Once you can do that a few mornings a week, then you can build on that and do a bit more… I think just getting people on the ladder of back to work makes a huge difference.*

The process of getting the person back in the work setting through graduated returns was also reported to have the benefit of guiding ongoing intervention. CM1 reported that this process involved:

> *Recognising that there is going to be some long term impairment, or residual impairment, but we don't know what it is as yet and it will become more evident as time goes on. So what are the things we need to change to promote* [their] *rehabilitation back to work now and what are the things that we can maybe anticipate are going to be a long term problem for* [them] *and that we can actually support and put in place now?*

Workplace reintegration was reported to be an important aspect of rehabilitation by P1, because they believed this is where the injured individual could regain elements of their work place functioning. By doing so, the injured individual was believed to be given the opportunity to recover through work place engagement. P1 commented that they felt that:

The subtle thing of people seeing return to work as a result of good rehabilitation, or the end, rehabilitation has to be done and then they go back to work, that to me is a crazy idea. The actual return to work is one of the final stages in recovery. The risk involved in the first view is that people will be re-introduced to work too late and they will be seen to be not needing support or less support because the recovery is done. If it is understood that somebody goes back to work to facilitate a stage in cognitive recovery and psychological recovery, and it has to be managed it's more likely to occur earlier on.

P3 also explained why they felt that late reintegration into the workplace following TBI could be problematic in the individual's overall recovery. As the following comments indicate, P3 believed that there can be significant changes in the individual's cognitions and behaviours that can be detrimental to RTW if the individual is not provided the opportunity to engage in their work environment:

After their injury, you get some people whose motivation significantly decreases and I think the longer they are out of the work, the more of a difficulty it is for them to get back. And you can sometimes see people develop really kind of entrenched behaviours or ways of doing things that they think are actually good things for them to be doing like the boom bust cycle, that aren't.

In this section, participants' responses indicated that they believed that RTW was facilitated by allowing the individual to engage in the workplace as early as possible to prevent the establishment of cognitions and behaviours that participants believed were not supportive of RTW. Participants believed that through missing this opportunity, individuals sometimes adopted patterns of behaviour that could later turn into barriers to RTW. The following section on stakeholder collaboration discusses reports that being able to adopt modified work roles, especially reduced responsibilities, was highly dependent on the level to which employers were willing to support the injured individual in their RTW.

4.8.3 Understanding and Working with the Stakeholders

Analysis of interviews with participants involved in TBI rehabilitation identified that they felt vocational rehabilitation following TBI could potentially involve a large number of stakeholders. Along with the individuals with TBI; their employers, clinicians delivering services, case managers, families, and support networks were all reported to potentially play significant roles in the RTW process. Participants felt each of these stakeholder groups could have potentially different expectations of timeframes and capacity of recovery from injury that needed to be carefully managed throughout intervention. To ensure services were responsive to all of the stakeholders involved and delivered in an efficient and timely manner, a number of participants' comments indicated that they believed rehabilitation needed to be coordinated through case management.

4.8.3.1 Coordinating Rehabilitation Services: The Importance of Case Management

The case manager participants reported they felt that the benefits of case management during TBI rehabilitation included the sharing of information between stakeholders and an overview of the whole

process of intervention. When CM1 was asked to identify what they believed their role as a case manager was in coordinating rehabilitation, they gave the following response:

> *Case management refers to a model of service delivery that is adapted to different settings. A case manager is responsible for coordinating and implementing the assessments and support interventions required to meet the needs of a person.*

However, CM1 also acknowledged they felt intervention needed to be individualised to accommodate contextual factors by stating:

> *Now, I think what actually happens though, is that your case management and your model of service delivery is dictated to you somewhat by the environment that you work within.*

CM2 explained the process of collecting information to inform intervention as follows:

> *Case managers should be a total facilitator*. [They] *should have in-depth knowledge of all the possible provisions of service out there and then be able to mix and match those with that person. But the baseline information they need needs to cover everything about that person. Which is all their support networks, all their previous medical history that may be impacting.*

These comments suggest that CM2 believed successful intervention involved investigating the individual's pre-injury functioning and social barriers to their recovery. Likewise, CM1 gave the following example to explain how they believed information from assessment of the individual's situational factors could be incorporated into intervention to facilitate RTW:

> *I've got to get some social rehab in place. They need some support in their home. They need transport to get back to work. What do I need to do about that? Do I need to contact the taxi company, is there somebody in the work place who can do it? What rehab provider are we going to work with here? What do I expect from the rehab provider?*

Case managers reported they believed case conferences to be useful in aiding RTW, where all the stakeholders involved had the opportunity to communicate during rehabilitation intervention development. The benefits of a case conference were reported to be to gain consensus among all stakeholders involved as to what actions to take in facilitating RTW through open communication. CM3 explained what they believed to be the importance of case conferences as follows:

> *So getting everybody in the same room, getting everybody to agree on the same path. And that's, you know, very feasible, because everybody is there to help the person.*

Rather than just occurring in case conferences, P3 indicated they felt communication between rehabilitation stakeholders needed to occur throughout the rehabilitation process. P3 commented that they felt the benefits of working together were to allow for the sharing of information and to send consistent messages to the injured individual as follows:

> *I want to know what someone else is doing and want them to know what I am doing. So we are not sending them mixed messages that the person is getting a consistent input. And if they*

have identified something at their session and they can let me know about it, then it's something I can work on and vice versa.

4.8.3.2 Understanding and Working with the Individual with Traumatic Brain Injury

Participants' responses during interviews suggested they believed the injured individual was central to any intervention following TBI. To help engage the individual in intervention, participants felt it was necessary to both understand what their motivations for work were and to integrate them in intervention development. In particular, participants reported they felt that it was important to understand the injured individual's work ethic and the importance of work to their self concept, as failure to do so was reported to potentially lead to situations where the individual did not engage in rehabilitation.

A number of participants indicated they believed it could not be assumed that all individuals wanted to RTW after injury. Responses indicated participants felt some individuals did not RTW, irrespective of their level of impairment or ways in which impairments influenced work function, due to their lack of motivation to do so. For example, MED1 gave the following comments:

I think there are a lot of people who the whole psychological process of having their injury and not being what they were before, it's all too hard. They fit comfortably in being off work and unwell and I think people have a varying degree of comfort with how they feel about not getting back to work.

MED1 also commented that they believed individuals with low levels of motivation sometimes *chose* not to engage in rehabilitation and developed strategies to avoid having to attempt to RTW, as illustrated in the following comments:

ACC send them off to these specialists who do these great assessments and come back with lots of suggestions of other jobs… for every job that is suggested, they have a reason why they can't do that, and you've got to wonder whether that's all physical or whether in fact it's their attitude that I can't do that job for this reason and I can't do that job for another reason.

In another example of how motivations were perceived to influence employment outcome, CM3, who worked for a private insurance company, gave an example of how they believed the individual's motivations to receive compensations could led to difficulties in returning to full time work:

We have in our contracts what's called the 10 hour clause, so cynically what we get is people saying I can't work any more than 10 hours. Because the minute they work 10 hours we're going to look at their financials.

A number of participants also indicated they believed it was important to understand the motivations of individuals with TBI who genuinely wanted to RTW if intervention was to be successful. CM2 gave the following example of their belief as to the importance of understanding motivations during intervention:

In any rehabilitation regime or intervention that we present with someone, if there's, at the beginning, a reluctance of a belief that it's not going to forward them on in their rehabilitation then there's no buy in. That's directly proportional to the result.

P1 illustrated their beliefs around the importance of the motivations of the individual with TBI in influencing RTW in the following example. In their interview, P1 talked about their beliefs of the importance of work for different individuals and the importance of incorporating this into the development and delivery of intervention by stating:

Work has different meaning to different people and that meaning should be understood collectively by the rehab team. And should be incorporated in how they address that issue and the kind of conversation they have with the client.

P1 said they believed a failure to understand these motivations lead to situations where individuals potentially become disenfranchised with the rehabilitation process and gave the following example:

They are being told, now you have to rest and do bugger all. Just rest okay. For some people, that's great. Beneficiaries really like it. But a bloke who has worked hard all his life, its hell on earth to be resting, it doesn't fit and they become non-compliant or they secretively over extend. I think that people are not always aware of the interpersonal and intra psychic dynamic around that message.

As an alternative, P1 commented that he believed it was sometimes possible to reframe intervention to be more conducive to an individual's motivations giving the following example:

If you introduce the intervention as not doing something, [highly motivated individuals are] *not going to buy into it. He's never done it all his life. But if you go in and say to him hey, don't behave like you're unemployed here mate, you're employed in the rehab industry. You've got a job to do here to optimise your recovery. If you do the following it will optimise. If you don't do it, it's going to take you longer to get back to work.*

Another method suggested to help engage individuals with the intervention process was to provide them with options as to how rehabilitation could be provided. By doing so, CM2 suggested that the individual was given the opportunity to actively engage in the rehabilitation process. CM2 commented that they believed that the importance of providing options in rehabilitation was as follows:

We often don't provide an option…. We should be able to assess the rationale behind, or the ramifications of that should be put to them and get their advice. How would that affect you? Would you mind doing that? Or what say we did something else? Maybe get you onto some sort of course that might be able to help develop this. CM2

Another example given by CM2 of using the individuals' motivations to help engage them in intervention was to look at other areas of vocational interest when assessing which jobs may be appropriate following injury. In this example, CM2 explained that they believed that the individual's motivations should be incorporated into the process of exploring jobs when people could not return to

their pre-injury position. CM2 gave the following example of a vocational practitioner using a diagram of circles to help discuss future work possibilities:

> *So* [the vocational practitioner] *draws a diagram of rings. So say someone's a professional basketball player and that's the focus of their life, and they've become a paraplegic. The outer ring is in ever decreasing circles, is areas of interest. The next circle might be the fitness, or the coaching, or something else. And the idea is to start to bring those goals and interests that are outside that central circle more central. So that it starts to decrease the centrality of the original focus and moves it out, without sort of dismissing it. And sometimes it takes a blend of working on what is still achievable from that in one of these increasing rings.*

P1 felt that, in addition to getting the individual back to work, it was important to understand the injured individual's motivations for employment if it was to be sustainable. Rather than being a one off event, P1 felt that it was also important to understand employment outcome after TBI to be an ongoing event that the individual needs to be satisfied with. P1 gave the following comments:

> *If someone suffers a brain injury at forty, the question to me isn't can he go back to his work… my question is can we get this bloke back and will he be happy? Is this the career that he wants? Is this sustainable in the longer term? My fear and my own kind of follow up with people is very often that they have longer term problems in the sustainability of return to work than we might anticipate.… There is a loss of quality of life, there is a loss of meaning. There is a difference, it is very difficult for people to go back to the same job following a moderate to severe TBI and feel the same about their job and themselves in that job. They don't.*

Responses from participants in this section suggest they believed individuals' motivations to work after injury influenced their engagement in interventions. Without integrating these aspects, intervention was reported to run the risk of not being accepted by the principal stakeholder in the rehabilitation process, the individual with TBI themselves. However, as the following section discusses, participants also indicated that they believed other parties' motivations, especially the employer, also influenced employment outcome.

4.8.3.3 Understanding and Working with the Needs of the Employer

Participants consistently reported they felt the injured individual's employer to be most vital stakeholder in RTW after the individual with TBI (if a pre-injury job existed). While some employers were reported to be supportive of the rehabilitation process, participants felt others were not. Because employers were acknowledged as having motivations and needs around the individual's RTW concerning running a commercially viable business, participants believed it was also important to integrate these needs into the development of interventions. Participants' responses indicated they felt that employers' readiness to help with RTW was influenced by a number of factors including the relationship that the individual with TBI and their employer had before their injury. For example, CM1 identified that in their experience:

> *Regardless of the nature of the injury, a lot of rehabilitation, of return to works are difficult because of the pre-injury relationship that the person has with their workplace. So, if they are not a well regarded employee, in fact they were a pain in the neck before the injury, they don't suddenly become someone you want back in the workplace.*

As identified earlier in the influence of impairments on workplace function section of these findings (Section 4.8.1), participants reported they believed return to the same position after injury was not always possible because of changes in the individual's ability to perform work roles. Where return to the same position wasn't possible, MED2 believed it was sometimes possible to investigate other roles in the work place, depending on whether their employer still wanted them. MED2 went further to comment that they believed where the individual was not able to return to the same identical role in the workplace, the option to explore alternative roles could/should be considered:

> *If it is not possible for them to return to the same kind of work, then looking at other alternatives, keeping in mind the clients own wishes and previous training and experiences, and looking at whether it's possible to offer something else within the same firm. Or if that's not possible, then look at another firm or re-training. Then it becomes a bigger task obviously.*

In their comments, MED2 suggested returning to the same work place was a preferable option to having to engage in looking for a new job. P1 also indicated that they felt that RTW was easier if the individual was returning to the same job by comparing it to "returning to the home country" because of the existing relationships and potential support systems in the old work place as follows:

> *Going back to the same job is a lot easier if it is what the person wants to do. And it's known and it's an existing support system, so it's kind of re-engaging life kind of thing. It's on the road to recovery. Having to say, I'm never going to do that again, I'm never going to be a forestry worker. Now I have to find out what it is that I want to do. It's a daunting kind of experience. It means negotiating a new system, a new support system. Developing new relationships, new skills at an advanced age. That is more like immigration, it's more like moving from one country to another where you have to start from scratch kind of thing. The other one is just going back to the old country.*

As was further explained by CM3, return to the same workplace did not always have to involve returning to exactly the same position. In the following example, CM3 commented about one of their clients who had successfully returned to work after injury, despite having impairments that had prohibited them from returning to their pre-injury role. Because the individual with TBI was identified as having a number of transferable skills within their industry, this individual was reported to have worked with the employer's supports to engage in a new role following computer training. In this example, the employer was reported to not have another position available for the employee after injury, but had worked with them to create an opportunity due to their positive pre-injury relationship. CM3 gave the following account:

> [The employer] *didn't have a job for him at first, so they said look, we might have some things coming up, but they will be computer based and he doesn't have computer skills. So we said right, no problem, we're going to go and get him those computer skills right now…. So we went off and got him some, he went and did a course over the last few months. And his employer just rang up and said the guy that's doing it has left and we want to bring him in, let's try this again, got him in, we got to close his claim.*

However, as this example describes, the individual returning to the same workplace was believed to be a possibility because the employer had been supportive of their RTW. As is explained in the following section, participants felt that there were a number of strategies that could be used to help engage employers in worksite interventions such as providing information about TBI, its symptoms, the process of recovery from TBI, and how other options may be explored to assist the individual in their RTW.

Participants indicated that they had experienced a spectrum of support from employers following injury ranging from those who were prepared to modify work conditions, to those who were not prepared to keep an employment option open for injured individuals while they recovered. As MED2 commented:

> *We get employers who are very understanding and supportive and cooperative. They are happy to start with light jobs and gradually increase the hours and provide a suitable environment and place for them to rest. We get some employers, probably by the nature of the work… they are not really prepared to bend the rules.*

When asked why they believed it was that some employers were supportive and others were not, MED2 commented that:

> *It's mostly things like, you know, small enterprises. For example, people who are running their workshop who really can't afford and their quite busy and they need to meet the job needs quickly and they don't want somebody who needs to be looked after and supported. Bigger firms probably are better in terms of their ability to be more supportive because they can afford it.*

The comments made by MED2 suggest that they believed that the employers needs can also play a significant role in RTW intervention. As the comments above suggest, this participant believed this to be due to businesses needing to be run as commercially viable enterprises resulting in them being able to be supportive of RTW, whereas others may not because of their financial situation.

A number of participants gave examples of individuals whose RTW was believed to have been greatly aided by the presence of employer support. In one instance, CM1 described an individual who they believed had managed to RTW because their employers had modified both the individuals work tasks, but their environment as well. This was demonstrated in the following example of employer support facilitating successful RTW where employers were reported to provide:

> *A quiet area within the factory where* [the individual with TBI] *could actually go and rest… the employer got a lazy-boy chair thing in there, rather than a bed where you lay down… So he also looked at different ways of altering the work environment that would make it easier for him to be able to perform the tasks that he needed to do. So lots of the strategies were around supporting him to get back to his old role.*

CM1 explained the process of job modifications to involve ascertaining what elements of the job the individual was still capable of performing after injury, which parts of the job the individual was anticipated to be able to perform once they recovered, or may not ever be achievable:

> *So it was all about breaking down the job role and saying well we do want him to return to this role, what can we leave, what can we take away, what can we alter, so that he can regain his work role and his value and his mana within the company.*

In the example above, the CM1's reports suggest that employers support had meant that an individual had managed to RTW even though their impairments limited their work function. This was reportedly achieved by arranging the work environment so that impairments did not become disabilities. While the comments given by the Other Professional Stakeholders indicate that they believed that not all employers were supportive of RTW, they also stated that they felt that communication with the employer could also increase the chances of RTW support.

All Other Professional Stakeholder interviewed felt that successful workplace reintegration was supported through providing employers with education about the nature of the individual's injury, what to expect from the individual's functioning following injury, and to gauge the expectations that the employer had around the individual's RTW. By working with employers and their motivations, participants felt that they could explore opportunities that the employer may not have considered. This process was also reported to involve looking at interventions from the employer's perspective to try and find solutions that would be mutually beneficial to the individual with TBI and their employer. However, this was reported to be dependent on how much impairments influenced the individual's work functioning. MED2 indicated in their following statements that they believed that a worksite assessment was necessary to determine where impairments were likely to influence job performance to explore alternative duties or the possibility for reduced work duties:

> *Usually* [occupational therapists] *do go with the clients initially to first of all do the worksite assessment, see what different jobs and tasks can be provided, how the client or patient could be supported in terms of having rest periods, in terms of looking at lighter jobs, in terms of graduated return to work, gradually increasing the hours and just go through that with the employer and with the client and monitor and supervise that. So that would be the ideal situation if you involve someone who knows what they're doing, work with the client and the employer at the site itself and take the client through the process.*

By discussing options with employers, a number of participants also believed it was possible to identify where employers expectations may negatively influence intervention efforts. For example, P3 made

the following statements about how they believed employers of individuals with TBI influenced their employment outcome:

> *If they are not provided with the knowledge of what the person is capable of or what difficulties they might have, then their expectations are, they are often too high from what I have experienced. They haven't had the* [occupational therapist] *going in and providing that level of explanation. And the right environment in terms of the person's ability to manage their fatigue, you know sending them back into a noisy or distracting environment… where there is no kind of clear structure is not ideal.*

One of the elements of the employers' expectations that P3 believed to be problematic in RTW was the expectation of timeframe of recovery. As they discussed:

> *One of the difficulties that we often encounter, like someone returning to their previous role, is that different employers have different time frames. So I have had someone whose employer has waited 2 years for them to be able to return to work and the another one has cut them after 3 weeks. So that is a challenge and often they are not open about their expectations.* P3

In addition to informing employers that recovery from TBI can be a slow process, participants reported that they believed that it was important to provide education about the symptoms of TBI to employers. Because individuals were reported to often look identical to before injury, Other Professional Stakeholder felt that it was important to validate the presence of TBI symptoms and explain the ways that the individual could be supported in their work role. As P3 reported:

> *You will have someone who is presenting physically as they were prior to an injury and that's a really hard thing for colleagues and employers to get their head around. The fact that this person looks just as they did and yet they are telling me they can't do certain things or they get tired too easily. So explaining that sort of process, that the unseen injury type thing, that they are going to need a high level of structure to start with. And a lot of guidance and monitoring to make sure that they are coping.*

Similarly, CM1 reported that they believed that talking to employers allowed for the opportunity to discuss what to expect in the individual's functioning after injury. This was reported to involve telling employers:

> *So if they don't hear you or they don't respond straightaway or they don't understand… they don't appear to be able to follow the instruction you have given them, it may be due to that injury. Or if they are in fact making mistakes, it is because they have become tired and fatigued and they can't concentrate.*

Comments made by participants suggest that they believe that employers play a significant role in RTW after injury and were acknowledged to have their own drivers and motivations to the individual returning to work. By working with these motivations, participants believed it was possible to develop

interventions that were mutually beneficial and therefore more likely to be successful in reintegrating individuals back into work places where existing support networks could be drawn upon.

4.8.4 Understanding and Working with Stakeholders in the Individual's Context

In addition to the individual with TBI and their employer, participants also believed there can potentially be a number of other stakeholders in the injured individual's environment who can influence their RTW, especially family members. These stakeholders were reported to both have the capability of being supports in the injured individual's day-to-day function, but were believed to also potentially present as significant barriers to RTW. CM2 summed up their belief of the necessity to evaluate how the individual with TBIs social influences may affect work by stating that they believed it to be important to understand the following social influences in the individual's background during intervention:

> *The work environment, social environment, cultural environment, the spiritual environment, and probably the familial environment as well, you know that social family support issue. And working out which ones are supportive and progressive, which ones are unsupportive and are diametrically opposed to moving us forward.*

P3 also gave an example of how they believed social influences in the individual's life could influence potential RTW. In this example, P3 indicated that they felt that where supports exist, it is possible for the individual to focus on RTW as opposed to being engaged in other concerns regarding their day to day functioning by stating:

> *There is kind of real core stuff about home environment and stability, that kind of thing. Can this person actually afford to live alone? So you have got a lot of social factors. Some guys will end up in boarding houses and things like that. And to try and manage that person's* [RTW] *in that sort of environment is really tough. You have often got people living with a large family, or they've got kids, that's incredibly difficult as well.*

Consistently, participants felt the most important social influence of employment for individuals with TBI outside of the workplace was their family. CM1 stated they felt family roles and obligations were an essential component of the individual's life to understand because these were believed to potentially be sources of difficulty in RTW as follows:

> *A guy who has an injury and he is having ongoing problems, fatigue, irritability and he has got a wife and 12 kids, you know you have got some problems in terms of supporting this person back into the whole of their life. Work is only one part of it.*

P1 gave another example of what they thought the potential role of family dynamics were on RTW by giving an example of one of their clients who they believed did not RTW because of family issues. Because this individual was reported to have spent much of their life focusing on work, an injury was believed to present as an opportunity to reconnect with their family. P1 gave the following account as how they believed family involvement has created a barrier to RTW after TBI:

A guy that's approaching his late 50's had always been a workaholic, his family, wife and sons and daughter had benefited greatly financially from that but had some resentment about him never being there, always being at work kind of thing. So when he knocked his head and couldn't go to work, it was almost a celebration. Any suggestion that he had to get back to work was immediately sanctioned by everyone involved. It got even more complicated in that the wife and one of the sons took over the business. They had to kind of step into the void and it became a battle ground. Return to work became a battle ground around the father's perceived neglect of the son and disqualification and disregard of the son… Then in that context, you will see an occupational therapist and people doing assessments and occupational physicians and so on, totally oblivious to that dynamic.

During interviews, Other Professional Stakeholders gave evidence to suggest they believed the influence of impairments on employment outcome following TBI needed to be understood not only in the social context that they existed, but also with respect to the work demands that the individual needed to perform in their employment. This was evident in that participants reported that they believed that some jobs were harder for individuals with brain injury to perform because of their associated occupational demands which were believed to be more likely to interact with impairments common after injury, such as concentration and attention problems. As such, there was evidence from interviews with Other Professional Stakeholders that they were performing evaluations of work disability by pre-empting where impairments were likely to interact with known job demands. While it was acknowledged that returning to the same job was often easier due to known support networks and job responsibilities, participants also believed that other areas of employment were also possible by drawing upon the individual's transferable skills to evaluate the work in other areas.

4.9 Discussion

The findings of this study describe a number of influences of employment that were not evaluated in the studies included in the systematic review of this thesis. As such, this study not only identified gaps in the literature examining predictors of employment after TBI, but has also contributed to clarifying why prediction of employment outcome following TBI has been such a difficult endeavour. Rather than just being related to impairments, participant responses suggested they believed employment outcome after TBI was also influenced by a number of dynamically interactive social and environmental factors such as supports, inputs and interactions between a number of stakeholder groups, workplace factors, and vocational interventions. This section discusses key themes identified during analysis, particularly focusing on how findings extend or challenge what was identified about the influences of employment from the systematic review including the influence of impairments (especially fatigue) on work performance, environmental factors, and intervention.

4.9.1 The Influence of Impairments on Work Performance

In support of findings in the systematic review of this thesis, all groups interviewed in this study reported numerous ways that they believed impairments influenced employment after TBI. For example, TBI participants illustrated occasions where they had experienced impairments limiting their ability to perform their jobs. However, the participants who were professionals involved in rehabilitation suggested they believed the influences of impairments on employment outcome were dependent on how they interacted with work demands. Other Professional Stakeholder indicated that they believed it was when specific abilities were influenced by impairments associated with TBI that were required for an individual to function in their job role that work performance was affected (as further discussed in Section 4.10.4 of this discussion).

Research evaluated in the systematic review of this thesis failed to find a relationship between the complexity of work demands and employment after TBI. For example, research has failed to indicate that the pre-injury degree of skill in occupation is predictive of employment status after TBI.(7, 111, 185) Because the studies in the systematic review defined work demands as highly skilled, skilled, semi-skilled, or unskilled, quantitative evaluation of worksite conditions in previous research may not have accounted for the interaction with impairments and consequent influence on employment outcome explained by participants in this chapter.

As a novel finding in this study, fatigue was identified by all groups interviewed to be one of the most significant impairments limiting work performance from their perspectives by reportedly influencing the ability to engage in sustained activity in the workplace. For participants with TBI who were unemployed at the time of interview, fatigue was reported as the factor they believed most influenced their ability to RTW following their injury. In contrast to managing other impairments after TBI, fatigue management techniques reported by all groups interviewed involved removing the individual from the employment-setting to rest. Fatigue was therefore identified as a potentially significant barrier to both vocational rehabilitation efforts, and sustainable employment outcome after TBI by all groups interviewed.

Previous research has identified fatigue as one of the most commonly reported symptoms after TBI,(55-65) however, no studies in the systematic review evaluated the association between fatigue and employment following TBI. While a paucity of literature exists concerning the effect of fatigue on employment after TBI, the findings of this study are consistent with recent research implicating fatigue as a source of significant limitation to social participation following TBI.(305) Rather than solely being the consequence of injury, participants involved in delivering intervention interviewed for this study, suggested they believed depression contributed to fatigue after TBI. As discussed in the next chapter, these findings challenge the lack of association between depression and fatigue following TBI found in a small number of studies (see Section 5.1.1).(64, 306) The influence of fatigue on employment outcomes after TBI, and the relationship between fatigue and depression were therefore identified as an important gap in the literature evaluating employment outcomes following injury.

4.9.2 Environmental Factors Influencing Employment Outcome

Interviews with all participants identified a number of social and environmental factors they believed could influence employment after TBI including; family roles, work place factors, funders, and employers. Each of these influences appeared to act as either a facilitator of or barrier to employment depending on the individual's situation. For example, the presence of financial and family support soon after injury were reported by TBI participants to allow them to focus on recovery. However, financial compensation, especially in the instances where compensation meant the individual was receiving close to the amount of money that they would get for a full time job, was also reported to pose potential barriers to return to full time work over time by Other Professional Stakeholders. Family dynamics were also reported to change after injury and lead to instances which were considered to potentially adversely affect the individual's ability to engage in full time work, such as higher expectations of child care. While social and environmental influences of employment have consistently been identified as gaps in the literature reviewing the influences of employment outcomes after TBI,(112, 113, 120) they still remain largely unexplored in predictive research.

All groups interviewed identified they believed employers and factors in the workplace could have a significant influence on employment outcome after injury. For example, Henry indicated that the support received from his employers following his injury had allowed him to focus on his recovery, rather than worrying about whether he would have a job go come back to (see Section 4.2.7). All professionals groups involved in rehabilitation (both Vocational Rehabilitation Practitioners and Other Professional Stakeholders) also indicated they believed relationships with employers could have a significant influence, indicating that interventions to assist positive employment outcomes involved informing employers of potential opportunities to support the individual with TBI back to work. Interviews with a number of participants delivering rehabilitation also indicated that it was when environmental factors interacted with factors intrinsic to the individual with TBI that work disability occurred. Work disability was therefore reported to be the sum of the interaction between the individual and their environment.

4.9.3 Evaluating Work Performance

There was consensus among all professional groups involved in rehabilitation that assessment tools used to quantify impairments did not give enough information to accurately predict likely employment status or work difficulties after TBI. This was reported to be due to the inherent inability for such tools to take into account the heterogeneity of work demands and lack of attention to the individual's interaction with their work environment. These limitations have been acknowledged in literature investigating the ecological validity of neuropsychological tests which highlight how they fail to take into account the presence distracting stimuli in work settings.(307) For example, worksite conditions have also been argued to be in contrast with the quiet environments in which neuropsychological tests occur.(308) Alternatively, the identification of impairments was reported to be contextualised through the assessment of the individual's environment (especially the work environment), the individual's specific work demands, the individual's pre-injury functioning, and other factors in the individual's environment that they believed could potentially influence employment. Stakeholders commented that assessment of the specific characteristics of an individual's work demands, assessed by a worksite assessment, was necessary to determine likely work performance.

In describing worksite assessments, Vocational Rehabilitation Practitioners reported a process of watching the individual in their context to establish problems with work performance. As identified appropriate in evaluations of worksite assessment methods elsewhere,(309-312) this was performed by either observing an individual in order to evaluate their cognitive or behavioural work capacity, or through discussions with the worker, employer, and family. Vocational Rehabilitation Practitioner participants also commented that they believed it was necessary to monitor the individual in their workplace over time to get a thorough picture of whether the individual was capable of engaging in sustainable employment. This notion is supported by research that has argued that work performance includes an individual's productivity level, quality of output, work tolerance, responses to work stressors, promptness, attendance, and the ability to solve work related and interpersonal problems.(313)

Despite the consensus among professional groups involved in rehabilitation that a worksite assessment is important in informing vocational rehabilitation, there are currently no evidence based guidelines for how they should be conducted, or evidence as to their ability to predict either work performance or employment outcome. Consequently, worksite assessments following TBI have been criticised as being biased by discipline specific focuses, amount of knowledge and experience of the professional conducting assessment, and their personal notions of what constitutes work and interpersonal competence.(313). As further discussed in the overall discussion of this thesis, the development of guidelines for worksite assessments remains an essential area of research to improve consistency of intervention development and delivery for vocational rehabilitation for individuals with TBI.

During worksite assessments, Vocational Rehabilitation Practitioners reported a process of evaluating the match between an individual's capabilities and work demands as presented in Figure 5.

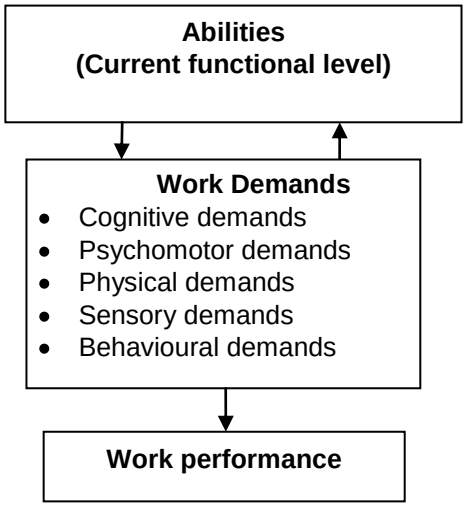


Figure 5: Evaluation of Work Performance Reported by Participants Delivering Intervention

This figure demonstrates the interaction between an individual's level of functioning (or abilities) and the specific demands of a job to influence work performance reported by Vocational Rehabilitation Practitioner participants. Figure 5 has bidirectional arrows between abilities and work demands to reflect Vocational Rehabilitation Practitioners reports that work performance was the dynamic outcome of the interaction between an individual's abilities and their work demands. As identified in the interviews with participants involved in rehabilitation, abilities were reported to include an individual's aptitudes, work experience, and compensatory techniques that individuals had developed to accommodate impairments. For example, the use of memory prompts was identified to be an ability that individuals could use to help accommodate impairments by one of the Vocational Rehabilitation Practitioner participants. Responses given by Other Professional Stakeholders indicated that an individual's abilities did not just represent their impairments relating to TBI, but also a number of other physical or psychological conditions that could influence their levels of functioning.

Professionals reports alluded to a number of different work demands that are similarly described by the O*NET system (314) used in industrial psychology for classifying work demands. This system argues that the demands of all occupations can be grouped under four major headings; cognitive, psychomotor, physical, and sensory; each of which can be further broken down into a number of sub categories. In addition to this grouping of work demands, other occupational requirements can also be argued to exist. For example, Other Professional Stakeholders commented that behavioural demands and shift requirements were potentially essential work demands of some jobs. Work demands were also argued by Vocational Rehabilitation Practitioners to involve other aspects such as customer interaction (as given in the example of a client who was working as a petrol station attendant) or for an individual to perform in a given role for sustained periods of time (as with clients working shift work).

The conceptual interaction of work demands and abilities in Figure 5 provides a useful framework for considering the unexplained variance in predictive studies that have associated levels of impairments with employment after TBI. While an individual may experience any number of impairments after TBI, the influence of these impairments on work functioning was reported by all professional groups involved in rehabilitation to be dependent on the specific work demands of an individual's job. As such, it can be argued that some individuals will have TBI related impairment but still be able to perform their job, as their impairments do not influence their work performance or their workplace supports/compensatory techniques enable them to perform sufficiently. For example, Ruth indicated that she had managed to function in her role as a manager, despite her attention problems, by ensuring that she worked in a quiet office. Alternatively, relatively small amounts of impairment could potentially have a large impact on the individual's function depending on their work demands, as was argued by one of the psychologist participants.

4.9.4 Interventions and Working with the Individual's Motivations

All participants interviewed reported that they believed that rehabilitation services were essential in facilitating a positive employment outcome after TBI. For example, participants with TBI who were unemployed at the time of interview indicated that they felt that they would have had a better chance at engaging in sustainable employment if they had received intervention earlier in their recovery. Interviews with professional groups involved in rehabilitation identified the specific features of intervention that they believed can potentially facilitate employment after TBI including: working with the individuals with TBI and their motivations; being informed by timely assessment; collaboration and communication between clinicians; involving families and the employer; and starting as soon as possible.

During interviews, professionals groups involved in rehabilitation identified the four key stakeholders of employment following injury described by Krause; the individual with TBI, their employer, the individuals delivering services, and funders;(94) as all playing vital roles in successful employment after TBI. Rather than each of these stakeholders playing a discrete role in successful rehabilitation, the current study indicated that collaboration and clear communication between each of these stakeholder groups was necessary if rehabilitation was to be effective. For example, one reason behind the importance of early intervention given by participants who were professional groups involved in rehabilitation was that it was considered to be essential in maintaining the relationship with the employer and identifying the expectations and understanding of TBI of the injured individual. Other Professional Stakeholders also indicated they believed understanding the individuals' expectations were important because they believed the individual with TBI was not passive in the rehabilitation process. Rather, Other Professional Stakeholders identified a need to identify the client's goals, motivations, and expectations to facilitate buy-in to the rehabilitation process. Failure to do this was reported to lead to situations where individuals with TBI were resistant or did not engage in the rehabilitation interventions that clinicians suggested. These findings align with recent investigation acknowledging the importance of external factors in vocational outcomes after TBI, where employment

is viewed as the product of the interaction between the needs and motivations of the individual and the use of supports rather than just symptoms of TBI.(315)

Return to work interventions focusing on communication and coordination, are also supported by a recent review of vocational interventions for TBI.(316) This review found that the Vocational Case Coordination model for TBI was the only method consistently associated with improved employment outcomes after TBI. The Case Coordination Model includes many of the methods suggested as effective by participants delivering intervention in that it advocates monitoring of progress across all phases of rehabilitation by a case coordinator and that it integrates elements of vocational rehabilitation early on in the overall rehabilitation process, such as early contact and ongoing involvement of the employer.(186) However, there are many questions remaining as to how intervention can best facilitate employment outcome after TBI including, how intervention should be informed by assessment, how the different professionals involved in intervention are most efficiently used, and how timing aspects of intervention influence employment outcome.

4.9.5 Relationship between Influences of Employment after Traumatic Brain Injury

In summarising the factors that participants reported to influence employment outcome, it is evident that there are a number of phenomena that are intrinsic to the individual with TBI but also in their environment. These have been graphically represented in Figure 6 with a deliberate attempt to represent participants feedback that employment outcome was not perceived to be the direct product of impairments but to be the outcome of the interaction between a number of different potential influences of employment.

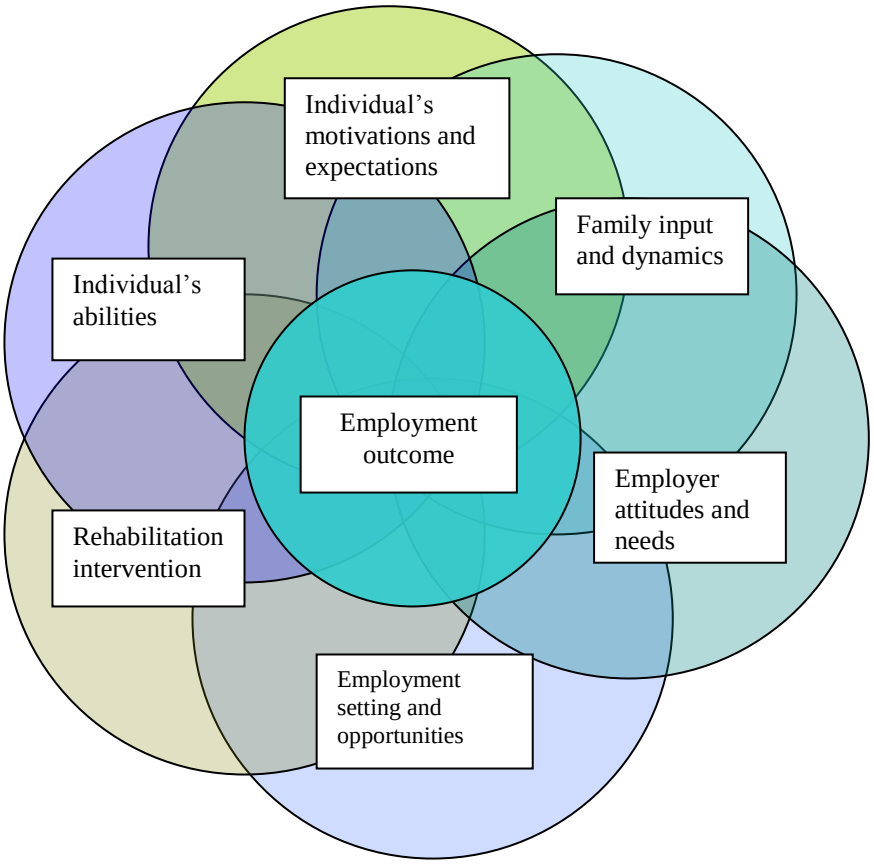


Figure 6: Factors Reported to Influence Employment after Traumatic Brain Injury by Stakeholders

The visual representation of the influences of employment given in Figure 6 attempts to provide an overview of the findings of this study. The overlapping nature of the influences indicates the possibility for dynamic relationships between influences. For example, participants indicated that they believed employment outcome was influenced once impairments interacted with workplace settings. Secondly, the overlapping of all stakeholders (employers, individuals with TBI, and professionals involved in rehabilitation) is intended to illustrate the potentially large number of stakeholders who can influence employment through a number of different pathways. Lastly, the figure indicates the complex nature of the influences of employment following injury. As findings of this study indicated, consideration of any one factor, without reference to the others identified, would be unlikely to explain all outcomes employment following TBI.

4.9.6 Limitations and Considerations of This Study

The study in this chapter has a number of methodological limitations that influence the transferability of results. Although the sample sizes of each stakeholder group were small, they are reasonable in view of the nature of the design.(298) As the qualitative investigations endeavoured to gather information from multiple perspectives to gain an appreciation of the complexity of the factors influencing employment after TBI, efforts were made to ensure different clinical backgrounds were involved. This strategy reflects that aims of qualitative sampling to reflect diversity of a population of interest.(298) However, the present qualitative investigation could have benefited from the inclusion of family

members, employers, and workmates. By doing so, it would have been possible to investigate the influence of family roles on engagement in intervention and the influence of impairments on work performance from different perspectives, most especially from people involved in the workplace or supporting the individual. The perceptions of the influences on employment after TBI by these groups therefore still remains an area of investigation that warrants attention as they were identified as potentially key stakeholders in the process leading to employment after TBI by participants involved in rehabilitation.

Additionally, injury details were complicated in a number of participant's cases, such as Gail, by a subsequent sub arachnoid haemorrhage following TBI and in Donald's case by multiple TBIs. Despite these factors, findings highlight a number of consistent themes across participants. Secondly, all TBI client participants were ACC clients who had been employed at the time of their injury. Because employment status at the time of injury has been identified as a predictor of employment after TBI, this is also a consideration when assessing applications of findings to the larger TBI population. More generally, it is also possible that the situational conditions specific to the NZ health system could also influence and restrict how findings relate to global trends of RTW after TBI due to the cultural make up of NZ and rehabilitation services delivered under the no fault ACC framework.

Throughout interviews, a process of snowball sampling was used to recruit TBI participants and professional groups involved in rehabilitation. It is therefore possible that individuals who suggested other potential participants may have biased results. For example, it may have been that participants suggested other participants who agreed with their opinions with regards to the influences of employment following TBI. While efforts were made to member check results with participants outside of the research process (see trustworthiness Section 4.2.6 in this chapter) the potential of selection bias exists. These findings therefore need discussion among a wider context to ensure the applications and implications of results.

The data collection methods used could also have influenced the findings of this study, in particular, the focus group method and telephone interviews. In regards to the focus group, although efforts were made to ensure that all participants had the opportunity to contribute their views, the perspectives of the individuals who were the owners of the service (as opposed to its employees) may have been dominant. This is not surprising given that they had extensive experience working in the industry at the time of the interview. While efforts were made to validate the interpretations of findings during member checking (see Section 4.2.6), it is likely that some of the quieter participants did not feel comfortable stating their opinions or contradicting individuals who were their employers. Similarly, it could be that telephone interviews conducted with individuals with TBI influenced their willingness to disclose personal information, as some have argued, due to lack of feedback cues (317) and reduced likelihood of rapport development in comparison to face to face interviews.(318) However, as appropriate to the researchers position at the time that research was undertaken, telephone interviews have also been acknowledged to enable researchers to collect data from geographically spread samples.(319) The findings of this study would therefore benefit from further systematic investigations

to see if the opinions of participants interviewed concerning the influences of employment following TBI are shared by other stakeholder populations. Furthermore, on reflection, the order in which interviews were conducted could also be argued to have influenced results. Because the Vocational Rehabilitation Practitioner focus group was conducted first, the views of the researcher may have been overly influenced by their interpretations from this interview. It may have been better to conduct the TBI participant interviews first to get their view of what they believed to be the influences of their employment from their perspectives.

Lastly, because the researcher's background had predominately been in quantitative research prior to this study, conducting a qualitative investigation posed both a challenge and opportunity to develop new research skills. In particular, the challenge of asking non leading questions, while allowing participants' narratives to emerge, required a skill that was developed throughout the study. While every effort was made during member checking to ensure that these narratives represented stakeholders' perceptions, it is now evident to the researcher that the undertaking of qualitative research is a challenging endeavour that calls for mastery in every aspect of study design, data collection, data analysis, and interpretation. While much was learned through the conduct of this study, and novel findings produced, it is evident that further expositions into inductive enquiry are necessary to master this area of research.

4.10 Conclusion

The responses of all stakeholder groups interviewed helped reveal the complexity of the factors influencing employment outcome after TBI from their perspectives. These were reported to include many of the factors that have been identified as gaps in the quantitative research evaluating the predictors of employment after TBI including the interaction between the individual with their environment, the rehabilitation services and support available to them, the co-operation and communication between stakeholders involved in rehabilitation, and the employment setting itself in determining employment after TBI. While the relationship between work demands and abilities goes someway to explaining employment after TBI, stakeholders also identified that they believed that this needs to take into consideration the needs of the individual and the influence of their social context. It is therefore identified that future research is needed to help identify the pathways through which factors influence employment after TBI, especially work performance, to inform where intervention can best facilitate employment outcome.

The importance that all groups interviewed placed on fatigue on influencing employment outcome was also identified as significant finding. As research has not systematically evaluated the influence of fatigue on employment outcome, this finding was used to develop the study in the following chapter evaluating the associations between reported fatigue and employment following TBI.

5 Fatigue, Depression and Employment Following Traumatic Brain Injury: A Retrospective Cohort Study

The findings of the qualitative study in the previous chapter indicated that stakeholders in the rehabilitation process perceived fatigue to be a significant barrier to employment outcome after TBI. This chapter describes a quantitative study investigating the relationship between fatigue and employment and the associations between fatigue and depression following TBI (n=97) based on the findings of Chapter 4. Following a description of literature investigating fatigue, generally and with specific reference to people with TBI, the justification of this study, methodology, methods, and findings are presented.

5.1 Fatigue

There is currently no universally accepted definition of fatigue despite it being one of the most common symptoms in primary healthcare.(320) Historical definitions have explained fatigue as the inability of a muscle, or groups of muscle, to sustain activity,(321) and attribute fatigue to excessive energy consumption as a result of depletion of hormones, neurotransmitters, or substrates of physiological function.(322) More recent explanations have explained fatigue holistically as a multi-dimensional construct including biological processes, psychosocial phenomena, and behavioural manifestations.(322) Sharpe and Wilks (320) explain fatigue as the result of a variety of predisposing, precipitating, and perpetuating factors (Table 32). Sharpe and Wilks' explanation of fatigue helps to identify the complex interaction of a number of factors both causing and exacerbating fatigue.

Table 32: Factors Related to the Causation and Perpetuation of Fatigue

Factor	Characteristics	Example
Predisposing	Pre-morbid characteristics associated with fatigue	History of depression
Precipitating	Acute physical injury or infection causing a biological pathway resulting in fatigue	Traumatic brain injury
Perpetuating	Psychosocial factors leading to fatigue	Physical inactivity, emotional disorders, sleep abnormalities

The definition of fatigue is further complicated by the distinction between acute and chronic fatigue. Acute fatigue has been argued to be characterised as identifiably linked to a physical cause, has rapid onset, is of short duration, is usually alleviated by rest, and has minimal effect on activities of daily living.(323) Alternatively, chronic fatigue is characterised as having multiple or additive causes, is often experienced with no relation to activity or exertion, persists over time, is not relieved by rest, and has a major effect on an individual's activities of daily living.(323)

Research has identified that fatigue reported in the general population is associated with higher levels of education, more acute health complaints, a greater frequency of psychosocial problems/psychiatric disorders,(324) being female,(325) and being of older age.(326) It has however been suggested that there is significant overlap between the symptoms of depression and fatigue. For example, the most recent version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)(327) lists decreased energy as one of nine symptoms indicative of a major depressive disorder. This

categorisation raises the argument that fatigue may exist as a symptom of depression or that those who are fatigued are more depressed. The relationship between fatigue and depression was investigated in a large community based prospective study (n=3481) following a population cohort for 13 years. This study found that participants who reported fatigue that could not be attributed to drug/alcohol use or a medical condition at baseline had a 28 times greater risk of the development of major depression at follow up than those without fatigue at baseline.(328) Addington et al concluded this study by stating “these findings further substantiate the idea that fatigue is neither purely predictive nor a consequence of psychiatric disturbance but rather is aetiologically heterogeneous” (p.17).(328) Likewise, research predicting chronic fatigue syndrome concludes that there is a dual interaction between depression and fatigue, with one increasing the risk of the other.(329) These findings suggest that fatigue and depression need to be carefully considered during research with regards to their relationship with one another.

5.1.1 Predictors of Fatigue Following Traumatic Brain Injury

Recent research has investigated the relationships between demographic factors, injury related variables, mood disturbances, and sleep problems in the development of fatigue after TBI (see Table 33).(64, 65, 306) However, variation in the timeframe of follow-up, along with how fatigue was measured, makes integrating the findings of these studies difficult. When temporal factors are taken into consideration, a number of consistencies can be identified across the studies in Table 33. Surprisingly, none of the studies found a significant relationship between reported fatigue and gender, age (as is the case in the general population), nor the severity of TBI. The only factor found to be consistently associated with increased levels of fatigue was a shorter time since injury.

The results of Ziino and Ponsford’s study found that anxiety and depression did not significantly add to the prediction of fatigue after injury despite being heavily correlated with it, suggesting co-linearity with other variables entered into the multivariate model.(64) Similarly, the study conducted by Ouellet and Morin found that depressive symptoms were not predictive of fatigue when anxiety and reported sleep disturbances were controlled for.(306) This study did however give descriptive evidence that participants reported that fatigue had interfered with their occupational functioning.

Literature suggests that while fatigue has been identified as a significant symptom following TBI, there is still much unknown both about a) the relationship between depression and fatigue after TBI and b) the relationship between fatigue and employment outcome following TBI. This study endeavoured to further investigate both of these issues, as described in the following justification of this study.

Table 33: Studies Investigating Prediction of Fatigue after Traumatic Brain Injury

Authors	Methodology	Sample	Instruments used to assess fatigue	Analysis	Findings
Borgaro, Baker, Wethe, Prigatano, Kwansnica (65)	TBI participants from an acute neuro-rehabilitation unit (average of 24 days post injury) compared with healthy controls	47 TBI participants (38% severe, 38% moderate, 24% mild) and 30 healthy controls	Barrow Neurological Institute (BNI) fatigue scale	Correlations and t-tests	Non statistically significant relationships between reported fatigue and days post injury, injury severity (GCS) and cognitive performance. No statistically significant difference in reported fatigue for gender. Fatigue not related to age or education
Ziino and Ponsford (64)	TBI participants who were 8 months post injury were compared with healthy controls	49 TBI participants (34% severe, 29.8% moderate and 36.2% mild) and 49 healthy controls	Visual Analogue Scale of Fatigue Fatigue Severity Scale Causes of Fatigue Scale	Multiple regression analysis	29% of variance in fatigue severity was explained by model. Years of education and time since injury were predictive of fatigue. Gender, age and duration of PTA were not predictive of fatigue. When depression and anxiety were added as variables, they did not add a statistically significant amount of variation to the prediction of fatigue
Ouellet and Morin (306)	TBI participants in post acute phase of recovery (M=7.85 years post injury)	452 TBI participants (59.9% severe, 23.3% moderate, 16.8% mild)	Multidimensional Fatigue Inventory	Logistic regression analysis (n=313)	45% of variance in fatigue outcome was explained by the model. Factors found to be predictive were shorter time since injury, being declared on long-term disability, higher levels of insomnia, higher levels of cognitive disturbances and severity of anxiety Factors not found to be predictive were gender, age, marital status, TBI severity and severity of depression, pain and irritability/anger.

5.2 Justification of Study

The qualitative investigations of this thesis gave evidence to suggest that fatigue was identified as a significant source of work disability after TBI. Based on these findings, one hypothesis that seemed important to test was whether fatigue and employment outcome after TBI were associated. This hypothesis was directional in that it was anticipated that individuals with TBI who reported the highest levels of fatigue were the most likely to be unemployed after injury. The systematic review of this thesis identified a number of factors that have consistently been associated with employment after TBI. This study aimed to investigate whether fatigue was associated with employment outcome once known predictors and indicators were accounted for.

The previous chapter identified that Other Professional Stakeholders indicated they believed there was overlap in the symptoms of depression and fatigue following TBI. These findings were used to generate the hypothesis that 'levels of fatigue and depression would be associated after TBI'. Once again, this hypothesis was directional in that it was anticipated that individuals with the highest levels of fatigue would report the highest levels of depression.

The aims of this study were therefore to investigate questions generated from the qualitative study of this thesis including:

1. What are the demographic and injury related variables associated with fatigue after TBI?
2. Are differences in levels of reported fatigue statistically significant across groups of depression severity?
3. Is fatigue associated with employment outcome following TBI once known predictors and indicators are controlled for (previous employment, age, injury severity and education)?

Specifically, the hypotheses of this study generated from the aims above were:

1. Fatigue would explain a statistically significant amount of variance in employment outcome in addition to previous employment, age, injury severity, and education.
2. Differences in reported levels of fatigue would be statistically significantly higher in individuals with the highest levels of depression in comparison to individuals with the lowest levels of depression.

The methodology, the measures used to collect data, and the decisions made as to how data would be collected for this study are described below.

5.3 Methodology

The effect of fatigue on productive activity after TBI and associations of fatigue with demographic variables were investigated with a cross-sectional retrospective cohort study. A cross sectional design was used due to time constraints precluding the possibility of following a TBI sample over a number of years during the doctoral research timeframe. This section describes the decision making processes for the selection of psychometric and outcome measures used, statistical analyses used, and ethical considerations during data collection for this study.

Data for this study were collected via two methods: a) demographic and clinical data was collected from the clinical notes of clients discharged from a community rehabilitation provider with four offices throughout NZ, and b) follow up information of occupational outcome, levels of fatigue related disability, and levels of depression were collected through self report questionnaires (see Appendix 10).

Because this study recruited participants from around NZ, face to face interviews were not a feasible method of data collection. A postal design was therefore chosen as the researcher did not have all potential participants' telephone numbers. Because this study relied on postal self response, it was essential that methods ensuring a high response rate were used. Questionnaires were therefore posted to potential participants following the methods suggested by a Cochrane Review to increase postal response rates.(330) This review found that postal response rates were higher in studies where (i) individuals were sent a letter introducing the project before a questionnaire was sent, (ii) if questionnaires were sent with stamped self-addressed envelopes, and (iii) if follow up letters were sent with another questionnaire and self addressed envelope to non-respondents. This sequence was followed in an effort to maximise the participant response rates (see Section 5.4.2).

5.3.1 Measures Used in This Study

The main work related outcome used in this study was informed by the studies in the systematic review and the overall aims of this thesis to investigate the influences of employment after TBI. Therefore, the dependent variable in this study needed to be able to differentiate between individuals who were working and who were unemployed. However, volunteer work and study were also considered as valid forms of work; consistent with a number of studies in the systematic review.(5, 7, 203, 204, 208, 212, 215, 218, 224, 226-229, 331) Other forms of occupational engagement that did not prepare individuals for employment, such as domestic duties, were categorised as 'unemployment'.

When assessing potential participants' clinical notes, it became apparent that there were inconsistencies in the TBI severity grading system used. The guidelines for categorisation of TBI severity as either mild, moderate, or severe brain injury in Table 1 were used. PTA and coma duration were prioritised in grading severity over the GCS in instances where more than one injury severity was reported as PTA and coma duration were identified as better indicators of employment outcome following TBI in the systematic review of this thesis (see Chapter 3).

5.3.2 Measurement of Fatigue

A number of methods for assessing levels of fatigue were identified, and assessed for relevance to the aims of this study. These measures were identified to vary significantly with respect to which aspect of fatigue they were measuring. It was therefore important to assess how fatigue assessments differed and how they related to the hypotheses of this study.

The lack of consensus of the definition of fatigue is reflected in wide variation in the measurement of fatigue. Accordingly, there is no accepted gold standard for the assessment and quantification of fatigue,(332) with a large number of assessments available. For example, in a review of fatigue measurements, Dittner et al identify 30 different scales and report that no two scales were found to assess the same construct.(332)

The major dichotomy in the measurement of fatigue is between objective and subjective measures. Objective fatigue is defined as "an observable and measurable decrement in performance occurring with the repetition of a physical or mental task".(333) However, the objective measurement of fatigue has been argued to be limited as no clear biological markers of fatigue have been identified.(322) Additionally, a number of objective measures of fatigue, such as quadricep endurance (334) and thumb pressing tests (335) have not been found to differentiate between TBI participants and healthy controls.(64, 335) In comparison, subjective measures of fatigue have been argued to assess the internal processes involved in fatigue including awareness, self monitoring,(322) and the subjective experiences of early exhaustion, weariness, and aversion to effort.(333) A number of subjective measures of fatigue have also been found to discriminate between healthy controls and people with TBI (See Table 34) and were therefore identified as being relevant to the aims of this study. Aaronson et al have distinguished between the different characteristics of the assessment of subjective fatigue as follows:

1. Subjective quantification of fatigue severity,
2. Subjective distress associated with fatigue,
3. Subjective assessment of the impact of fatigue on activities of daily living, and
4. Widely recognised correlates of fatigue such as sleep disturbance and depression.(322)

Subjective measures of fatigue that have been validated with TBI populations were consequently identified and evaluated for fit with the aims of this study.

Three measures of subjective fatigue were identified as validated with TBI populations at the time of research and evaluated for the use of this study: the Barrow Neurological Institute Fatigue Scale, the Fatigue Impact Scale, and the Fatigue Severity Scale (see Table 34).

Table 34: Fatigue Measures Validated with Traumatic Brain Injured Samples

Fatigue measure	Number of items	Purpose of assessment	Evidence of validation with TBI samples
Barrow Neurological Institute Fatigue Scale (65)	10	To quantify fatigue symptoms in acute neuro rehabilitation.	Statistically significant difference between Barrow Neurological Institute Fatigue Scale scores for TBI participants and healthy controls (65)
Fatigue Impact Scale (336)	40	To quantify the limitations in functioning that the individual attributes to fatigue.	Statistically significant difference between Fatigue Impact Scale subscales for TBI participants and healthy controls. (335)
Fatigue Severity Scale (337)	9	To quantify severity of fatigue symptoms.	Statistically significant difference in total Fatigue Severity Scale scores between TBI participants and healthy controls. (64, 335)

The Barrow Neurological Institute Fatigue Scale was deemed inappropriate for use in this study as it was designed specifically to quantify fatigue in acute settings and this study's aims were to evaluate symptoms of fatigue in a post acute community dwelling sample. The Fatigue Impact Scale, (which measures the functional limitations that an individual attributes to fatigue) was chosen in preference to the Fatigue Severity Scale (which measures severity of fatigue symptoms) as the intention of this research was to evaluate the fatigue related functional limitation that individuals with TBI attributed to their injury. This was done as it was acknowledged that individuals who experienced fatigue may have found ways to compensate for impairments related to fatigue or that some individuals were more disabled by the experience of fatigue than others. The Fatigue Impact Scale (FIS) was therefore used to measure the perceived impact of fatigue on cognitive, physical, and psychosocial functioning reported by participants (see Appendix 10).

The FIS is a 40 item measure that asks respondents to indicate how much of a problem fatigue has caused them in the past month on a four point Likert scale between no problem to extreme problem. The FIS has been found to discriminate between individuals with TBI and healthy controls on all scales (335) and has been found to correlate well with the Sickness Impact Profile, a measure of general health status based on a patients description of how their functioning has been affected by their disease, for a TBI sample.(332)

Preliminary evaluation of the psychometric properties of the FIS (see Section 5.6) supported using a shorter version of the FIS known as the Modified Fatigue Index Scale (see Appendix 11). The Modified Fatigue Impact Scale (MFIS) was developed by the authors of the FIS by removing items from the original FIS identified through field testing as redundant.(338) However, development of the MFIS had not previously been informed by statistical analysis. Because all the items in the MFIS exist in the FIS, it was possible to extract the MFIS from the data taken in the FIS and investigate the relative psychometric properties through principal components analysis and internal consistency estimation. The MFIS was chosen for analysis in the present study after the FIS was identified to load poorly on the author defined subscales during principal components analysis. In comparison, a principal components analysis of the MFIS revealed that items loaded onto scales proposed by its authors. All descriptive and inferential statistics were therefore conducted using the MFIS in this study. It is however acknowledged that there was the potential that order effects of how the FIS items were listed could have influenced the way in which participants answered the items of the MFIS (this is considered in Section 5.7.4).

5.3.3 Measurement of Depression

A number of depression measures were identified as having been validated with TBI populations at the time of research and were reviewed for suitability to quantify depression in this study. Identified depression scales included the Beck Depression Inventory-II,(339) the Centre for Epidemiological Studies – Depression Scale,(340) and the Zung Depression Scale.(341) The review of depression measures took into account the conjecture that somatic symptoms of depression have been argued to coincide with the somatic symptoms of TBI,(342) leading to the overestimation of depression.(343)

However, of all of the depression measures reviewed, only the Beck Depression Inventory-II (BDI-II) had a separate somatic depression subscale as verified by a number of factor analytic studies (see Table 35).(344) The BDI-II was therefore chosen to evaluate depression in the current study as it was possible to evaluate the contribution of somatic symptoms to overall levels of depression and evaluate somatic depression's separate relationship with reported fatigue by separating them in analysis (see findings of this chapter Section 5.6.2 and 5.6.3). The BDI-II has also been supported for the use with TBI populations in that it has been found to have high internal consistency (α=0.92),(345) and is strongly correlated with the Hamilton Psychiatric Rating Scale of Depression (r= 0.71) and with depression items of the Structured Clinical Interview for Depression (r=0.83) for TBI samples.(339) Additionally, the BDI-II has been used extensively in recent TBI research evaluating social outcomes after injury, thus allowing for comparison of results.(346-352)

Table 35: Items on Scales of the Beck Depression Inventory-II.(344)

Sub scale	Item number	Item
Cognitive symptoms	9	Suicidal thoughts
	6	Punishment feelings
	5	Guilty feelings
	1	Sadness
	7	Self-dislike
	8	Self-criticism
	14	Worthlessness
	3	Past failure
	2	Pessimism
General symptoms	21	Loss of interest in sex
	13	Indecisiveness
	4	Loss of pleasure
	17	Irritability
	12	Loss of interest
	10	Crying
	11	Agitation
Somatic symptoms	20	Fatigue
	15	Loss of energy
	19	Concentration difficulty
	16	Changes in sleep
	18	Changes in appetite

The BDI-II is a 21 item self report assessment of the cognitive, behavioural, and somatic symptoms associated with depression.(353) Respondents are asked to choose a sentence from a group of choices that best indicates their experience of depressive symptoms over the last 2 weeks on a scale of 0-3, with 3 indicating greater depressive symptoms. BDI-II subscales are summed to diagnose levels of depression from a range of normal, mild, moderate, to severe depression (see Table 36).(353)

Table 36: Beck Depression Inventory-II Diagnostic Thresholds

Total score	Diagnosis based on total score
0-9	Normal levels of ups and downs
10-18	Mild to moderate depression
19-29	Moderate to severe depression
30-63	Severe depression

5.3.4 Cause of Injury Categories

The categories of cause of participants' TBI were condensed for this study so that they represented mechanism of injury, for example acceleration/deceleration versus focal injury. This was performed as mechanism of injury was deemed to be more closely related to patterns of TBI than cause alone. Causation was therefore classified as being either a) being hit in the head (such as with assault), b) head hitting a surface (such as with falls), or c) due to acceleration/deceleration forces (as with motor vehicle accident). This approach to grading cause of injury was also used in a number of studies included in the systematic review of this thesis.(109, 217)

5.3.5 Choice of Statistical Analyses

The choice of inferential statistical techniques used for this study was informed by following the decision making algorithms given in Tabachnick and Fidell (pgs. 29-31).(354) Firstly, the major research question was defined, then the number and type (continuous/discrete) of dependent variables specified and lastly, the number and type (continuous/discrete) of independent variables similarly specified (see Table 37). Because the hypotheses for this study were all unidirectional, statistical significance levels were set at 0.05 for all inferential statistics.

Table 37: Justification of Statistical Tests Used in this Study

Research question	Dependent variables	Independent variables	Appropriate statistical test
Structure of scale	Multiple: continuous (FIS and MFIS)	Multiple	Factor analysis (principal components analysis)
Prediction of group membership	One: discrete (employment outcome group)	Multiple: both continuous and discrete (time since injury, age, TBI severity and levels of fatigue)	Sequential logistic regression
Significance of group differences	One: continuous (levels of fatigue)	One: discrete (categorical levels of depression, injury severity, levels of education, employment outcome, cause of injury)	One way ANOVA or t-test

Because the selection of variables to be entered into a predictive equation for employment outcome was informed by the systematic review of this thesis, it was possible to control for known predictors in multivariate analysis. Sequential logistic regression analysis was therefore used in the prediction of employment outcome groups. In comparison, fewer studies have been undertaken to inform which factors need to be controlled for when investigating the predictors of fatigue following TBI. ANOVAs were therefore used to test for differences in levels of fatigue between groups of depression severity (normal, mild, moderate, and severe). This approach also appeared appropriate given that a very large

sample would have been needed to test all possible predictors in the face of insufficient evidence to select them.

While there is variation in recommended minimum sample size for factor analyses to reach sufficient levels of power, Bryant et al suggest a sample of 100 cases is acceptable.(355) The present study therefore had close to acceptable numbers of participants to conduct principle components analyses for validation of the FIS and MFIS for the present study. Further, Tabachnick and Fidell suggest that N>= 50 + 8m (where m = the number of independent variables) are acceptable sample sizes for multiple regressions.(354) Under these guidelines, six or less predictors would be appropriate given the current studies sample size.

5.3.6 Ethical Considerations

This study was reviewed by the Northern Regional Ethics Committee. The Northern Regional Ethics Committee questioned the development of a client database where the researcher had accessed client files without their knowledge to establish eligibility to participate in the study (see Section 5.4.2). This issue was resolved as all potential participants had signed an agreement on entry to the service from which they were sampled that gave their consent for their information to be used for research purposes (see Appendix 12 for the service agreement). The database that had been constructed from the review of client notes included 731 clients who met eligibility criteria. These clients had been discharged from the service in the period of five years prior to the undertaking of this research. While it had originally been intended that a heterogeneous sample would help identify temporal trends in fatigue following TBI, the Ethics Committee considered that only individuals who had been discharged from the service two years prior to the undertaking of research should be sampled. This decision was made as the committee believed that the difficulty tracking individuals five years after discharge from the service was likely to create a significant source of bias within the study. This committee did not identify any other conflicts of interest in the conduct of this research and ethical approval was granted. A cultural and disability advisor was consulted prior to the study being undertaken, whose advice informed the development of the study.

5.4 Methods

5.4.1 Sampling

Participants were recruited from a cohort of individuals who had received community based intervention from a rehabilitation provider with offices in Auckland, Christchurch, Tauranga, and Whangarei. Purposive sampling was used in that potential participants were evaluated against inclusion and exclusion criteria to determine eligibility to participate in research (see Table 38).

Table 38: Inclusion and Exclusion Criteria for Fatigue Study

Criteria for participation
Inclusion criteria • Admitted to the rehabilitation service (assessment or vocational rehabilitation) with a confirmed diagnosis of TBI • Discharged from the clinical service between 2004-2005 • Older than 16 at the time of injury and younger than 65 at time of follow up • Able to read and write English.
Exclusion criteria. • Evidence of co-morbid physical conditions that were identified to negatively influence employability such as amputation or tetra/paraplegia • In prison, residential rehabilitation service, or psychiatric ward at time of follow up • Anoxic brain injury, stroke, or aneurysm as principal cause of brain injury.

Participants were excluded if they were in prison, residential rehabilitation, or a psychiatric ward at follow up so that the sample would be comprised of individuals able to engage in community based employment. Participants were also excluded if they were identified as having conditions other than TBI that were known to influence occupational function (as identified in the systematic review), such as psychiatric or drug abuse histories and/or co morbid physical injuries such as spinal cord injury or amputation by reviewing patient case notes. This step was taken to control for potential confounding relationships between variables other than TBI and employment. Participants were also restricted to older that 16 at the age of injury and younger than 65 at the time of follow up to ensure that the cohort represented those who predominately make up the population eligible for community based employment.

5.4.2 Procedure

Study participants were identified through a manual search of clinical notes of clients discharged from community rehabilitation services. All clinical notes for individuals discharged from any of the four national offices of the community rehabilitation provider during 2004-2005 were read by the researcher for potential inclusion in the present study. TBI severity, cause of injury, time of injury, pre-injury occupational status, age, gender, and contact details were collected from clinical notes and entered into an excel spreadsheet.

Postal self response questionnaires were sent to potential participants following the process suggested by the Cochrane Review to increase postal response rate (see methodology); participants who met inclusion/exclusion criteria were sent a letter introducing the study (see Appendix 13) and informing them that a questionnaire would be sent to them over the next fortnight. Questionnaires, (see Appendix 10), participant information sheets (see Appendix 14), self addressed envelopes, and consent forms (see Appendix 15) were posted to potential participants a fortnight after the introduction letter inviting them to participate. A reminder letter (see Appendix 16) with a second copy of a questionnaire and a stamped self addressed envelope were sent to all eligible non respondents two weeks after the first questionnaire was sent.

Questionnaires sought demographic information not recorded in clinical notes including educational level (did not finish high school, finished high school, degree, or diploma) and ethnic group (European,

Maori, Pacific Islander, Asian, other). Information was also collected on participant self reported occupational status (employment, study, volunteer work, or unemployed) at the time of filling out the questionnaire and the average number of hours per week spent in principal occupation. Reported impact of fatigue on functioning was measured by the FIS and levels of depression measured by the BDI-II.

5.4.3 Data Entry

Demographic and injury information was transferred into the Statistical Package for Social Sciences (SPSS) version 15.0 for windows (356) from the excel spreadsheet generated during potential participant identification for analysis. Completed questionnaires were received, matched by a code on the front of their questionnaire with details in the Excel spreadsheet, and entered into the SPSS file. All data from questionnaires was manually double checked against questionnaires once all data had been entered to ensure accuracy of data entry.

5.4.4 Data Checking

Data screening was performed prior to analysis following the guidelines given by Tabaschnick and Fidell which involved the following sequence: checking univariate statistics for accuracy of input (checking for outliers), evaluating the distribution of missing data, checking for nonlinearity and homoscedasticity, checking for normality of distributions, and evaluating multicollinearity (pg.91).(354)

Missing Value Analysis was performed in SPSS to determine patterns of missing data and whether missing values needed to be imputed. This analysis revealed that there were no missing values for continuous variables, such as age at injury and time since injury, but that there were seven missing values for the reported number of hours spent in principal occupation. Because the number of hours spent in principal occupation per week was not used in any inferential statistics, missing values were not imputed. However, missing value analysis revealed that there were missing values for a number of categorical or ordinal variables including items of the FIS and the BDI-II, ethnicity, cause, education, and pre-injury employment status (see Table 39).

Table 39: Missing Data from Questionnaires

Number of responses missing for item	Variable with missing data	% of data missing
1	FIS items: 4, 14, 15, 17, 25, 26, 36, 37 BDI-II items: 8, 13, 19, 20 Ethnicity Cause	1.0%
2	FIS items: 20, 19, 29, 33, BDI-II items: 4, 5, 6, 9, 10, 14, 15, 21	2.1%
3	FIS items: 27 BDI-II items: 1, 3, 16, 17, 18 Education Previous employment	3.1%
4	BDI-II items: 12	4.1%
6	BDI-II items: 7	6.2%
10	BDI-II items: 11	10.3%

Because missing values identified in Table 39 were ordinal and categorical, methods of multiple imputation were not appropriate. In comparison to continuous variables, there are no generally accepted methods for the replacement of ordinal and categorical variables. Therefore, missing values for cause, ethnicity and education were excluded pair wise during statistical analysis. Missing data for FIS and BDI-II items were imputed using the SPSS median value replacement method so that all respondents were eligible for analysis, rather than being excluded pair wise during statistical analysis. It was therefore necessary to perform sensitivity analysis on findings, to ensure that the replacement of missing FIS and BDI-II items did not lead to spurious findings. Because there are no standard guidelines on how sensitivity analysis should be performed, this process was informed by an advising statistician. Sensitivity analysis was performed by first replacing missing values of the MFIS and the BDI-II with maximum values and re-running all inferential statistical analyses influenced by missing values and then replacing values with minimum values and re-running all inferential statistical analyses influenced by missing values. No differences in statistical significance were identified in comparison of output of the three different steps of statistical analysis.

Descriptive frequencies were used to determine the distributions of variables used in analysis. These analyses revealed that responses were suitably stratified; with no exceptional outliers and that distributions were close to normally distributed. Therefore, parametric t-tests, ANOVAs, and Pearson's correlations were used in univariate analysis. Because logistic regression does not have the assumptions that predictor variables are normally distributed, linearly related, or have equal variance, (354) it was not necessary to ensure that predictors had equality of variances nor to check for non-linearity. Likewise, ANOVAs have been identified to be fairly robust concerning deviations from equality of variances and non-linearity.(354)

5.4.5 Data Analysis

Data analysis for this study was conducted in four steps (see Table 40). Once principal components analysis of the FIS and MFIS were performed, descriptive statistical analysis was undertaken. Identified trends were then checked for statistical significance in univariate analysis, comparisons were made for demographic variables between respondents and not respondents, and multivariate analysis performed.

Table 40: Stages of Statistical Analysis

Stage	Analysis performed	Purpose
1st	Test validation	To investigate the psychometric properties of the FIS and MFIS
2nd	Descriptive statistics	Report descriptive statistics and to identify trends in data for exploration with inferential statistics
3rd	Univariate associations	To investigate associations between demographic, injury related and outcome variables. Comparisons made between respondents and non respondents were made to determine if differences in demographic and injury related variables existed
4th	Multivariate analyses	To investigate whether fatigue and employment outcome were related when known predictors and indicators of outcome were controlled for.

5.5 Results

All individuals who met inclusion/exclusion criteria were sent letters inviting participation (n=245). 46 invitation letters were returned to sender either because the individual had moved or because the address was unknown (18.8% of the total sample). One individual was identified as having died. Of the remaining 198 eligible participants, 97 returned questionnaires. This represents a 49.0% response rate of contactable eligible participants. Demographic characteristics of participants are given in Table 41. Univariate analyses to check for statistically significant differences in respondent and non respondent demographic variables are presented in Section 5.6.2. See Table 55 for a comparison of demographic variables for questionnaire respondents and non respondents.

Table 41: Demographic Characteristics of Questionnaire Respondents

Characteristic	Sub category	N	Percentage
Gender	Male	57	58.8%
	Female	40	41.2%
Severity	Mild	53	54.6%
	Moderate	18	18.6%
	Severe	26	26.8%
Cause	Hit head	22	22.7%
	Hit in head	28	28.9%
	Acceleration/deceleration	46	47.4%
	Missing	1	1.0%
Ethnicity	European	76	78.4%
	Maori	7	7.2%
	Pacific Islander	5	5.2%
	Asian	6	6.2%
	Other	2	2.1%
	Missing	1	1.0%
Education	Did not finish high school	17	17.5%
	Finished high school	37	38.1%
	Degree or diploma	40	41.2%
	Missing	3	3.1%
Previous Employment	Yes	79	81.4%
	No	10	10.3%
	Study	5	5.2%
	Missing	3	3.1%
Region	Auckland	65	67.0%
	Christchurch	26	26.8%
	Tauranga/Hamilton	6	6.2%

5.5.1 Test Validation

The psychometric properties of the FIS and MFIS were investigated to gather evidence of appropriateness for use with TBI populations. Principal components analysis with varimax rotation was conducted on data collected using the FIS, followed by calculation of internal consistencies. Principal components analysis was used, as this is suggested as appropriate when the purpose of analysis is to reduce data into components and assess if they match the scales suggested by the scales author.(357) Varimax rotation was used, as is suggested appropriate when the aim is to differentiate extracted components.(357) Principal components analysis was then performed on the MFIS by using

the 21 items taken from the FIS 40 item scale. Acceptable Cronbach's alpha levels were set at 0.7 in accordance with recommended guidelines for internal consistency evaluation.(358) SPSS defaults of eigenvalues over 1.0 were used to determine principal components in principal components analysis.

5.6 Fatigue Impact Scale and Modified Fatigue Impact Scale Principal Components Analysis

The 40 items of the FIS were found to load onto five components during principal components analysis (see Table 42). Items are identified in Table 42 in accord with being associated with the FIS defined scales of physical (P) psychosocial (S) or cognitive (C) in the second column from the left (see Table 42). The items deleted from the FIS to generate the MFIS are highlighted in grey in Table 42. Auxiliary loadings of items (loading highly onto more than one factor), are identified in Table 42 by showing secondary loadings in parentheses.

Results of the principal components analysis for the FIS showed that all but one of the items loading on components 3 (items 2, 3, 28, 19, 36), 4 (items 4, 12) and 5 (items 32, 33, 29, 39, 40) were removed from the FIS for the MFIS by the scales authors. The other items deleted from the FIS were most weakly loaded on any of the components (items 8, 22, 20, 25, 7). While item 27 loaded highly on the first component, this item was not obviously cognitive in nature, as with the rest of the items loading on this component, and therefore removal is justified given a lack of face validity for a cognitive scale. On the whole, principal components analysis of the FIS identified that there was evidence that the items removed to construct the MFIS were justified for a TBI sample given that they had the weakest loadings on the principal components, loaded on components not consistent with the author's suggested subscales, or lacked face validity.

Table 42: Principal Components Analysis of Fatigue Impact Scale Items

			Component				
Item	Scale	FIS item description	1	2	3	4	5
6	C	I feel like I cannot think clearly.	.764				
21	C	I am less motivated to do anything that requires thinking	.766				
34	C	I fell slowed down in my thinking	.764				
35	C	I find it hard to concentrate	.748				
26	C	I am less able to finish tasks that require thinking	.747				
30	C	I find it difficult to organise my thoughts when I am doing things at home or at work	.736				
27	S	I feel unable to meet the demands that people place on me	.726				
18	C	I find it difficult to make decisions	.668				
5	C	I have difficulty in paying attention for a long period of time	.653				
11	C	I find that I am more forgetful	.632				
8	S	I have to rely more on others to help me or do things for me	.595				
22	S	I avoid situations that are stressful to me	.578				
20	S	Normal day to day events are stressful for me	.575				
1	C	I feel less alert	.461	(.442)		(.452)	
23	P	My muscles feel much weaker than they should		.799			
31	P	I am less able to complete tasks that require physical effort		.792			
17	P	I have trouble maintaining physical effort for long periods		.761			
24	P	My physical discomfort has increased		.744			
14	P	I am less motivated to do anything that requires physical effort		.739			
15	S	I am less motivated to engage in physical activities		.732			
37	P	I have to limit my physical activities		.723			
13	P	I have to be careful about facing my physical activities		.715			
16	S	My ability to travel outside my home is limited		.707			
9	S	I have difficulty planning activities ahead of time because my fatigue may interfere with them		.577			
10	P	I am more clumsy and uncoordinated		.570			
7	S	I work less effectively (inside or outside the home)	(.521)	.522			
25	S	I have difficulty dealing with anything new	(.437)	.500			
2	S	I feel that I am more isolated from social contact			.619		
3	S	I have had to reduce my workload or responsibilities			.613		
28	S	I fell less able to provide financial support for myself and my family			.612		
19	S	I have few social contacts outside my own home			.563		
36	S	I have difficulty participating fully in family activity			.517		
38	P	I require more frequent or longer periods of rest			.516	(.435)	
4	S	I am more moody				.799	
12	S	I am more irritable and more easily angered				.699	
32	P	I worry about how I look to other people					.709
33	S	I am less able to deal with emotional issues	(.419)				.501
29	S	I engage in less sexual activity					.489
39	S	I am not able to provide as much emotional support to my family as I should	(.431)				.475
40	S	Minor difficulties seem like major issues	(.432)			(.431)	.438

NB The items deleted from the FIS to generate the MFIS are highlighted in grey

A second principal components analysis was performed on the same data set by only using the 21 items of the MFIS taken from the FIS. The results revealed two principal components, with all but one items loading highly on only one component (see Table 43). The authors of the MFIS, however, report

three sub-scales; physical (P), psychosocial (S) and cognitive (C),(338) as indicated in Table 43 in the second column from the left. The component structure resembled the cognitive and physical subscales purported by the MFIS authors exactly while the psychosocial items (item 8, I am less motivated to engage in physical activities and item 9, my ability to travel outside my home is limited) loaded highly on the physical factor. Because of the high loadings on the physical factor and obvious physical nature of these two items, items classified by the MFIS authors as psychosocial, were included on the physical subscale in all univariate and multivariate calculations. This was done in preference to having a scale with only two items which was anticipated to cause problems during analysis due to lack of spread in participants responses.

Table 43: Principal Components Analysis of Modified Fatigue Impact Scale Items

Item	Scale	Modified Fatigue Impact Scale Item Description	Component	
			1	2
17	P	I am less able to complete tasks that require physical effort	.849	
10	P	I have trouble maintaining physical effort for long periods	.834	
6	P	I have to be careful about facing my physical activities	.829	
20	P	I have to limit my physical activities	.824	
13	P	My muscles have felt weak	.805	
14	P	My physical discomfort has increased	.804	
8	S	I am less motivated to engage in physical activities	.785	
9	S	My ability to travel outside my home is limited	.773	
7	P	I am less motivated to do anything that requires physical effort	.770	
4	P	I am more clumsy and uncoordinated	.632	
21	P	I require more frequent or longer periods of rest	.545	(.483)
3	C	I feel like I cannot think clearly		.856
19	C	I find it hard to concentrate		.846
18	C	I fell slowed down in my thinking		.842
15	C	I am less able to finish tasks that require thinking		.801
16	C	I find it difficult to organise my thoughts when I am doing things at home or at work		.789
2	C	I have difficulty in paying attention for a long period of time		.775
12	C	I am less motivated to do anything that requires thinking		.763
11	C	I find it difficult to make decisions		.726
5	C	I find that I am more forgetful		.682
1	C	I feel less alert		.618

The physical and cognitive subscales of the MFIS were found to have high internal consistency (α = 0.962 and α = 0.958 respectively) (see Table 44), and have the same overall internal consistency as the FIS (α = 0.983). The total amount of variance explained by the two principle components was 73.8% (as opposed to 75.46% for the five principle component solution of the FIS). The current evidence therefore indicates that the items deleted from the FIS to generate the MFIS led to a more concise tool with similar construct validity but considerably better face validity. The MFIS was therefore used in all analyses for this study.

Table 44: Internal Consistency and Principal Component Analysis Results of the Modified Fatigue Impact Scale

Component	Number of items	Eigenvalue	Percentage of variation explained by factor	Internal consistency (α)
1. Physical fatigue	11	13.58	64.66%	0.962
2. Cognitive fatigue	10	1.919	9.149%	0.958
Total	21	NA	73.80%	0.983

5.6.1 Descriptive Statistics

Descriptive statistics of reported hours per week spent in occupational engagement, MFIS subscales, and BDI-II subscales were conducted to identify trends in data and differences between demographic and injury related groups for further investigation in univariate (see Section 5.6.2) and multivariate statistical analysis (see Section 5.6.3). Please note, none of the analysis in this section was inferential, but were done to identify where trends in data for further investigation in univariate and multivariate statistical analysis.

As shown in Table 45, the distributions of the employment outcome groups indicated that, on average, individuals in the employed group reported working the equivalent of full time (as determined by the NZ Government threshold of 30 works per week being deemed full time work), (359) the study group reported being engaged in study the equivalent of part time, and that volunteers reported engaging in volunteer work the equivalent of one day a week.

Table 45: Descriptive Statistics of Reported Hours per Week Spent in Principal Occupation

Group	N	Missing Data for hours per week	% of sample	Range		Hours per week spent in principal occupation	
				Min	Max	Mean	SD
Employed	57	4	58.8%	8.0	80.0	35.13	14.88
Study	10	1	10.3%	8.0	45.0	18.87	12.71
Volunteer	10	2	10.3%	2.0	20.0	8.83	6.83
Unemployed	20	0	20.6%	0	0	0	0

Comparison of the distribution of demographics and injury severity across the employment outcome groups (see Table 46) revealed a number of trends: (a) there were comparable distributions of males and females across employment outcome groups, (b) a larger proportion of individuals with higher degrees were employed than individuals who did not finish high school, (c) a higher proportion of individuals with MTBI were employed than those with moderate or severe TBI, and (d) there were comparable proportions of individuals in the employment outcomes for most of the cause groups, except that more individuals in the falls group were employed and more individuals in the acceleration/deceleration group were in study than the other groups.

Table 46: Distribution of Employment Outcome Groups for Demographic and Traumatic Brain Injury Related Variables

	Employed		Study		Volunteer		Unemployed	
	N	%	N	%	N	%	N	%
Gender								
Male	31	54.4%	7	0.1%	9	16.8%	10	10.3%
Female	26	65.0%	3	7%	1	3%	10	25%
Education								
Did not finish high school	10	58.8%	0	0%	2	11.8%	5	29.4%
Achieved high school	15	40.5%	5	13.5%	6	16.2%	11	29.7%
Degree or diploma	30	75%	5	12.5%	2	5%	3	7.5%
Severity								
Mild	39	73.6%	3	5.7%	4	7.5%	7	13.2%
Moderate	8	44.4%	2	11.1%	1	5.6%	7	38.9%
Severe	10	38.5%	5	19.2%	5	19.2%	6	23.1%
Cause of injury								
Fall	13	59.1%	1	4.0%	1	4.0%	7	38.2%
Hit in head	18	64.3%	2	7.2%	3	10.7%	5	17.8%
Acceleration/deceleration	25	62.2%	7	45.5%	6	13.5%	8	17.8%

Descriptive analysis of the employment outcome groups showed no clear pattern for trends in time since injury, whereas age at the time of injury indicated that those who were studying after injury were younger than individuals who were employed, volunteering, or unemployed (see Table 47). Additionally, those who were unemployed appeared to be older than all other employment outcome groups.

Table 47: Descriptive Statistics of Time since Injury and Age at Time of Injury for the Employment Outcome Groups

	Employed (n=57)		Study(n=10)		Volunteer (n=10)		Unemployed(n=20)	
	M	SD	M	SD	M	SD	M	SD
Time since injury (years)	3.50	2.79	6.48	6.42	8.12	7.35	5.36	6.93
Age at time of injury (years)	36.17	11.59	24.62	9.08	33.43	11.31	44.38	12.54

The descriptive statistics of the MFIS scales (see Table 48) identified that the distribution of the physical and cognitive subscales were roughly equivalent indicating that the total fatigue score was neither under nor over represented by either of the scales.

Table 48: Descriptive Statistics of the Modified Fatigue Impact Scale

	Number of items	Range of scale	Minimum	Maximum	Mean	Std. Deviation
Physical fatigue	11	0-44	.00	40.00	17.26	9.93
Cognitive fatigue	10	0-40	.00	41.00	16.63	11.96
Total fatigue	21	0-84	.00	81.00	33.89	20.59

Trend analysis of the descriptive statistics of the MFIS revealed that the distributions of the reported disability caused by physical, cognitive, and total fatigue were similar for gender, severity of injury, and cause of injury groups (see Table 49). However, reported fatigue was found to be highest for individuals with the lowest levels of education and with the highest levels of depression.

Table 49: Descriptive Statistics of Modified Fatigue Impact Scale

Variable	N	Physical fatigue		Cognitive fatigue		Total fatigue	
		M	SD	M	SD	M	SD
Gender							
Male	57	16.54	9.72	15.46	12.07	32.00	19.38
Female	40	18.27	10.27	18.30	11.74	33.89	20.59
Severity							
Mild	53	15.47	9.13	14.38	11.70	29.85	19.38
Moderate	18	20.28	12.84	19.17	13.70	39.45	25.69
Severe	26	18.81	8.81	19.46	10.64	38.27	17.94
Cause							
Fall	22	16.77	9.05	17.04	12.21	33.82	18.98
Hit in head	28	17.96	10.66	16.42	11.82	34.39	21.91
MVA	46	17.26	10.09	16.86	12.11	34.13	20.88
Employment outcome							
Employed	57	15.21	9.68	12.61	01.74	27.82	19.36
Study	10	16.60	11.27	19.90	14.60	36.50	24.52
Volunteer	10	17.00	7.60	27.90	9.11	38.90	14.97
Unemployed	20	23.55	8.97	23.80	10.93	47.35	18.14
Education							
Did not finish high school	17	21.29	10.84	20.06	13.33	40.82	23.12
Finished high school	37	18.00	9.76	17.89	10.99	35.89	18.85
Degree or diploma	40	14.80	9.39	14.00	12.02	28.80	20.49
Depression							
Normal depression	20	5.05	4.49	4.90	7.06	9.95	9.99
Mild depression	34	15.71	6.67	13.38	9.99	29.09	15.34
Moderate depression	29	22.07	7.53	23.76	9.22	45.83	14.55
Severe depression	14	28.50	6.42	26.50	9.43	55.00	13.92

Trend analysis of the distribution of the BDI-II scales revealed that respondents reported slightly higher levels of somatic depression than general and cognitive depression (see Table 50). When the scores of BDI-II scales across diagnostic depression groups were compared, somatic depression scores were not however found to be high in comparison to general and cognitive depression scores (see Table 51).

Table 50: Descriptive Statistics of the Beck Depression Inventory-II

	Number of items	Range of scale	Minimum	Maximum	Mean	Std. Deviation
Cognitive symptoms	9	0-27	0	22	6.09	5.40
Somatic symptoms	5	0-15	0	15	5.89	3.01
General symptoms	7	0-21	0	16	6.49	4.16
Total depression	21	0-63	0	50	18.47	11.23

Table 51: Distribution of Beck Depression Inventory-II Scale for Depression Severity

Depression diagnosis	N	Cognitive depression		Somatic Depression		General depression		Total depression	
		M	SD	M	SD	M	SD	M	SD
Normal depression	20	.80	1.01	2.10	1.74	1.25	1.16	4.15	3.10
Mild depression	34	3.62	1.69	5.71	1.78	5.09	1.96	14.41	2.70
Moderate depression	29	8.03	3.32	6.79	1.72	8.79	2.38	23.62	2.74
Severe depression	14	15.64	4.14	9.86	2.63	12.64	1.91	38.14	6.97

Analysis of the descriptive statistics of the BDI-II revealed that the distributions of depression severity groups were similar for gender, severity, and cause groups (see Table 52). However, reported depression was found to be highest for individuals with the lowest levels of education.

Table 52: Exploratory Descriptive Statistics of the Beck Depression Inventory-II

Depression diagnosis	N	Normal depression		Mild depression		Moderate depression		Severe depression	
		N	%	N	%	N	%	N	%
Gender									
Male	57	13	22.8%	17	29.8%	18	31.6%	9	15.8%
Female	40	7	17.5%	17	42.5%	11	27.5%	5	12.5%
Severity									
Mild	53	13	24.5%	25	47.2%	13	24.5%	2	37.7%
Moderate	18	4	22.2%	1	5.5%	6	33.3%	7	38.8%
Severe	26	3	11.5%	10	38.5%	10	38.5%	5	19.2%
Cause									
Hit head	22	5	22.7%	9	40.9%	7	31.8%	1	4.5%
Hit in head	28	6	21.4%	10	35.7%	7	25.0%	5	17.8%
MVA	46	8	12.5%	15	32.6%	15	32.6%	8	12.5%
Education									
Did not finish high school	17	3	17.6%	5	29.4%	4	23.5%	5	29.4%
Finished high school	37	5	13.5%	11	29.7%	14	37.8%	7	18.9%
Degree or diploma	40	11	27.5%	17	42.5%	10	25.0%	2	5.0%

Descriptive statistics of the distribution of BDI-II subscale scores across employment outcome groups revealed that those in the employed group reported the lowest levels of depression (see Table 53).

Table 53: Distribution of Beck Depression Inventory-II Scales across Employment Groups

	Employed (N=57)		Study (N=10)		Volunteer (N=10)		Unemployed (N=20)	
	M	SD	M	SD	M	SD	M	SD
Cognitive depression	4.63	4.42	9.70	8.07	8.30	5.08	7.35	5.41
General depression	5.68	3.89	5.70	5.42	9.40	2.76	7.75	4.09
Somatic depression	5.40	2.86	5.90	4.48	6.30	2.45	7.05	2.65
Total depression	15.72	9.98	21.30	17.16	24.00	6.90	22.15	11.16

5.6.2 Univariate Analysis

Inferential univariate statistical analysis was conducted to establish whether there were statistically significant differences between respondents and non respondents with respect to demographic variables, and to establish whether trends evident in descriptive analysis were statistically significant. Correlation matrices (Pearson's) were constructed to establish the strength of associations between fatigue and depression, age at time of injury, and time since injury.

Respondent's demographic information was compared with non respondents to investigate the degree that respondents were representative of individuals eligible for study participation. Independent group t-tests were used to compare continuous variables (see Table 54) and chi square tests were used to compare categorical and ordinal variables (see Table 55) between respondents and non respondents. Analysis revealed that there were no statistically significant differences between respondents and non respondents with respect to demographic information.

Table 54: Comparison of Continuous Characteristics of Respondents and Non-Respondents

Variable	Respondents (n=97)	Non respondents (n=148)	t	p
Age at time of injury (years)	36.39 (12.56)	33.93 (12.24)	1.525	.129
Time since injury (years	4.67 (5.05)	4.64 (4.97)	.031	.975

Table 55: Comparison of Ordinal and Categorical Characteristics of Respondents and Non-Respondents

Variable	Category	Respondents (n=97)	Non respondents (n=148)	x^2	df	P
Cause	Hit head	22 (22.7)%	31 (20.9%)	.818	2	.664
	Hit in head	28 (28.9%)	50 (33.8%)			
	Acceleration /deceleration	46 (47.4%)	63 (42.6%)			
Severity	Mild	53 (54.6%)	76 (52.1%)	.159	2	.923
	Moderate	18 (18.6%)	29 (19.6%)			
	Severe	26 (26.8%)	41 (28.1%)			
Gender	Male	57 (58.8%)	96 (64.8%)	.930	1	.335
	Female	40 (41.2%)	52 (35.2%)			
Pre injury employment	Yes	79 (84.1%)	105 (78.4%)	1.23	2	.541
	No	10 (10.6%)	18 (13.4%)			
	Studying	5 (5.3%)	11 (8.2%)			

5.6.3 Evaluation of Modified Fatigue Impact Scale and Beck Depression Inventory-II Scales

T-tests were also used to establish that differences in physical, cognitive, or total fatigue for gender were not statistically significant (see Table 56).

Table 56: T-test Results for Differences in Reported Modified Fatigue Impact Scale Scores for Gender

	t	Sig
Physical fatigue	.843	.401
Cognitive fatigue	1.155	.251
Total fatigue	1.078	.284

Correlations performed between MFIS and BDI-II sub-scale scores indicated that all sub-scales were highly positively correlated (see Table 57).

Table 57: Correlations between the Modified Fatigue Impact Scale and Beck Depression Inventory-II Scales

	Physical fatigue	Cognitive fatigue	Total fatigue	Cognitive depression	Somatic depression	Affective depression
Cognitive fatigue	.768(**)					
Total fatigue	.928(**)	.951(**)				
Cognitive depression	.598(**)	.512(**)	.586(**)			
Somatic depression	.800(**)	.629(**)	.746(**)	.655(**)		
Affective depression	.789(**)	.586(**)	.690(**)	.726(**)	.674(**)	
Total depression	.757(**)	.631(**)	.732(**)	.925(**)	.832(**)	.899(**)

** Significant at the 0.01 level

Correlations performed between the cognitive fatigue and physical scale of the MFIS with age and time since injury found that neither were significantly associated (see Table 57).

Table 58: Correlations between the Modified Fatigue Impact Scales and Age and Time since Injury

	Cognitive fatigue	Physical fatigue
Age	.102	.144
Time since injury	.186	.041

** Significant at the 0.01 level

ANOVA's were used to determine if statistically significant differences in reported cognitive, physical, and total fatigue were evident between groups for severity of injury, levels of education, severity of depression, employment outcome group, and cause of injury (see Table 59). No statistically significant differences in reported fatigue were evident for severity or cause of injury groups. Differences in cognitive, physical, and total fatigue for levels of education approached but did not reach statistical significance. Differences between cognitive, physical, and total fatigue were highly statistically significant for severity of depression and employment outcome group.

Table 59: ANOVA Results for Differences in Reported Modified Fatigue Impact Scale Scores

		df (between groups, within groups)	F	Sig
Injury severity	Cognitive fatigue	2, 94	2.12	.125
	Physical fatigue	2, 94	2.05	.135
	Total fatigue	2, 94	2.32	.103
Level of education	Cognitive fatigue	2, 91	1.90	.155
	Physical fatigue	2, 91	2.80	.066
	Total fatigue	2, 91	2.58	.081
Severity of depression	Cognitive fatigue	3, 93	23.70	.000*
	Physical fatigue	3, 93	42.94	.000*
	Total fatigue	3, 93	38.73	.000*
Employment outcome	Cognitive fatigue	3, 93	23.70	.000*
	Physical fatigue	3, 93	42.94	.000*
	Total fatigue	3, 93	38.73	.000*
Cause of injury	Cognitive fatigue	2, 93	0.02	.982
	Physical fatigue	2, 93	0.09	.913
	Total fatigue	2, 93	0.01	.995

* Significant at the 0.001 level

5.6.4 Multivariate Analysis

Ordinal regression was used to investigate predictors of employment outcome groups (employed, study, volunteer or study). This was done using sequential logistic regression as there were more than two outcome variables and because the intention was to determine whether fatigue was associated with employment once known predictors were controlled for. As such, stepwise regression, where the entrance of variables is based on statistical criteria,(354) was considered inappropriate. The selection of variables for entrance into the ordinal regression analyses was informed by the systematic review of predictors of employment outcome after TBI (see Chapter 3). The factors that were most consistently found to be predictors in Chapter 3 were employment status before injury, age, severity of injury, and education.

Sequential logistic regression models were conducted in the following manner, i) a model with only predictors known to be associated with employment outcome was run with block entry (see Table 60), ii) a model with known predictors and cognitive fatigue was run (see Table 61), iii) a model with known predictors and physical fatigue was run (see Table 62) then iv) a model with known predictors and both cognitive and physical fatigue (as given by a total fatigue score) was run (see Table 63).

Table 60: Sequential Logistic Regression of Employment Groups using Known Predictors

	Model fitting criteria	Likelihood ratio tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig
Intercept only	202.63			
Final	140.07	62.57	21	.000

Table 61: Sequential Logistic Regression of Employment Groups using Known Predictors and Cognitive Fatigue

	Model fitting criteria	Likelihood ratio tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig
Intercept only	202.63			
Final	127.41	75.22	24	.000

Table 62: Sequential Logistic Regression of Employment Groups using known Predictors and Physical Fatigue

	Model fitting criteria	Likelihood ratio tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig
Intercept only	202.63			
Final	133.51	69.12	24	.000

Table 63: Sequential Logistic Regression of Employment Groups using Known Predictors and Total Fatigue

	Model fitting criteria	Likelihood ratio tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig
Intercept only	202.63			
Final	129.92	73.34	24	.000

The findings of sequential logistic regressions indicated that the model that improved most significantly from the intercept only (the null hypothesis) was the model with known predictors and cognitive fatigue ($x^2 = 75.22$, $p > .000$). While the model that included known predictors and physical fatigue improved on the intercept only model (-2 Log Likelihood = 133.51) the chi-square test indicated that it was not as well associated with employment outcome groups as cognitive fatigue ($x^2 = 69.12$, $p > .000$). Results also showed that the model with both physical and cognitive fatigue was less associated with outcome than the model with just cognitive fatigue and known predictors ($x^2 = 73.34$, $p > .000$) These findings are also supported by the Pseudo-R^2 values for the ordinal regressions, given in Nagelkerke estimates, which gave a Pseudo-R^2 value of .557 for the predictor only model. The highest of Pseudo-R^2 value was for the cognitive fatigue added model (Pseudo-R^2 =.630), with the physical fatigue model explaining less shared variance (Pseudo-R^2 = .596). Evidence to suggest that physical fatigue was less associated with employment outcome is also supported by findings that showed that the model with both cognitive and physical fatigue added explained less variance than cognitive fatigue and known predictors (Pseudo-R^2 = .620).

5.7 Discussion

The findings of this study support the qualitative research of this thesis and other studies suggesting fatigue as a source of work disability following TBI.(272, 306, 360, 361) The present study has extended what was known from research evaluating the relationship between fatigue and employment after TBI as prior studies used either; descriptive or univariate analysis,(306, 361) looked at functional outcome rather than employment status in their analysis,(360) or were small qualitative studies. (272) By exploring fatigue in a multivariate study with factors most consistently identified in the systematic review as associated with employment outcome after TBI, the findings suggest fatigue explains novel variance in the explanation of employment following TBI. This section describes the main findings, implications for rehabilitation, areas for new research, and limitations of this study.

5.7.1 Fatigue, Depression and Employment

The findings of this study supported the hypothesis that individuals who were unemployed following TBI would report the highest levels of fatigue. Cognitive fatigue in particular was found to explain more novel variance in employment outcome than physical fatigue when entered into multivariate equations after known predictors. These findings highlight the importance of viewing fatigue as a multidimensional construct which can influence function in different areas. This may be important with respect to employment outcome after TBI because work demands may consist of a number of different cognitive or physical tasks. The findings of this study indicating fatigue influences both physical and cognitive functioning after TBI are supported by the findings from Ouellet et al (published after this study was conducted) which evaluated the relationship between fatigue and employment outcome after TBI (employment/study, volunteering, or unemployment).(361) Ouellet et al found that individuals in the unemployed group reported the highest levels of both cognitive and physical fatigue. These findings further validate the findings of the study described in this chapter as a measure of fatigue severity was used (rather than disability caused by fatigue) as was done in this study. However, because analysis was univariate and no other variables were controlled for, it is not possible to infer that either physical or cognitive fatigue explained more variance in employment outcome from these findings.

While research has been inconsistent in finding a relationship between fatigue and depression after TBI,(64, 306) the study presented in this chapter found highly significant differences in the levels of reported fatigue across different groups of depression severity. These findings have been supported in recent research that found chronic stress and depression were the only successful predictors of fatigue in multivariate analysis of fatigue severity following TBI.(362) As suggested in the introduction of this chapter, explanations of fatigue include both factors *causing* fatigue and factors *perpetuating* it. Depression may therefore be either the cause or a perpetuating influence of fatigue following TBI. Alternatively, it may be that individuals who are depressed are more disabled by the experience of fatigue. Further investigation is needed to elucidate the relationship between fatigue, depression, and experiences of disability following TBI.

The current study supports recent research findings that fatigue after TBI is not limited to the acute phase of recovery and has significant long-term impact on the cognitive and physical functioning of individuals' following TBI.(58, 306, 362) Whilst there was no statistically significant relationship between physical fatigue and time since injury (r=.041, p=.687) in this study, the relationship between cognitive fatigue and time since injury was stronger although still not significant (r=.186, p=.068). These findings suggest that some aspects of fatigue develop over time after injury, a finding supported by a recent longitudinal study with TBI populations. Bushnik et al (363) found that fatigue was reported to be at its highest six months after TBI, and although fatigue reduced at 12 months after injury, fatigue levels increased slightly again by 18-24 months after injury. While these findings also suggest that fatigue following TBI changes over time, there remains a lack of understanding of the causes and mechanisms of the development of fatigue over time after TBI.

This study found that the relationships between participant's age, education, TBI severity, TBI cause, gender, and their fatigue were not statistically significant. These findings are consistent with existing literature that has failed to associate fatigue with severity of TBI injury,(64, 65, 306, 360-362) age, or gender.(64, 65, 306) The lack of a statistically significant relationship between fatigue and demographic features in this study may in part be due to measuring *disability reported by fatigue* rather than the *severity of fatigue* itself. It is possible that some individuals experienced high levels of fatigue but had developed strategies or received supports that limited the influence of fatigue on their functioning. As further mentioned in the limitations of this study section, the inclusion of a severity measure in addition to the measurement of disability caused by fatigue could have helped explain the relationship between fatigue and fatigue related disability.

Although the MFIS was developed for the assessment of fatigue in multiple sclerosis, the present study gave empirical evidence for use with TBI populations due to symmetry between principle components loadings and author defined scales, high internal consistencies, and an overall large amount of variance explained by a two factor solution (74.4%). There is therefore evidence for the use of the MFIS in future research in preference to the larger FIS whose items have been identified as not measuring the construct of interest by its authors. However, as acknowledged in Section 5.3.2, order effects and slight changes in the wording of items of the MFIS call for validation of findings regarding the effectiveness of the MFIS in quantifying fatigue in TBI populations.

5.7.2 Implications of Findings for Rehabilitation

The findings of this study have implications for the provision of vocational rehabilitation for individuals with TBI. Firstly, evidence supports the notion that fatigue is not a unitary outcome, but that it is multidimensional, including both physical and cognitive fatigue. Therefore vocational rehabilitation planning could be enhanced by identifying which aspects of fatigue an individual is experiencing in order to understand how their fatigue is likely to influence their work performance. Secondly, it may be helpful to explore with an individual what their thoughts and beliefs around fatigue are, as this is likely to influence their engagement in rehabilitation interventions. As identified in the qualitative section of

this thesis, a number of participants stated they believed they were unlikely to ever RTW because of their fatigue and had avoided situations where they felt their fatigue would prohibit them from performing their job. It may be particularly important to identify beliefs and expectations of disablement caused by fatigue if individuals appear to be avoiding engaging in intervention. Lastly, the relationship between depression and fatigue identified in this study indicates that mood should be assessed in individuals with fatigue to determine if psychological intervention for depression is required. As noted below, and in the overall discussion of this thesis (see Section 6.4.7), there is currently little known about which strategies are most successful in dealing with fatigue after TBI, or how depression relates to the experience of disablement after TBI.

5.7.3 Areas for New Research

Although this study found strong evidence of an association between fatigue and employment status after TBI, there is still a need to verify the relationship between fatigue, depression, levels of disability caused by fatigue, and work performance following TBI.

Given that fatigue has been found to be a persistent symptom of TBI in this and other studies,(58, 306, 362, 363) longitudinal research is needed to establish the factors associated with the development of fatigue over time. As identified in the introduction of this chapter, fatigue can be argued to be the result of a number of different predisposing, precipitating, and perpetuating factors. While fatigue is often referred to as a singular phenomenon in research,(64, 65, 306) it is possible that different influences are involved in the development and maintenance of different aspects of fatigue after TBI. By assessing the development of patterns of both cognitive and physical fatigue over time, it will be possible to assess which factors are involved in the development and maintenance of each and thus target interventions appropriately.

In the methodology of this study, it was argued that the evaluation of disability caused by fatigue can be beneficial when trying to test associations with social outcomes. However, it cannot be assumed that fatigue severity and disability caused by fatigue are directly related. For example, some individuals may have supports in their environment that mean they can function with fatigue or individuals may have found adaptive techniques to deal with fatigue. Further research is therefore warranted to establish how individuals become disabled by fatigue following TBI. Identifying the conditions/factors that contribute to the level of disability may lead to the development of strategies to support functioning for those who experience fatigue *before* they become disabled. Currently there is uncertainty as to which intervention strategies should be used to deal with fatigue, in part due to lack of understanding around the causes of fatigue after TBI.

5.7.4 Limitations of the Study

The present study had a number of methodological limitations that influence the generalisations that can be drawn from findings. The most significant of these was the employment outcome used. While the outcomes used in this study needed to distinguish individuals who were employed and unemployed, the classification of people being unemployed makes the assumption that those

individuals were actively seeking, but had not been able to gain employment, which may not have been the case. For example, people looking after small children would have been classified as unemployed in the study even though capable of employment. Although the employment classification used in this study was similar to many other studies, (5, 7, 203, 204, 208, 212, 215, 218, 224, 226-229, 331) thus allowing some comparison of findings, it is acknowledged that other factors that are not related to TBI or fatigue can influence employment outcome and that these were not controlled for in this study.

While severity of TBI was used during multivariate analysis, this study did not control for levels of cognitive impairments. Including assessment of cognitive impairments in multivariate analysis would have been beneficial as they were found to be one of the significant indicators of outcome in the systematic review of this thesis and this could have added to what was known about explained variance from past studies. The inclusion of both assessments of levels of concentration and attention would also have been particularly helpful as one of the suggested mechanisms of the influence of fatigue on function is the coping hypothesis which argue that fatigue after TBI is the result of increased cognitive effort required by individuals with attention and concentration problems.(71) Because these impairments were not measured, it cannot be determined what influence they had.

Although the present study showed support for the use of the MFIS with TBI populations, there are a number of reasons why its use can be questioned. Firstly, the MFIS data was extracted from the FIS, rather than the MFIS being the format by which data was collected. One of the limitations of this is that the FIS contains a number of items that could influence the way in which participants responded to the subset of questionnaire items within the MFIS. Additionally, the MFIS asks the same questions as the FIS but with slightly different wording. For example the item in the FIS ‘because of my fatigue, I am less motivated to do anything that requires physical effort’ being phrased ‘I have been less motivated to do anything that requires physical effort’ in the MFIS. Although this study provided data to suggest that the MFIS had a better factor structure than the FIS, findings will need to be validated with another larger TBI sample for the MFIS’s use with TBI populations to be substantiated.

Another limitation of the current study was the lack of a validated fatigue severity measure. Although the logic for using the MFIS was given in the methodology of this study, in retrospect, the inclusion of a fatigue severity measure in addition to the MFIS would have helped to establish the relationship between fatigue severity and the ways in which people experience fatigue related disability after TBI.

Similar methodological issues as those identified in the systematic review of predictors of employment after TBI (see Chapter 3) were also indentified in this study in that it was cross sectional and did not investigate the match between work abilities and work demands. The current cross sectional design used in this study raises the methodological concern that only a snapshot of an individual’s occupational outcome was taken, which may have been influenced by any number of confounding factors unrelated to TBI. For example, people may have been planning to study before they had their

head injury or, as the qualitative findings suggest, the family structure may have changed so that part time work was now preferable.

Lastly, this study had a relatively small sample size, from a convenience sample rather than being population based, and was based on postal responses. As this study performed a number of multivariate statistical analyses, it is possible that the sample size was not sufficiently large enough to reach statistical significance. In particular, the sample size used for the factor analysis was relatively small in comparison to recommended sample sizes for principal components analysis. However, as principal components analysis was used to calculate the use of the MFIS rather than to make inferences as to the effects of fatigue on employment, the influence on results do not significantly influence the overall findings of this study. The sample pool was those who had accessed a community rehabilitation service and as such, do not necessarily reflect a population based sample of all people with TBI. It is therefore likely that they would have experienced greater disability than people in the community following TBI that did not use services. However, at the time of this study, no population data base for TBI in NZ was available. Further, it seemed appropriate to investigate these questions in a population that had at some point required assistance following TBI. In terms of the respondents, there was a 49.0% postal response rate from participants which is considered acceptable by suggested standards.(364) Additionally, as shown in the analysis of this study, there were no statistically significant differences between respondents and non-respondents on key characteristics such as age, gender, severity of injury, and time since injury suggesting findings have generalisability.

5.7.5 Conclusion

The findings of this study have provided quantitative evidence that fatigue, especially cognitive fatigue, was related to work disability after TBI. Furthermore, depression was found to be highly associated with the experience of fatigue after TBI. Because this research was correlational, statements about causality cannot be made as it is possible that other factors not controlled for in this study influenced this relationship. There is therefore a need to replicate these findings and expand upon them to investigate the ways in which fatigue causes limitations to capacity for sustained engagement after TBI so that intervention strategies can be developed to ensure a successful RTW outcome after TBI.

6 Discussion

The three studies in this thesis have explored the influences of employment after TBI using a number of different research approaches. Central to all three of these studies was the question 'can employment after TBI be predicted?' The three investigations each addressed this question by: systematically evaluating published research; exploring perspectives of individuals with TBI and professionals delivering rehabilitation as to what factors they considered to be influences of employment following TBI; and evaluating the association between fatigue and employment after TBI. Each study contains a study-specific discussion of the ways in which findings have contributed to the knowledge base of the influences of employment after TBI, the generalisations that can be drawn from findings, and the limitations of that study. This chapter brings together the key findings of the studies in this thesis and proposes the possible application of work disability as a framework to guide future research and clinical practice. In addition, what has been learnt as a researcher throughout the process is explored before addressing possible areas of future research stemming from the findings of studies in this thesis.

6.1 Summary of Research Findings in this Thesis

Evidence from the systematic review of this thesis (Chapter 3) identified that the factors most consistently associated with employment outcome after TBI in published quantitative studies were pre-injury productivity, age, levels of education at the time of injury, and levels of impairment (see Section 3.2.4 and 3.2.6). The review also identified that a large amount of variance in employment outcome remains unexplained, with the largest and most rigorous study accounting for 41% of variance in employment outcome, and all other studies explaining between 20%-40% of variance in employment outcome. The systematic review concluded that many of the social and environmental factors that have been identified to influence employment after TBI require further research.

While the original intention of this thesis was to develop a model to predict employment outcome after TBI, the studies in the systematic review suggest that the prediction of employment outcome based on what is known from predictive studies remains a difficult endeavour. Although the stated purpose of developing a predictive model of employment after TBI has been identified elsewhere as being to identify rehabilitation goals to guide clinical decision making during intervention,(8) the studies in this review did not identify a systematic way in which this may be achieved. While it is evident that pre-injury and impairment factors do indeed influence employment after TBI, knowledge of these factors alone cannot predict which individuals will be employed following injury. The systematic review concluded that viewing only factors intrinsic to the individual ascribed to a medical model of disability and argued that a more holistic approach was needed in the explanation of the factors influencing employment after TBI.

The qualitative research (Chapter 4) extended on the findings of the systematic review by investigating which social and environmental factors were believed to influence employment from the perspectives of individuals with TBI and professionals involved in intervention. Rather than a focus on impairments alone (as much of the prior predictive research had done), all participants suggested they believed

both work and non work social conditions influenced employment outcome. Findings also suggested that professionals involved in intervention considered that it was how impairments interact with work demands that effects work performance, which in turn influences employment outcomes. The qualitative study also identified which specific aspects of intervention were believed to facilitate employment after TBI from the perspective of professionals involved in intervention including collaboration between stakeholder groups, timing of intervention, and working with the motivations of the individual with TBI. The findings from all groups interviewed suggest that fatigue was a significant barrier to employment after injury by restricting individuals' ability to engage in sustained activity and was used as the basis of the third study in this thesis investigating fatigue and employment after TBI.

When comparing the findings of the systematic review and the findings of the qualitative study, it is evident that there is a gap between what has been found to be associated with employment outcome in published quantitative research, and what individuals with TBI and professionals delivering intervention perceive to be the influences on employment status following injury. Evidence from the qualitative study indicated that all participants interviewed considered employment was not just the consequence of impairment or pre-injury characteristics but the product of the interaction between the individual and their environment. As the following section describes, findings from this study therefore give support to biopsychosocial models of disability in the explanation of the influences on employment following TBI.

The third study of this thesis explored the influence of fatigue on employment after TBI (Chapter 5) by using a quantitative cross-sectional cohort study. While fatigue had not been identified as a predictor of employment outcome in the literature identified in the systematic review, this study found that cognitive fatigue was highly associated with employment outcome even when associations with age, education, pre-injury productivity, and severity were accounted for. Whereas other studies have found inconsistent relationships between fatigue and psychological outcome, this study found that the most depressed participants reporting the highest levels of fatigue related disability.

6.1.1 Limitations of the Studies in this Thesis

While the findings of each of the studies in this thesis helped to identify influences of employment after TBI, each had a number of limitations that influence the generalisations that can be drawn from findings. Firstly, as identified in Section 3.3.1 of the systematic review, no grey searches of literature were undertaken. This could influence the overall result of the review as it has been argued studies that do not find statistically significant findings are less likely to be published.(268) Secondly, as identified in Section 4.10.7 of this thesis, a number of key stakeholder groups were not interviewed who would have informed results including employers, workmates, and family members. As each of these groups have been identified to have influence on employment outcome,(93-95) it would have been beneficial to have interviewed these groups during qualitative investigations to inform the findings of this thesis (as further discussed in areas of future research in this section). Lastly, as identified in the fatigue study, similar limitations where evident in the quantitative study of this thesis as to studies identified in the systematic review in that it was cross sectional, did not control for a number

of factors in the relationship between fatigue and employment outcome, and assumed that individuals had not chosen to be unemployment for personal reasons.

Despite the limitations identified, the findings of the studies in this thesis have a number of implications for the development and delivery of rehabilitation services for individuals with TBI. The following section discusses how the studies in this thesis may inform rehabilitation development and the importance of models of work disability in future research evaluating the influences of employment after TBI.

6.2 Applications of Work Disability as a Framework

As identified in Chapter 2 , biopsychosocial explanations of disability have been argued to be helpful when evaluating the influences of employment after injury.(78) When evaluating published literature that investigates work disability from a biopsychosocial framework, it can however be identified that the majority of work disability research has been conducted with chronic pain populations. When assessing this literature with respect to the findings here, it is evident that there are a number of practical applications from this work that could be applied to TBI research and intervention. In particular, the ICF (10) appears to have the potential to guide both vocational rehabilitation and research exploring the determinants of employment after TBI. This is important as a recent review of research evaluating the facilitators of or barriers to employment after injury (including TBI) argued that one of the difficulties facing work disability research is that it is rarely informed by theory.(86) Murphy and Foreman argued that the adoption of the ICF when evaluating the influences of employment following injury has a number of benefits: i) it highlights the multiple and interacting physical, personal, and environmental determinants of health outcomes and ii) it locates RTW issues in a broader conceptualisation of health and disability.(86)

As identified in Figure 7, Murphy and Foreman argued that the concept of work disability, in reference to the ICF, identifies a number of opportunities for intervention aimed at an individual's body functions and structures, factors in the individual's work and non work environment, and personal factors (including demographic and psychological factors). The opportunities for intervention described by Murphy and Foreman were supported in the qualitative study of this thesis by professionals involved in rehabilitation. These participants reported that they believed work disability to be the product of the interaction of pathology and impairments with environmental factors, and that work disability calls for an integrated holistic approach to rehabilitation. This process was reportedly evaluated using a worksite assessment to see how the individual was interacting with their environment to determine where work disability was occurring. The implications of a work disability framework based on the ICF for worksite assessments and delivery of intervention are discussed below.

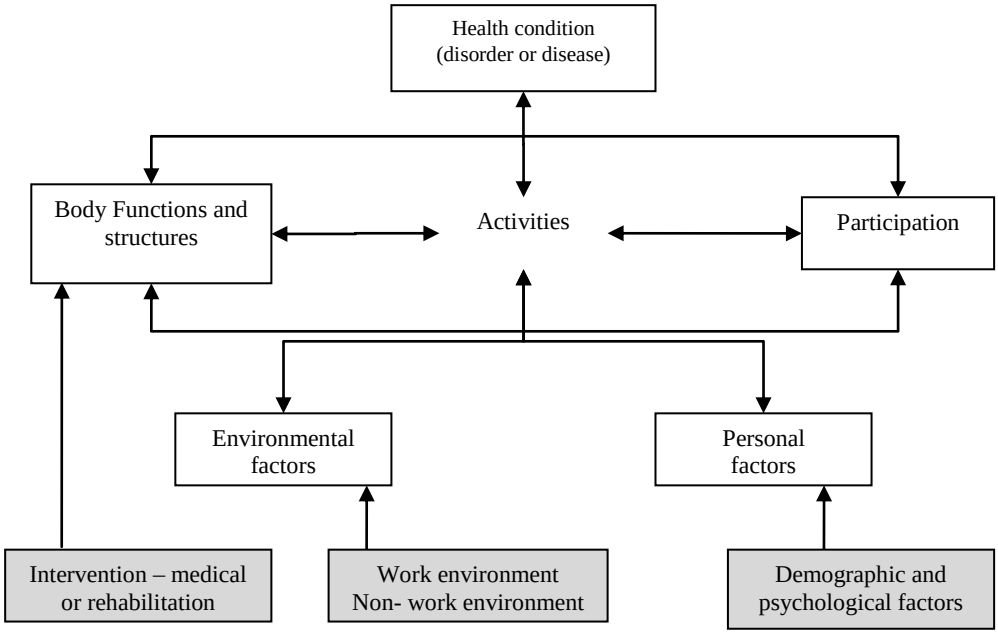


Figure 7: The International Classification of Functioning Model of Health and Disability (adapted to include possible return-to-work interventions). From: Murphy and Foreman, 2006 (86)

6.2.1 Implications of a Work Disability Framework for Worksite Assessments

During the qualitative study (Chapter 4), professionals groups involved in intervention reported a process of evaluating each of the potential influences on employment outcome when planning intervention. These evaluations were reported to identify where impairments could potentially influence work performance, where non work conditions could influence employment outcome, and where environmental conditions could be modified to enable work function. Similar to the influences of social participation identified in the ICF model, employment was therefore reported to be the product of the interaction of the individual with their work and non-work environment.

Worksite assessments were reported to be central to the assessment process to inform rehabilitation planning by all professional groups in the qualitative research. In evaluating the potential for worksite assessments to inform the vocational rehabilitation process, there are a number of elements that can be identified as adding to an evaluation based solely on factors identified in the systematic review. Firstly, having the individual attempting RTW *in* the workplace at the time of a worksite assessment was reported to be key. This certainly would appear to be advantageous when trying to predict an individual's work performance because a number of aspects of work performance rely on observing the individual in a dynamic setting that clearly can't be replicated in a clinical setting. For example, behavioural difficulties have been implicated as significant barriers to individuals returning to work after TBI by influencing their interactions with other people, but could only be observed while an individual is interacting with other people.(45) Furthermore, research evaluating what occupational therapists report as essential priorities while performing worksite assessments for individuals with TBI listed behavioural factors such as social performance adeptness, temperament control, social insight, intra-

personal skills, and coping with noise as the most important components to evaluate during assessment.(313) Each of these aspects arguably calls for the observation of the individual in their work environment if the 'real world' situation is to be reviewed. Worksite assessments can also be argued to hold advantage for informing intervention by highlighting areas where workplace modifications or alternative duties are possible (this not being addressed in any study included in the systematic review). As such, worksite assessments can inform areas where it is possible to address levels of work disability by providing supports or removing barriers to work performance. However, as identified in the areas of future research section of this discussion, one of the major factors limiting worksite assessments informing intervention is that there are currently no accepted guidelines as to what they should involve or how they should be performed.

A longitudinal view of employment following TBI is also arguably necessary when planning interventions as many of the influences of employment identified in Figure 7 may change over time. For example, at any stage during which an individual is employed, work demands of the job may change. As was noted in the qualitative research of this thesis, one individual with TBI who had successfully returned to work following TBI experienced work disability many years later when moved to a call centre due to his concentration and attention impairments (see Section 4.6.3). As such, job changes may not always be dramatic, but small shifts in demand may expose a new difficulty or work disability. Therefore, rather than solely predicting work performance, worksite assessments should identify the possibility for the work role to change and the individuals anticipated ability to adapt to those changes. Additionally, Vocational Rehabilitation Practitioner participants in the qualitative study suggested that a cross sectional evaluation of an individual's work performance did not give accurate details as to an individual's ongoing work performance. As ongoing work performance is argued to be contingent on maintaining adequate levels of work duties, psychosocial integration, meeting goals, and demonstrating potential for advancement,(267) a one-off evaluation of work performance is unlikely to give accurate information as to how the individual will function over time. The limitations of one-off assessment were acknowledged in a recent study evaluating the worksite assessment practices of functional assessment assessors as to their practices during evaluation.(310) This study found that participants considered a number of strategies could be used to increase the rigor of assessments including; performing assessments over two or more days to allow for the comparison of information, repeated assessment using multiple methods, and viewing findings as optimal performance, and adjusting conclusions accordingly. As such, multiple observations may be necessary to identify which aspects of their environment contribute to levels of work disability and where intervention can facilitate positive employment outcomes.

6.2.2 Implications of a Work Disability Framework for Intervention

As identified in Figure 7, intervention across a number of different domains in the individual's life may be necessary to help enable positive employment outcomes after TBI. As Murphy and Foreman suggested, rather than just focusing on the individual or how well they are able to perform their work roles, intervention may also need to focus on other non-work environmental influences in the

individual's life.(86) This notion was supported in interviews with professional groups involved in intervention who reported a process of contextualisation of work performance in which the potential for environmental factors to either act as facilitators of or barriers to the individual's employment were evaluated. In doing so, participants gave evidence to suggest that they were not only evaluating the potential for impairments to influence work performance, but also evaluating factors in the individual's non work life that could influence their employment outcome. Participants also suggested that interventions needed to incorporate a number of stakeholders, who have been identified elsewhere as influencing employment outcome after TBI,(93-95) including the individual with TBI, their family, their employer, and other healthcare providers if intervention were to be successful. As findings from the qualitative study described, these elements all potentially warrant consideration as they may have significant impact on employment outcome irrespective of the individual with TBI. For example, family responsibilities may mean that childcare needs to be organised for the individual if they are to RTW or reduced work conditions need to be negotiated with employers if they are to run commercially viable businesses.

The qualitative findings of this thesis also highlighted the importance that Other Professional Stakeholders placed on understanding the individual's 'motivations' during intervention. These perspectives align perhaps in part with Noerdsfelt's critique of the ICF, arguing that the ICF does not give enough attention to the concept of free will.(365) Noerdsfelt argued that rather than individuals just being *capable* of performing work actions, they must also *want* to perform those actions. This theme emerged in the findings of the qualitative research, as Other Professional Stakeholders argued that they believed it was essential to make sure that interventions worked with individual's motivations if they were to be successful.

As also suggested in the qualitative research here, the intervention process was reported as needing to engage the individual's employer to understand how changes in the work role will influence their needs and motivations. This employer involvement has been found to support positive employment outcomes after injury in a recent review of RTW interventions for chronic pain, indicating that there was strong evidence that contact between health care providers and employers, and work accommodations significantly reduced levels of work disability.(366)

One of the benefits of using the framework of work disability to guide intervention to enable individuals to engage in employment after TBI is that disability is suggested to occur over three stages; acute, subacute, and chronic.(367) Each of these phases is argued to need different intervention approaches due to different physical and psychosocial risk factors and response patterns. For example, evidence from chronic pain populations indicates that individuals who move from acute to chronic phases of disability experience decreased self-efficacy about RTW, negative affect and increased habituation to being work disabled.(266) Because recovery times following moderate and severe TBI can be as long as two or more years,(41) and enduring functional deficit persists for many individuals, the chances of an individual developing chronic disability following TBI are substantial. The notion that work disability develops over time received support from the qualitative study which found that many of the

participants with TBI believed they were unlikely to engage in work again and gave examples where they had actively avoided work opportunities because of their impairments, especially fatigue. Interventions to foster positive employment outcomes may therefore need to take different approaches with regard to the importance placed on the different elements of intervention described in Figure 7 depending on the timeframe after injury.

6.3 Important Lessons Learnt Throughout Conduct of Research

Throughout the undertaking of each of the studies in this thesis, a number of lessons were learned by the researcher that will improve the quality of future research. In particular, three key lessons were learned: the importance of planning in research; the need for collaboration in research (especially during mixed methodology research); and the difficulty in researching social outcomes.

Each of the studies in this thesis was informed by a number of research methodologies. However, whilst undertaking each of the studies, much was learned about the true complexity of each research methodology. In some instances, this lead to double handling of data being necessary as either data entry or analysis had to be conducted on multiple occasions to ensure that rigorous principles were adhered to. The researcher learned the importance of ensuring that every aspect of the undertaking of research was thoroughly evaluated before any data is collected throughout this process.

As part of learning the complexity of each research methodology, the researcher also learnt the importance of collaboration during the research process. Because this thesis utilised both quantitative and qualitative research methodologies, research methods from different epistemological views have been used. During the conduct of research, this called for both approaching research problems in different ways and having to adapt to different philosophical standpoints in the ways in which knowledge is derived. This process was facilitated by a number of research experts who, on a number of occasions, constructively challenged the way in which data had been analysed and conclusions had been drawn. These mentors and advisors have been essential in ensuring that research followed accepted protocols and that a true appreciation of how different methodologies should inform how research is done was achieved by the researcher. Additionally, as identified throughout the thesis, employment outcomes after TBI are best understood as the product of the interaction between a number of different groups including the individual with TBI, their families, their employers/workmates, funders of services, and the professionals involved in intervention. Because each of these parties have different motivations and needs with respect to RTW after TBI, it is essential that each standpoint is taken into consideration. While this research endeavoured to collaborate with as many of these groups as possible, it is evident that future research in this area will need to work closely with a number of different stakeholder groups to ensure the validity of findings.

Throughout the research in this thesis, the difficulty in investigating social outcomes became apparent. Investigating what influences employment requires understanding factors that enable work performance, what motivates people to perform in their job, but also the influence of environmental

factors on an individual's ability to perform in such roles. As opposed to confined laboratory experiments in 'pure scientific' research, undertaking social research requires the ability to appreciate the complexity of both the relationships between an individual and their workplace as well as the larger social environment in which they exist. Additionally, these elements can all potentially interact with one another and change over time. Now that these elements are clear to the researcher, the premise of trying to develop a predictive equation, as was the intention at the outset of the work, seems as a very ambitious undertaking. If such complexity had been understood from the beginning, the research would have focused attention on one aspect of the influences, and not tried to answer all aspects of the question simultaneously. As such, the researcher has learned the importance of refining research questions to the point where they are achievable, but still contribute to what is known from previous research.

6.4 Areas for Future Research

Although the findings of studies in this thesis have added to what was known about the influences of employment after TBI and how they may be applied to intervention, there are a number of key areas for future research identified throughout undertaking each study. Research questions outstanding and/or highlighted in the findings of the studies of particular interest include:

1. What should worksite assessments to inform vocational rehabilitation involve?
2. How do the motivations of individuals with TBI influence their engagement in intervention and consequent employment outcome?
3. What factors influence employers' engagement in intervention?
4. How do the influences of employment after TBI change over time?
5. What aspects of vocational rehabilitation influence an individual's employment outcome?
6. What factors influence fatigue after TBI?
7. What intervention strategies influence reported fatigue following TBI?
8. How should employment be measured in studies evaluating employment outcome following TBI?

The rationale and importance of each of these questions is discussed in more detail below.

6.4.1 What Should Worksite Assessments to inform Vocational Rehabilitation Involve?

As identified in the qualitative phase of research, worksite assessments have the potential to inform vocational interventions for individuals with TBI. However, it was also noted that there are currently no accepted guidelines for how worksite assessments should be conducted, who should perform them, or even what they should involve. Guidelines for worksite assessment practices would therefore appear key to ensuring that vocational interventions are informed from evidence based principles. In comparison to the lack of guidelines for worksite assessments, a number of methods have been proposed as measuring workability.(368-375) Workability is defined as an individual's capacities to meet work demands,(376) similar to what stakeholders delivering interventions in this study identified as important. However, current measures to assess workability have not been designed specifically to

inform rehabilitation and have mostly been developed in the field of chronic pain.(376) Additionally, as opposed to the process described by the professionals interviewed in the qualitative study of this thesis, instructions for the workability assessments reviewed did not necessarily require observing the individual as they engage in their workplace. As such, most measures of workability have been identified as placing too much emphasis on the physical components of function, and not enough on the individual's cognitive or behavioural function.(376) In comparison, suggested worksite assessment practices could be developed with the intended purpose of informing vocational interventions, assessing actual functioning across a number of different domains (such as cognitive, physical, behavioural), and pre-empting where environmental barriers and supports could influence employment outcome.

Developing guidelines for worksite assessments also has the potential to inform research evaluating workplace influences of employment after TBI. It is anticipated that observations of individuals who attempt to RTW during worksite assessment would help elucidate the dynamics between the individual and their workplace to identify triggers of potential difficulty in the RTW process. For example, while the qualitative research of this thesis identified that participants believed there were a number of factors within the workplace that consistently made RTW difficult, such as distracting stimuli, these have not been adequately researched to identify which specific elements of the workplace contribute to difficulties in work performance after TBI. By identifying these triggers and factors, it may be possible to develop strategies to accommodate or develop compensatory techniques to reduce levels of work disability experienced after TBI.

6.4.2 How do the Motivations of Individuals with TBI Influence their Engagement in Intervention and Consequent Employment Outcome?

In addition to workplace factors, research is also needed to determine how expectations and motivations of an individual with TBI influence their employment outcomes. By evaluating these factors, it may be possible to identify how intervention can be developed to best meet individual's needs and motivations. This is currently an area under researched in determining the influences of employment after TBI. For example, a recent review of the influence of expectations and injury perceptions on employment outcome following injury found that there is a paucity of literature in this area and that no studies of acceptable methodological rigour had been done for TBI populations.(377) Once the identification of which aspects of an individual with TBIs needs and aspirations have been identified, structured interviews can be developed to evaluate individual's vocational motivations to inform rehabilitation development. Understanding of the motivations and vocational needs of individuals with TBI may also be argued to be important elements in identifying long term sustainability of function and satisfaction with outcome. As such, a method to systematically evaluate what the individual wants and aligning these, where possible, with characteristics in the workplace could also arguably need to be integrated into the assessment of work performance.

6.4.3 What Factors Influence Employers' Engagement in Intervention?

To enable work modifications within the workplace, it is necessary to first understand what factors guide the decision making process of employers around allowing individuals to RTW. Employer

engagement in rehabilitation requires the employer to be supportive of modifications or reduced work responsibilities, therefore, it is important to establish which factors influence employers engaging in the process. In addition, research into how others in the workplace perceive individuals with injury could be supported and what their drivers are could also help to identify what factors enable individuals to function in their jobs after injury.

6.4.4 How do the Influences of Employment after TBI Change over Time?

Research evaluating employment outcome after TBI can be criticised for conceptualising RTW as being an all or nothing process, where individuals either RTW or not. In comparison, Young et al argue that the RTW process following injury occurs over four stages; off work, re-entry, maintenance, and advancement.(267) There is therefore a need to research what factors contribute to an individual's progression through each of these stages of RTW. By doing so, it may be possible to identify critical periods during RTW attempts where intervention is necessary. Another related issue to advancement through these stages can also be argued to be, what factors enable sustainability of employment after TBI? For example, during interviews with TBI participants, Bill indicated that he had managed to RTW after injury, but that he had changed jobs frequently before he believed his employers would ask him to leave due to what he reported as inadequate work performance. In this instance, cross sectional evaluations would have indicated a positive outcome, as he had returned to work. Future research is needed to see which elements influence the ability for individuals to stay in the workplace after injury.

Sustainability of employment outcome after TBI may also be argued to be dependent on the level of which other areas of the individual's life are also influenced. For example, a recent qualitative investigation of the perceptions of individuals with TBI as to the success of their vocational outcome following their injury found that a number of participants reported that they had returned to work after their injury in a full time capacity for a period of time (ranging from six months to several years), but that this had led to personal catastrophe in other areas of their life.(272) In these instances, a cross sectional evaluation of employment outcome would have indicated a positive outcome, however, these findings suggest that this outcome was not sustainable and had lead to significant reductions in reported levels of quality of life. Further research is therefore necessary regarding how RTW after TBI affects other aspects of the individual with TBIs life to identify where sustainable outcomes are possible.

6.4.5 What aspects of Vocational Rehabilitation Influence an Individual's Employment Outcome?

Although vocational rehabilitation has been identified as one of the influences of employment outcome both within this thesis and by other researchers, (93, 96) there is still much remaining unknown regarding which aspects of intervention influence employment outcome. In a recent review of vocational interventions after TBI, participants who received intervention were found to RTW faster than individuals not receiving intervention and have only slightly higher employment rates at follow up.(378) In a more recent review, Fadyl and McPherson argue that the identification of which elements of intervention influence employment outcome will be obscured if different types of intervention are considered together.(316) This review evaluated studies investigating program-based vocational

rehabilitation,(133) supported employment,(179) and Vocational Case Co-ordination models of vocational rehabilitation (379) for evidence of effectiveness in producing higher employment outcomes than controls. This review found that there was little support for supported employment and program-based vocational rehabilitation interventions in improving employment outcome, but that the case-coordination model showed the strongest evidence for improved employment outcomes. What is of note, is that a key feature of the Vocational Case Coordination model of rehabilitation is 'monitoring' of overall intervention by a case-coordinator over all periods of intervention from acute to community. Further, social aspects are integrated early in the intervention process, such as engaging employers. Both of these factors were supported by evidence from the qualitative study of this thesis in that professional involved in rehabilitation suggested that early intervention and coordination of services helped to lead to successful employment outcomes. However, just which aspects of intervention are crucial for successful employment and, how different sub populations of TBI (mild versus severe, employed pre-injury unemployed pre-injury) should be addressed during intervention, remains unknown. There is therefore a need to identify which aspects of intervention lead to better employment outcomes and where different intervention strategies are necessary for different TBI sub populations if improved employment outcomes are to be achieved.

6.4.6 What Factors Influence Fatigue after TBI?

Although fatigue was consistently identified as an influence on employment following TBI in the studies of this thesis, there remain a number of outstanding questions with regards to fatigue and employment outcome following TBI. The most prominent of these being, what causes fatigue after TBI? As identified in the fatigue study of this thesis, depression was highly associated with fatigue. Whether depression acts as a source of fatigue or an exacerbating feature of fatigue remains unanswered by research. Additionally, there is currently uncertainty as to which neurological mechanisms are involved with fatigue. For example, recent research using functional magnetic resonance imaging has found that individuals with TBI who experienced cognitive fatigue while performing cognitive task had significantly decreased activity in several regions including the middle frontal gyrus, superior parietal cortex, basal ganglia and anterior cingulate than healthy control.(380) While these findings are promising in relation to establishing the mechanism of fatigue, the inferences that can be drawn from these findings are limited due to the small sample size of this study (n=11 TBI participants and n=11 healthy controls).

It will also be necessary to develop evidence based measures if the determinants of fatigue following TBI are to be rigorously investigated. For example, the MFIS used in this thesis was developed for the evaluation of fatigue in multiple sclerosis population with evidence of validation for TBI samples.(335) However, it cannot be assumed that the experience of fatigue for individuals with multiple sclerosis is tantamount to the experience of individuals with TBI. It is therefore necessary that further qualitative investigations be undertaken to evaluate how fatigue and consequent disability is experienced by TBI populations to assess where assessment tools can be developed to capture the functional influences of fatigue following TBI.

6.4.7 What Intervention Strategies Influence Reported Fatigue Following TBI

Lastly, suggested strategies to intervene with fatigue in the qualitative research of this thesis involved removing the individual from a work setting. However, there is currently scant literature evaluating which intervention strategies best influence levels of fatigue following TBI. One study evaluating the ability of modafinil, a wakefulness promoting drug, to reduce levels of daytime sleepiness in individuals with TBI did not find it to be effective in reducing levels of fatigue.(381) There has however been evidence from chronic fatigue syndrome research that cognitive behavioural therapy can have long lasting effect on reducing levels of fatigue. In a Cochrane review, cognitive behavioural therapy was concluded to be effective at reducing the symptoms of fatigue in comparison to usual forms of care, for individuals with chronic fatigue syndrome.(382) Again, while such results are promising, they have not been evaluated in TBI populations.

6.4.8 How Should Employment be Measured in Studies Evaluating Employment Outcome Following TBI?

As identified in the systematic review of this thesis, there is currently a lack of consensus as to how employment should be measured in research evaluating social outcomes following TBI. While a dichotomous outcome of employed or unemployed is often used, Ownsworth and McKenna (112) argue that there is also a need to investigate the time spent at work, number of jobs held, job stability, and quality of performance as employment outcomes after TBI. Additionally, as Franche, Frank, and Krause identify, employment after injury can also include level of income, and consequent occupational identity.(266)

Although it is argued that tools used to measure employment following TBI need to expand beyond a dichotomous outcome, it is also acknowledged that the different conceptualisations of employment following TBI may be equally as valid depending on the research question, Therefore, it cannot be assumed that one measure of employment will be appropriate for all studies. Alternatively, it is identified that future research is need to answer the questions identified by Ownsworth and McKenna (112) and Franche, Frank, and Krause (266) with regards to how employment is measured if studies are to more accurately determine the influences of employment following TBI.

6.5 Conclusion

The purpose of the research in this thesis was to determine whether employment after TBI can be predicted. Whilst the research undertaken has found evidence to support associations between a number of influences and employment after TBI, a predictive equation of employment based on existing research remains problematic. As the qualitative research of this thesis suggested, the difficulty in predicting employment is likely to be in part be attributable to employment outcome being the product of the individuals dynamic interaction with their work and social environment, the individual's functioning after TBI, the supports available to the individual, the individual's motivations, workplace factors, and vocational interventions (see Figure 6) rather than being a direct consequence of impairments alone. Predicting employment outcome after TBI may therefore continue to be difficult,

in that many of the proposed influences cannot be known at the time of injury or can potentially change over time.

Findings of this thesis support a recent review of the facilitators of and barriers to RTW after injury (including chronic pain and spinal cord injury) that:

> Work disability and return to work are multi-determined outcomes that cannot be accurately predicted just from knowledge of the medical or physical dimensions of the injury or condition… Characteristics of the injured worker, components of particular medical and occupational rehabilitation interventions, physical and psychosocial job characteristics, workplace factors, the insurance or worker's compensation scheme, and broader societal factors such as labour market conditions and the prevailing legal framework have all been shown to have some role to play in influencing return-to-work outcomes independently of the underlying condition (p.4).(86)

Each study in the current thesis has added weight to arguments that going beyond a focus on impairment is key to enhancing opportunities for vocational re-engagement for people after TBI. The latter two studies have contributed novel findings about the nature of, and relationship between, impairments associated with TBI, their disabling consequences, and the impact on work. A greater focus on a biopsychosocial model of work disability in TBI is argued to be necessary in informing future research evaluating the influences of employment after TBI and to inform the development of vocational rehabilitation interventions for individuals with TBI. By doing so, it is argued that a holistic understanding of the complexities of the factors influencing employment following TBI can be further explored and therefore better understood and responded to.

7 Appendices

Appendix 1: Data Extraction of Studies Involved in the Systematic Review

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Bogner (194) (8/9)	N= 351 22% Mild 13% Moderate 65% Severe	CIQ Productivity 1 year post discharge	Gender, age, race, education, pre-injury productivity, marital status, substance abuse history	GCS, cause	FIM (at discharge from rehabilitation), LOS		(1) Logistic regression (2) 15.9% (3) Age, pre-injury employment, FIM, substance abuse history
Greenspan (109) (8/9)	N= 343 Mild-Severe	Return to work or failure to return to work 1 year post discharge	Age, race, gender, education, history of chronic disease	AIS, cause, ISS		FIM (at one year), marital status	(1) Logistic regression (2) - (3) FIM at one year, Education, marital status.
Harrison-Felix (195) (8/9)	N = 803 Mild-Severe	CIQ Productivity 1 year post injury	Age, gender, marital status, race, education, productive activity	Cause (violent/ non violent), GCS, LOC, FIM, blood alcohol level		Acute payor, rehabilitation payor, alcohol use	(1) Multiple regression analysis (2) 23% (3) Pre-injury productivity

AIS= Abbreviated Injury Scale, CIQ= Community Integration Questionnaire, CT scan= Computerised Tomography scan, DRS= Disability Rating Scale, FAM= Functional Assessment Measure, FIM= Functional Independence Measure, GCS= Glasgow Coma Scale, GHQ=General Health Questionnaire, ISS= Injury Severity Score, LOC= Length Of Coma, LCFS= Levels of cognitive functioning scale, LOS= Length of Stay, PECS= Patient Evaluation Conference System, PTA= Post Traumatic Amnesia, RLAS = Rancho Los Amigo Scale, WAIS-R = Wechsler Adult Intelligence Scale Revised, WMS = Wechsler Memory Scale

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Kreutzer (5) (9/9)	N= 186 17% Mild 22% Moderate 61% Severe	Competitive employment or sheltered employment/ supported employment, unemployment, student, retired, homemaker, volunteer at 1, 2, 3 and 4 years post injury	Age, gender, marital status, race, education	LOC, cause, GCS	LOS	DRS (at one year), FIM(at one year), employment at 1, 2 ,3 years post injury, driving own vehicle	(1) Discriminant function analysis (2) 70.2% correctly classified (3) DRS (1 year), LOC, age
Ponsford (7) (8/9)	N= 74 8% Mild 3% Moderate 89% Severe	Full time/ part time employed or unemployed 2 years after injury	Age, gender, education, skill in pre-injury job:	GCS, PTA, fractured limbs	LOS, DRS (on admission to rehabilitation)	Chronicity	(1) Discriminant function analysis (2) 74% correctly classified (3) DRS, GCS, age

AIS= Abbreviated Injury Scale, CIQ= Community Integration Questionnaire, CT scan= Computerised Tomography scan, DRS= Disability Rating Scale, FAM= Functional Assessment Measure, FIM= Functional Independence Measure, GCS= Glasgow Coma Scale, GHQ=General Health Questionnaire, ISS= Injury Severity Score, LOC= Length Of Coma, LCFS= Levels of cognitive functioning scale, LOS= Length of Stay, PECS= Patient Evaluation Conference System, PTA= Post Traumatic Amnesia, RLAS = Rancho Los Amigo Scale, WAIS-R = Wechsler Adult Intelligence Scale Revised, WMS = Wechsler Memory Scale

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Sherer (196) (9/9)	N= 1083 20% Mild 16% Moderate 63% Severe	Employed full/ part time, at least part time student, full time home maker or non productive at 1 year after injury	Race, education, productivity, gender, marital status, age	Cause, GCS, PTA	LOS, DRS (upon admission and discharge from rehabilitation), FIM (upon admission and discharge from rehabilitation)		(1) Logistic regression (2) 41% (3) Pre-injury productivity, race/age, education, FIM, LOS
Vanderploeg, (197) (9/9)	N= 626 Mild	Employment (working full time or not working full time) 8 years on average post injury	Age, education, race, General Technical Test, medical problems, psychiatric history	LOC, cause		Geographical region	(1) Logistic regression analysis (2) 23.1% (3) Pre-injury intelligence, race/ current region/ LOC interaction, psychiatric history

AIS= Abbreviated Injury Scale, CIQ= Community Integration Questionnaire, CT scan= Computerised Tomography scan, DRS= Disability Rating Scale, FAM= Functional Assessment Measure, FIM= Functional Independence Measure, GCS= Glasgow Coma Scale, GHQ=General Health Questionnaire, ISS= Injury Severity Score, LOC= Length Of Coma, LCFS= Levels of cognitive functioning scale, LOS= Length of Stay, PECS= Patient Evaluation Conference System, PTA= Post Traumatic Amnesia, RLAS = Rancho Los Amigo Scale, WAIS-R = Wechsler Adult Intelligence Scale Revised, WMS = Wechsler Memory Scale

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Dawson, (198) (7/9)	N = 68 at 1 year 56% Mild 21% Moderate 23% Severe N = 47 at 4 years 51% Mild 17% Moderate 32% Severe	Return to paid employment and/ or school or did not return to paid employment or school at 1 and 4 years	Age, gender, pre-injury work stability, education	GCS, LOC, ISS, PTA	LOS		(1) Hierarchical regression analysis (2) 1 year = 22% 4 years = 34% (3) 1 year = demographic variables and injury-severity variables 4 years = GCS, LOC, PTA
Dikmen (4) (7/9)	N = 366 60% Mild 15% Moderate 25% Severe	Return to work or failure to return to work at 1, 6, 12 and 24 months	Age, education, gender, race, marital status, job stability, earnings, pre-existing condition	GCS, AIS, ISS		Halstead Impairment Index, Name Writing Dominant and Non dominant hand (1 month	(1) Regression models (2) - (3) Age, Education, Job stability, GCS

AIS= Abbreviated Injury Scale, CIQ= Community Integration Questionnaire, CT scan= Computerised Tomography scan, DRS= Disability Rating Scale, FAM= Functional Assessment Measure, FIM= Functional Independence Measure, GCS= Glasgow Coma Scale, GHQ=General Health Questionnaire, ISS= Injury Severity Score, LOC= Length Of Coma, LCFS= Levels of cognitive functioning scale, LOS= Length of Stay, PECS= Patient Evaluation Conference System, PTA= Post Traumatic Amnesia, RLAS = Rancho Los Amigo Scale, WAIS-R = Wechsler Adult Intelligence Scale Revised, WMS = Wechsler Memory Scale

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Felmingham, (199) (6/9)	N = 55 12 % Mild 28% Moderate 60% Severe	CIQ Productivity 2 years post rehab	Age, employment	GCS		CIQ, employment at 6 months, GHQ (psychological distress), FAM cognitive (6 months)	(1) Logistic regression (2) 26.2% (3) Age, pre injury employment. employment at 6 months, General Health Questionnaire
Fleming, (200) (7/9)	N = 209 Mild-Severe	CIQ Productivity 2-5 years post rehab (averageof 3.5 years post injury)	Age, gender, education, occupation	DRS, GCS, PTA, neurosurgery	Barry Rehabilitation Inpatient Screening of Cognition score, Rivermead Behavioural Memory Test, Modified Barthel Index, DRS, Lafayette Grooved pegboard (during acute rehabilitation) LOS	CIQ (at follow up)	(1) Logistic regression (2) 27% (3) Age, PTA, modified Barthel Index, pre-morbid occupation

AIS= Abbreviated Injury Scale, CIQ= Community Integration Questionnaire, CT scan= Computerised Tomography scan, DRS= Disability Rating Scale, FAM= Functional Assessment Measure, FIM= Functional Independence Measure, GCS= Glasgow Coma Scale, GHQ=General Health Questionnaire, ISS= Injury Severity Score, LOC= Length Of Coma, LCFS= Levels of cognitive functioning scale, LOS= Length of Stay, PECS= Patient Evaluation Conference System, PTA= Post Traumatic Amnesia, RLAS = Rancho Los Amigo Scale, WAIS-R = Wechsler Adult Intelligence Scale Revised, WMS = Wechsler Memory Scale

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Gurka, (202) (6/9)	N= 79 20% Mild 19% Moderate 61% Severe	Employed or unemployed 6 and 24 months post discharge				FAM, FIM at follow up	(1) Logistic regression (2) 5% at six months 18% at 24 months (3) FAM cognitive
Keyser-Marcus, (203) (6/9)	N= 451 at 1y N= 252 at 2yr N= 187 at 3yr N= 136 at 4yr N= 120 at 5yr Mild-Severe	Employed or unemployed 1 to 5 years post injury	Employment, productivity, age, education	GCS	DRS (at discharge), FIM (at discharge), LOS		(1) Logistic regression (2) - (3) 1yr = Pre-injury productivity, age, education, LOS 2yrs = Pre-injury productivity, age 3yrs = Pre-injury productivity, age, FIM 4yrs = Age 5yrs = Pre-injury productivity, DRS
Rao, (105) (6/9)	N= 57 Severe (PTA of at least 24 hours)	Return to work/ school or failure to return to work/ school up to 26 months post injury			LCFS, DRS, PECS (during rehabilitation)		(1) Logistic regression (2) 73-84% correctly identified (3) PECS, LCFS, DRS

AIS= Abbreviated Injury Scale, CIQ= Community Integration Questionnaire, CT scan= Computerised Tomography scan, DRS= Disability Rating Scale, FAM= Functional Assessment Measure, FIM= Functional Independence Measure, GCS= Glasgow Coma Scale, GHQ=General Health Questionnaire, ISS= Injury Severity Score, LOC= Length Of Coma, LCFS= Levels of cognitive functioning scale, LOS= Length of Stay, PECS= Patient Evaluation Conference System, PTA= Post Traumatic Amnesia, RLAS = Rancho Los Amigo Scale, WAIS-R = Wechsler Adult Intelligence Scale Revised, WMS = Wechsler Memory Scale

Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Rosenthal, (204) (6/9)	N= 586 Mild-Severe	CIQ Productivity 1 year post injury	Race, age, education, gender	GCS, PTA, cause	FIM (rehabilitation admission and discharge), DRS (discharge), RLAS (discharge)	Marital status, income, alcohol use, drug abuse, living with others	(1) Multiple regression (2) 25% (3) Discharge DRS/ family income, age, cause of injury, race, alcohol abuse at follow up
Ruff, (205) (7/9)	N = 93 (53 used in regression analysis) Severe	Return to work/ school or not returned to work/ school at 6-12 months post injury	Age	LOC		WMS, Finger-tapping Test, WAIS-R, Selective Attention Speed, Katz Adjustment Scale (one year after injury)	(1) Regression analysis (2) 88% returned to work identified, 53% of those not returning to work (3) Verbal intelligence, age, attention

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Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Sherer, (206) (7/9)	N= 388 22% Mild 20% Moderate 58% Severe	Competitively employed/ student/ homemaker or non productive at 12 months post injury	Age, education, pre-injury productivity	GCS, PTA	Token test, Controlled Oral Word Association Test, Visual Form Discrimination Test, Block Design Test, Grooved Pegboard Test, Logical Memory Test, Auditory Verbal Learning Test, Digit Span Test, Trail Making Test, Symbol Digit Modalities Test, Wisconsin Card Sorting Test (during rehabilitation stay)		(1) Logistic regression (2) - (3) Pre-injury productivity, education, neuropsychological battery, PTA
Stemmer, (207) (6/9)	N= 35 (severity not stated)	Employed or unemployed 18 months post injury	Age, gender, education	Site of lesion	FIM, neuropsychological battery (11 items extrapolated from 50 standardised neuropsychological tests), social abilities (at time of admission)		(1) Linear regression (2) 32% (3) Drive, attention, processing speed, brain stem lesion, age

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Table 64: Data Extraction of Studies Identified as Methodologically Commendable or Acceptable (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings (1) Statistical analysis (2) % variance explained (3) Best predictors
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	
van der Naalt, (61) (7/9)	N= 67 64% Mild 36% Moderate	Previous work/ study resumed, previous work/ study with reduced responsibilities, previous work/ study 1,3, 6, and 12 months post injury	Age, education, gender	PTA, GCS		Physical head-injury symptoms (at 3 months)	(1) Multiple regression analysis (2) 42% (3) PTA, physical complaints
Wagner, (108) (6/9)	N= 105 63% Moderate-severe 32% Severe	Return to pre-injury comparable work, fulltime school, homemaking or not at 1 year after injury	Gender, age, race, prior brain injury, psychiatric history, alcohol/ drug use history, education, income, insurer	Injury cause, GCS, CT scan, AIS, Trauma score, Combined Trauma Score, ISS		Discharged to somewhere other than home	(1) Logistic regression (2) - (3) Discharge destination, prior psychiatric diagnosis.

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Appendix 2: Data Extraction of Studies Identified as Methodologically Marginal

Table 65: Data Extraction of Studies Identified as Methodologically Marginal

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings (1) Statistical analysis (2) % variance explained (3) Best predictors
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	
Boake (208) (5/9)	N= 293 19.2% Mild 18.8% Moderate 60% Severe 2% unknown	Competitively employed/ full time student or not at 1, 2, 3 and 4 years post injury			Multilingual Aphasia Examination, WAIS-R, WMS, Halsten-Reitan battery, Rey Auditory Verbal Learning Test, Trail Making B Test (on emergence from PTA)		(1) Relative risk ratio (2) - (3) -
Chamelian (209) (4/9)	N= 157 Mild to Moderate	Returned to employment or failure to return to work at 6 months after injury	Education, occupation, prior head injury, psychiatric history, alcohol/ substance abuse	GCS, AIS		Psychotropic/ analgesia use, General Health Questionnaire (at 6 months)	(1) Logistic regression (2) - (3) Dizziness, Total GHQ, Psychotropic/ analgesia use.

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Cifu, (210) (4/9)	N= 132 Mild- Severe	Competitively employed or not competitively employed at 1 year post discharge	Age, education, marital status, ethnicity	GCS, PTA (GOAT), intracranial haematomas	FIM, DRS, RLAS, Neurobehavioural Rating Scale (at admission and discharge from rehabilitation) Grooved pegboard, Trailmaking A and B, WMS (at emergence from PTA), LOS		(1) T-tests (2) - (3) -

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Ezrachi, (211) (4/9)	N= 59 Moderate-Severe	Unemployed, sheltered workshop or open job market at 6 months post rehab	Age, education, pre-injury adjustment	LOC	Orientation Remedial Module, Purdue Pegboard, Figure Recognition,. Letter Cancellation-Double Stimuli, Rusk Institute of Rehabilitation Medicine, Spatial relations, RIRM Navigation, Metropolitan Achievement Test, Wide Range Achievement Test, WAIS, RIRM, Behavioural Competence Index (2 weeks before program, 2 weeks post program).	Family support, time from injury to programme, self esteem, self appraisal, interpersonal empathy, social cooperation, acceptance of programme	(1) Multiple regression analysis (2) 61% (3) Acceptance of program, verbal aptitude, involvement with others, LOC, dexterity

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Fabiano (212)	N= 94 Severe	Full time part time of unemployed at 6 years post injury	Education, gender, age, pre-injury occupation:	LOC		WAIS-R (timeframe not stated)	(1) Discriminant function analysis (2) 78% of employed correctly predicted 79% of non competitively employed or employed part time. (3) WAIS-R scales
Fraser, (107) (5/9)	N= 102 60% Mild 12 % Moderate 30% Severe	Return to work or no return to work 12 months post injury	Age, education, gender	GCS	Halstead-Reitan Neuropsychological Test Battery, time to follow commands, Sickness Impact Profile, Head Injury Symptom Checklist (1 month post injury)	Halstead-Reitan Neuropsychological Test Battery, time to follow commands, Sickness Impact Profile, Head Injury Symptom Checklist (12 months post injury), litigation, compensation (12 months post injury)	(1) T-tests (2) - (3) -

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Godfrey, (213) (4/9)	N= 66 Severe	Return to work or not returned to work either six months, one year, or 2-3 years after injury	Age, education, socioeconomic status	PTA, GCS		Raven progressive matrices, Rey auditory verbal learning test, Paced serial addition task, neuropsychosocial impairment test, Memory impairment scale, Head injury behaviour scale, Social Skill Assessment (at follow up)	(1) Multiple regression analysis (2) - (3) Neuropsychological impairment
Gollaher, (214) (4/9)	N= 99 13% Mild 4% Moderate 83% Severe	Employed or unemployed at 1 and 3 years post injury	Gender, age, education, pre-injury productivity	GCS,	DRS (at admission and discharge from rehabilitation)		(1) Multiple regression analysis (2) 26% (3) Education, pre injury productivity and DRS

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Goran, (215) (5/9)	N= 94 Severe	Full time employment/ successful college enrolment or Part time/ supported employment/ unemployment 1 year post injury	Age, education	LOC		WAIS-R, IAP (post injury, timeframe not given) Chronicity	(1) Discriminant function analysis (2) 83% correctly identified as working or college 73% correctly identified as part time or non employed (3) Abstract reasoning, social comprehension, remote memory, Full scale IQ.
Goranson (216) (5/9)	N= 42 67% Mild 33% Moderate	CIQ productivity 13.5 months following injury	Age, gender, education	PTA	Participation in rehabilitation	Early productivity	(1) Stepwise regression (2) 22.6% (3) Early productivity, age

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Hanlon, (217) (5/9)	N = 100 Mild	Return to pre-morbid occupation in previous capacity, return to pre-morbid occupation in different capacity or return to some other occupation or failure to return to gainful employment at 1 year post injury	Age:	Cause, type of TBI, LOC, CT scan		Trail making Teat-A, Digit Span, Logical Memory, Visual Reproduction, WMS, California Leaning Test, Boston Naming Test, Controlled Oral Word Association Test, Judgement of Line Orientation Test, Wisconsin Card Sorting Test, Trail Making Test B, Finger Tapping Test, WAIS-R, Beck Depression Inventory (3-40 months post injury)	(1) T-tests (2) - (3) -
Hoofien, (218) (4/9)	N = 76 Severe	Vocational outcome 14 years post injury	Education, age, number of siblings, Quality of Military Service	Length of coma, number of disabilities (at time of injury)	LOS		(1) Regression analysis (2) 15.9% (3) Quality of military service

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings (1) Statistical analysis (2) % variance explained (3) Best predictors
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	
Ip (219) (4/9)	N = 45 20% Mild 27% Moderate 53% Severe	Return to work or studies or not returned to work or school at 3 years post injury	Age, education, sex, occupational status, alcohol use, marital status	GCS, LOC, CT scan	WAIS-R, WMS, Groove Pegboard test, Trail making test, Grip strength test, Finger tapping test, Halstead-Reitan Neuropsychology Test Battery (upon entry into Rehabilitation unit)	Chronicity	(1) Regression analysis (2) - (3) Those returned to work: alcohol use, marital status, Trails A Those not returned to work: Performance IQ, Visual Memory Index, Trail B.
McCullagh, (110) (4/9)	N = 57 Mild	Return to previous job or study at 5-6 months		GCS			(1) Chi-square analysis (2) - (3) -
O'Connell (220) (4/9)	N = 43 Not stated	Return to full time of part time work or not at 1 year post rehab	Age, gender, race, occupation, education		WAIS-R, WMS (upon entry into rehabilitation unit)		(1) Logistic regression (2) 52% (3) Age, verbal memory, performance IQ

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Paniak, (221) (4/9)	N = 118 Mild	Return to full time pre injury vocational status (work, school or homemaker) at 3-4 months	Age, psychological treatment, socioeconomic status, alcohol use, previous injury, gender, prescription medications	PTA, AIS		Seeking or receiving financial compensation	(1) Discriminant function analysis (2) 79% correctly identified 86.2% returned to work 58.1% hadn't returned to work (3) Age, seeking financial compensation.
Prigatano, (222) (5/9)	N = 18 50% Mild 22% Moderate 28% Severe	Gainfully employed full or part time/ actively involved in school programme or not at 21.6 months post injury	Education, age,		WAIS-R, WMS, Halstead Reitin Neuropsychological test, Russell-Neurenger average Impairment Test (on entering rehabilitation programme)	Chronicity	(1) T-tests (2) - (3) -
Rao, (223) (4/9)	N= 79 3% Moderate 97% Severe	Return to work/ school or not return to work/ school at 16.5 months post discharge	Age	PTA, CT scan, LOC	Patient Evaluation Conference System score (discharge from rehab), LOS		(1) T-tests, chi-square (2) - (3) -

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Ruffolo (111) (4/9)	N = 50 Mild	Return to pre-injury employment, return to modified employment or not returned to work 6-9 months post injury	Age, gender, marital status, education, occupation	GCS, LOC, ISS	Paced Auditory Serial Attention Test-Revised, reaction time, subjective problems, sickness impact profile, social interaction, discharge destination (1 month after injury)		(1) chi-square (2) - (3) -
Sander, (224) (5/9)	N= 138 Mild-Severe	Employed or unemployed 16 months after injury	Age	GCS, LOC		Neurobehavioural Functioning Inventory, drug use, alcohol use, psychiatric issues (2 months after injury)	(1) T-tests (2) - (3) -

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Sherer, (225) (5/9)	N= 76 14% Mild 30% Moderate 55% Severe	Competitively employed/ engaged in educational/ vocational training or not employed/ engaged in vocational training 22.5 months after injury	Education level, substance use	GCS, need for supervision (during rehab)			(1) Multiple logistic regression (2) 42% (3) Pre injury substance abuse
Sherer, (226) (5/9)	N= 66 31% Mild 12% Moderate 67% Severe	Competitive employment/ modified employment/ school or volunteer/ unemployed 30.2 months) post injury	Employment status, alcohol use	GCS	RLAS (on admission to rehabilitation), Awareness Questionnaire (admission to rehabilitation)	Chronicity	(1) Logistic regression (2) 41% (3) Difference between patient and clinician or family assessment of awareness of impairment
Simpson, (227) (5/9)	N = 61 Mild- Severe	Unemployed, modified employment, or unemployment at 10.42 years post injury	Age, occupation, education,	PTA, LOC		Brock adaptive functioning questionnaire, medical/ physical problems, personality issues, chronicity (at follow up)	(1) Discriminant function analysis (2) 77.4% correctly identified (3) Education, chronicity, pre injury occupation, coma

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Table 65: Data Extraction of Studies Identified as Methodologically Marginal (continued)

Author (citation) (Method rating)	Sample	Follow up	Variables evaluated in each study				Findings
			Pre-injury	Injury/ emergency care	Acute rehabilitation	Other	(1) Statistical analysis (2) % variance explained (3) Best predictors
Stambrook, (228) (5/9)	N = 131 20% Mild 42% Moderate 38% Severe	Full time employment, part time employment, student or unemployed at 3.75 years after injury	Age employment status	GCS, PTA, LOC	LOS	Sickness impact profile, Katz adjustment scale, Profile of Mood States (at follow up)	(1) Stepwise multiple regression (2) 37.6% (3) Pre-injury vocational status, physical impairment, belligerence
Uzzell, (229) (4/9)	N = 54 39% Mild 20% Moderate 41% Severe	Full time work, part time work or unemployment 16 months post injury	Age	GCS	WAIS, WMS (n=22 during hospital stay)	WAIS, WMS (n= 32 as out patient)	(1) Chi square test (2) - (3) -
Vilkki (230) (4/9)	N = 53 Mild- Severe	Return to pre-injury functioning or non return to position that was the same or better than the pre-injury position at 1 year after injury	Age, education	PTA		Modified Benton Visual Retention Test, Category Identification test, Sorting test, Spatial Learning test Neurobehavioral rating scale (2-4 months after injury)	(1) Stepwise discriminant analysis (2) - (3) -

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Appendix 3: Qualitative Participant Information Sheet

TRAUMATIC BRAIN INJURY EMPLOYMENT ATTRIBUTIONS

Participant information sheet

Principal investigator:	Tim Dyer, Doctoral candidate
Address:	C/O Disability Resource Centre PO Box 24042 Royal Oak Auckland
Telephone:	(09) 373-7599 extn. 89295 or 0212500251
Email:	blueshift@ihug.co.nz

You are invited to take part in a study of personal views of the factors that influence employment after a Traumatic Brain Injury (TBI). To gather information, the present study will consist of a number of interviews. This sheet provides an overview of the study so that you can make an informed decision about whether or not you would like to participate. You are under no obligation to participate in this project and if you need more time to think about your participation, you may take the information sheet and consent form home and send them back to us in the self-addressed envelope provided.

About the study:

- This study aims to investigate the factors that individuals who have sustained a Traumatic Brain Injury and the Health Professionals who facilitate rehabilitation think influence employment outcomes.
- We are most interested in your own personal views rather than those of your family, friends or the people treating you.
- The telephone interview will take approximately 1 hour and be conducted at a time that is convenient to you.
- If you are uncomfortable with any of the questions during interviews, you do not have to answer them. You will be free to stop the interview at any time without having to give an explanation. If you do not want your responses to be used, you can also have your data withdrawn.

As a participant you will be invited to discuss the factors that you think influence employment outcomes after a Traumatic Brain Injury. Interviews will be audiotaped to allow them to be written into notes for later analysis.

Benefits and Risks

The information from focus groups will help us gain a clearer understanding of the factors unique to your condition. This understanding may help health professionals find ways of assisting people to gain employment after they have had a Traumatic Brain Injury.

You have been selected for this study because you have sustained a Traumatic Brain Injury, have undergone vocational rehabilitation and can speak English.

Your participation

Your participation in this study is entirely your choice. You do not have to participate, and if you choose not to take part in this study, and if you choose not to take part you will receive the usual care. If you do agree to take part you are free to withdraw from the study at any time, without having to give a reason and this will in no way affect your future health care.

Results

A summary of results will be sent to all participants. This may take more than a year after your participation as analysis of results can take some time. The results of this study will be used in Tim Dyer's Doctorate (PhD thesis).

Confidentiality
No material that could personally identify you will be used in any reports of this study. Interviews will be audiotaped and later written into a report. No one will hear the audiotapes or see the initial report except the principal investigator and his supervisor, Professor Des Gorman. While your comments may be used in the final report, you will not be referred to by name. Audiotapes and written notes will be kept in a locked cabinet and destroyed once the study has finished

Where can you get more information about the study?

- Please feel free to contact the principal investigator, Tim Dyer, at the contact number at the top of the sheet if you have any further questions about the study.
- If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact a Health and Disability Advocate, telephone 0800 555 050.

Compensation
In the unlikely event of a physical injury as a result of your participation in this study, you may be covered by ACC under the Injury Prevention, Rehabilitation and Compensation Act. ACC cover is not automatic and your case will need to be assessed by ACC according to the provisions of the 2002 Injury Prevention Rehabilitation and Compensation Act. If your claim is accepted by ACC, you still might not get any compensation. This depends on a number of factors such as whether you are an earner or non-earner. ACC usually provides only partial reimbursement of costs and expenses and there may be no lump sum compensation payable. There is no cover for mental injury unless it is a result of physical injury. If you have ACC cover, this will affect your right to sue the investigators.

If you have any questions about ACC, contact your nearest ACC office or the investigator.

Statement of approval
This study has received ethical approval from the Auckland Ethics Committee.

Appendix 4: Qualitative Study Consent Form

CODE			

Consent Form

TITLE OF THE PROJECT: Traumatic Brain Injury Employment Attributions.

INVESTIGATOR: Tim Dyer

PARTICIPANTS NAME: _____

POSTAL ADDRESS: _____

_____

_____

TELEPHONE NUMBER: _____

English:	I wish to have an interpreter.	Yes	No
Maori:	E hiahia ana ahua ki tetahi kaiwhakamaori/kaiwhaka pakeha korero.	Ae	Kao
Samoan:	Ou te mana'o ia i ai se fa'amatala upu.	Ioe	Leai
Tongan:	Oku ou fiema'u ha fakatonulea.	Io	Ikai
Cook Island:	Ka inangaro au I tetai tanagata uri reo.	Ae	Kare
Niuean:	Fia manako au ke fakaaoga e taha tagata fakahokohoko kupu.	E	Naki

- I have read the information sheet dated 27th September 2004 for volunteers taking part in a study designed to investigate the personal views of individuals who have sustained a Traumatic Brain Injury, Vocational Rehabilitation Professionals and ACC case managers as to the factors that influence an individual's employment after a Traumatic Brain Injury.
- I have had the opportunity to discuss this study. I am satisfied with the answers I have been given.
- I have has the opportunity to use whanau support or a friend to help me ask questions and understand the study. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time and this will in no way effect my continuing health care.
- I understand that my participation in this study is confidential and that no material that could identify me will be used in any reports on this study. I have had time to consider whether to take part and know whom to contact if I have any questions about the study.

I_____(full name) hereby consent to take part in this study

Signed:_____ Date:_____

I wish to receive a copy of the results (please circle one).	Yes	No

Project explained by Tim Dyer, Researcher

Signed:_____ Date:_____

Appendix 5: Focus Group Script

Introduction:

Hi everyone and thanks for coming to the focus group today. My name is Tim Dyer and I am conducting my doctoral research through the Department of Occupational Medicine at the University of Auckland. In my research I am investigating the factors that influence an individual's employment after they sustain a Traumatic Brain Injury. I am focusing my research on investigating people's perceptions of what they think are the most influential factors in gaining employment after a Traumatic Brain Injury. I will therefore be asking people to discuss the factors that they think are most influential in the focus group today.

Because it's hard to remember everything that is being said, we have a tape recorder here so that after the meeting, I can go back and write everything down. Are people happy for this to be used?

Before we begin, I have a couple of requests. Firstly, it is important that you speak out about how you feel. We are interested in collecting everyone's point of view. Secondly, please respect other people when they are speaking and all take turns at responding to questions. If you have something to say and miss the opportunity, make a note of it because we can come back and revisit it later on.

Warm up questions:

So that I know about what you do, can we go around the table and take turns introducing ourselves and tell us a little about your role and experiences with Traumatic Brain Injury clients…

Brain-storm:

During the brainstorming section of the focus group, participants will be asked to offer factors that they believe to be influential in gaining employment post-TBI. All suggestions will be written up on a whiteboard. Once participants have exhausted the factors that they believe to be influential, they will be asked to group them together.

Exploration:

Once groups of employment factors have been identified, they will be explored with focus group participants. This will mean asking participants to explain why they are important and how they influence employment outcomes.

Wrap-up of focus group:

To ensure that group participants have had the opportunity to discuss all factors that they consider important, participants will be invited to add anything that may have been missed or has not been addressed sufficiently.

Appendix 6: Factors Identified during Focus Group as Predictive of Return to Work:

- Demands of job
- Return to work too soon/ timing of rehabilitation
- Employer factors
- Work history
- Drug alcohol issues
- Type of job to return to (self employed, big company, small company)
- Fatigue
- Work injury
- Physical aspects of the injury: Mechanism/ type of injury/ severity of injury
- Cognitive issues
- Pre-injury skills/ personality
- Insight
- Psychiatric/ psychological history
- Type of job/ employers
- Compensation/ income
- Professionals involved
- Distance from work
- Coping skills
- Pre-injury organisational
- Culture/ ethnicity
- Education/ early diagnosis

Appendix 7: Script for Interviews with Participants with Traumatic Brain Injury

Introduction:

My name is Tim Dyer and I am conducting my doctoral research through the Department of Occupational Medicine at the University of Auckland. In my research I am investigating the factors that influence an individual's employment after they sustain a Traumatic Brain Injury. I am focusing my research on investigating people's perceptions of what they think are the most influential factors in gaining employment after a Traumatic Brain Injury. I will therefore be asking people to discuss the factors that they think are most influential in the focus group today.

We want to assure everyone that whatever you say in this meeting is totally confidential and there is no way whatsoever that this will affect any services that you currently receive or services that you will receive in the future. This means that in the final report, you won't be named or singled out.

Because it's hard to remember everything that is being said, we have a tape recorder here so that after the meeting, I can go back and write everything down. Are you happy for this to be used?

Questions:

1. What is your current employment status?

2. What was your occupation before your injury?

3. What factors have you found as being helpful in aiding you getting employment after your Traumatic Brain Injury?

   Once people have answered and given factors, they will be asked to comment on which factors they considered as most helpful (i.e. rank factors in terms of helpfulness)

4. What factors do you consider as being barriers for employment after a Traumatic Brain Injury?

   Once people have answered, they will be asked to comment on which factors they consider as the biggest barriers (i.e. rank factors)

5. Have the factors that were helpful or barriers changed over time? i.e. From when you first had your injury.

6. What factors do you think are likely to act as barriers to you getting employment/ staying employed in the future?

7. What factors do you think are likely to be helpful to getting employment/ staying employed in the future?

Appendix 8: Script for Interviews with Rehabilitation Stakeholders

Introduction:

My name is Tim Dyer and I am conducting my doctoral research through the Department of Occupational Medicine at the University of Auckland. In my research I am investigating the factors that influence an individual's employment after they sustain a Traumatic Brain Injury. I am focusing my research on investigating people's perceptions of what they think are the most influential factors in gaining employment after a Traumatic Brain Injury. I will therefore be asking people to discuss the factors that they think are most influential in the focus group today.

Because it's hard to remember everything that is being said, we have a tape recorder here so that after the meeting, I can go back and write everything down. Are you happy for this to be used?

Questions:

- What is the purpose of your role as a health professional in the rehabilitation of people with Traumatic Brain Injury?

- What assessments are important to get to inform the rehabilitation of individuals with TBI?

- What non-standardised information is important to gather to inform the rehabilitation process?

- What factors act as barriers to employment outcome after TBI?
- Asked to comment on the influence of fatigue on employment outcome if hadn't mentioned it.

- What factors act as facilitators to employment after TBI?
- Asked to comment on what interventions/ processes facilitate employment after TBI?

- Asked to discuss the processes of work disability

Appendix 9: Traumatic Brain Injury Participant Demographics

Andrew

Andrew worked as a quality control manager co-ordinating a gang of workers prior to injury. Andrew was a victim of a home invasion where he was hit in the back of the head with a hammer 18 months prior to the interview. He briefly lost consciousness during this attack and suffered a mild head injury. Rehabilitation services were initiated 2 weeks post injury. Andrew had not returned to his pre-morbid job at the time of interview.

Bill

Bill was working as a branch manager of an oil supply company specialising in sales when he sustained a TBI including multiple orthopaedic injuries 20 years prior to the interview. He reported that he did not receive rehabilitation services for his TBI until 4 years after his injury. Bill continued to apply for sales positions for 12 years after injury but had failed to maintain stable employment. Bill was unemployed at the time of his interview.

Donald

Donald had a motor cycle accident that resulted in a severe head injury 20 years before the interview. He managed to return to work 5 months after injury to his job as a printing machine operator. He stayed with this employer for 4 years until he was made redundant. He consequently found employment with another company as a print maker. Donald's second mild head injury occurred 17 years after his first injury, again involving a motor cycle accident. Following a graduated return to work, Donald started to make mistakes in his work resulting in disciplinary meetings. Donald consequently accepted an exit package following union involvement. Donald had remained unemployed since this time.

Gail

Gail was employed full time as an office manager at a forensic centre when she was involved in a motorcycle accident resulting in severe multiple trauma including crushed vertebrae, a metal plate in her pelvis, a torn bladder and a moderate TBI 7 years before the interview. Gail attempted several work trials and voluntary positions since her injury each of which was unsuccessful. Her condition was further compounded by a sub arachnoid haemorrhage 3 years after her accident. She had remained unemployed since her injury at the time of interview.

Henry

Henry sustained a moderate head injury during a motor vehicle accident with 3 days of PTA. This injury resulted in surgical intervention involving a shunt. Henry had started a new job 4 days prior to the accident as a mechanical engineer specializing in design. This job was held open to him during his 18 month recovery. Henry returned to his pre morbid job full time following a graduated return to work.

James

James was found on the floor at his work place following a suspected fall. He has no memory of being in hospital until a week after his injury diagnostic of a severe TBI. His job as a motor mechanic was held open to him for the 6 months prior to his return. James returned to full time work after a 3 month supported graduated return to work.

Ruth

Ruth accepted redundancy from her position as a manager of a medical practice 2 days prior to being rear ended by a car. She sustained a mild head injury without loss of consciousness. Vocational rehabilitation services were implemented 3 months following injury due to the identification of head injury related deficits. Ruth had returned to work as a medical practice manager at the time of interview.

Appendix 10: Fatigue Study Questionnaire

THE UNIVERSITY OF AUCKLAND
FACULTY OF MEDICAL AND HEALTH SCIENCES

Employment after Traumatic Brain Injury in New Zealand

Questionnaire

CODE			

Please read each question carefully before marking your response

Are you currently in paid employment?

Yes ☐ No ☐

If no, which of the following best describes your current occupational status?

Study

Volunteer work (unpaid) ☐

Unemployed ☐

On average, how many hours a week do you spend involved in your principal occupation?

☐ Hours per week

Please indicate your level of education:

Did not finish high school ☐

Achieved high school certificate (5th form cert or UE) ☐

University or polytechnic diploma/ certificate or degree ☐

Please indicate the ethnic group that you primarily associate with:

European/ Pakeha ☐

Maori ☐

Pacific Island ☐

Asian ☐

Other ☐

Please state_____

Please read each statement carefully, and then <u>circle one number</u> that best indicates how often <u>fatigue</u> has affected you during the <u>past 4 weeks</u>. <u>Please answer every question.</u> If you are not sure which answer to select, please choose the one answer that comes closest to describing you.

	Circle one number on each line	**No problem**	**Small problem**	**Moderate problem**	**Big problem**	**Extreme problem**
1	*Because of my fatigue…* **I feel less alert**	**0**	**1**	**2**	**3**	**4**
2	*Because of my fatigue…* **I feel that I am more isolated from social contact**	**0**	**1**	**2**	**3**	**4**
3	*Because of my fatigue…* **I have had to reduce my workload or responsibilities**	**0**	**1**	**2**	**3**	**4**
4	*Because of my fatigue…* **A am more moody**	**0**	**1**	**2**	**3**	**4**
5	*Because of my fatigue…* **I have difficulty in paying attention for a long period of time**	**0**	**1**	**2**	**3**	**4**
6	*Because of my fatigue…* **I feel like I cannot think clearly.**	**0**	**1**	**2**	**3**	**4**
7	*Because of my fatigue…* **I work less effectively (inside or outside the home)**	**0**	**1**	**2**	**3**	**4**
8	*Because of my fatigue…* **I have to rely more on others to help me or do things for me**	**0**	**1**	**2**	**3**	**4**
9	*Because of my fatigue…* **I have difficulty planning activities ahead of time because my fatigue may interfere with them**	**0**	**1**	**2**	**3**	**4**
10	*Because of my fatigue…* **I am more clumsy and uncoordinated**	**0**	**1**	**2**	**3**	**4**
11	*Because of my fatigue…* **I find that I am more forgetful**	**0**	**1**	**2**	**3**	**4**
12	*Because of my fatigue…* **I am more irritable and more easily angered**	**0**	**1**	**2**	**3**	**4**
13	*Because of my fatigue…* **I have to be careful about facing my physical activities**	**0**	**1**	**2**	**3**	**4**
14	*Because of my fatigue…* **I am less motivated to do anything that requires physical effort**	**0**	**1**	**2**	**3**	**4**
15	*Because of my fatigue…* **I am less motivated to engage in physical activities**	**0**	**1**	**2**	**3**	**4**
16	*Because of my fatigue…* **my ability to travel outside my home is limited**	**0**	**1**	**2**	**3**	**4**
17	*Because of my fatigue…* **I have trouble maintaining physical effort for long periods**	**0**	**1**	**2**	**3**	**4**
18	*Because of my fatigue…* **I find it difficult to make decisions**	**0**	**1**	**2**	**3**	**4**
19	*Because of my fatigue…* **I have few social contacts outside my own home**	**0**	**1**	**2**	**3**	**4**
20	*Because of my fatigue…* **Normal day to day events are stressful for me**	**0**	**1**	**2**	**3**	**4**

	Circle one number on each line	No problem	Small problem	Moderate problem	Big problem	Extreme problem
21	*Because of my fatigue…* **I am less motivated to do anything that requires thinking**	**0**	**1**	**2**	**3**	**4**
22	*Because of my fatigue…* **I avoid situations that are stressful to me**	**0**	**1**	**2**	**3**	**4**
23	*Because of my fatigue…* **My muscles feel much weaker than they should**	**0**	**1**	**2**	**3**	**4**
24	*Because of my fatigue…* **My physical discomfort has increased**	**0**	**1**	**2**	**3**	**4**
25	*Because of my fatigue…* **I have difficulty dealing with anything new**	**0**	**1**	**2**	**3**	**4**
26	*Because of my fatigue…* **I am less able to finish tasks that require thinking**	**0**	**1**	**2**	**3**	**4**
27	*Because of my fatigue…* **I feel unable to meet the demands that people place on me**	**0**	**1**	**2**	**3**	**4**
28	*Because of my fatigue…* **I fell less able to provide financial support for myself and my family**	**0**	**1**	**2**	**3**	**4**
29	*Because of my fatigue…* **I engage in less sexual activity**	**0**	**1**	**2**	**3**	**4**
30	*Because of my fatigue…* **I find it difficult to organise my thoughts when I am doing things at home or at work**	**0**	**1**	**2**	**3**	**4**
31	*Because of my fatigue…* **I am less able to complete tasks that require physical effort**	**0**	**1**	**2**	**3**	**4**
32	*Because of my fatigue…* **I worry about how I look to other people**	**0**	**1**	**2**	**3**	**4**
33	*Because of my fatigue…* **I am less able to deal with emotional issues**	**0**	**1**	**2**	**3**	**4**
34	*Because of my fatigue…* **I fell slowed down in my thinking**	**0**	**1**	**2**	**3**	**4**
35	*Because of my fatigue…* **I find it hard to concentrate**	**0**	**1**	**2**	**3**	**4**
36	*Because of my fatigue…* **I have difficulty participating fully in family activity**	**0**	**1**	**2**	**3**	**4**
37	*Because of my fatigue…* **I have to limit my physical activities**	**0**	**1**	**2**	**3**	**4**
38	*Because of my fatigue…* **I require more frequent or longer periods of rest**	**0**	**1**	**2**	**3**	**4**
39	*Because of my fatigue…* **I am not able to provide as much emotional support to my family as I should**	**0**	**1**	**2**	**3**	**4**
40	*Because of my fatigue…* **Minor difficulties seem like major issues**	**0**	**1**	**2**	**3**	**4**

Please choose **one statement** from among the group of four statements in each question that best describes how you have been feeling **during the past two weeks, including today. Circle the number beside your choice**. Please choose only one statement for each group.

1	**0** I do not feel sad. **1** I feel sad much of the time **2** I am sad all the time **3** I am so sad or unhappy that I can't stand it.	8	**0** I don't criticize or blame myself more than usual. **1** I am more critical of myself than I used to be. **2** I criticise myself for all of my faults **3** I blame myself for everything bad that happens.
2	**0** I am not discouraged about the future. **1** I feel more discouraged about the future than I used to be. **2** I do not expect things to work out for me. **3** I feel that the future is hopeless and will only get worse.	9	**0** I don't have any thoughts of killing myself. **1** I have thoughts of killing myself, but I would not carry them out. **2** I would like to kill myself. **3** I would kill myself if I had the chance.
3	**0** I do not feel like a failure. **1** I have failed more than I should have **2** As I look back, I see a lot of failures. **3** I feel I am a total failure as a person.	10	**0** I don't cry any more than I used to. **1** I cry more than I used to. **2** I cry over every little thing. **3** I feel like crying, but I can't.
4	**0** I get as much pleasure as I ever did from the things I enjoy **1** I don't enjoy things as much as I used to. **2** I get very little pleasure from the things I used to enjoy **3** I cant get any pleasure from the things I used to enjoy.	11	**0** I am more restless or wound up than usual. **1** I feel more restless or wound up than usual. **2** I am restless or agitated that its hard to stay still **3** I am so restless or agitated that I have to keep moving or doing something.
5	**0** I don't feel particularly guilty. **1**I feel guilty over many things I have done or should have done. **2** I feel quite guilty most of the time. **3** I feel guilty all of the time.	12	**0** I have not lost interest in other people or activities. **1** I am less interested in other people or things than before. **2** I have lost most of my interest in other people or things. **3** I hard to get interested in anything.
6	**0** I don't feel I am being punished. **1** I feel I may be punished. **2** I expect to be punished. **3** I feel I am being punished.	13	**0** I make decisions about as well as ever. **1** I find it more difficult to make decisions than usual. **2** I have much greater difficulty in making decisions than I used to. **3** I have trouble making any decisions.
7	**0** I feel the same about misled as ever **1** I have lost confidence in myself **2** I am disappointed in myself **3** I dislike myself	14	**0** I do not feel worthless **1** I don't consider myself as worthwhile and useful as I used to be **2** I feel more worthless as compared to other people. **3** I feel utterly hopeless.

15	**0** I have as much energy as ever. **1** I have less energy than I used to have **2** I don't have enough energy to do very much **3** I don't have enough energy to do anything.	19	**0** I can concentrate as well as ever **1** I can't concentrate as well as usual **2** Its hard to keep my mind on anything for very long **3** I find I can't concentrate on anything
16	**0** I have not experienced any change in my sleeping pattern. **1a** I sleep somewhat more than usual **1b** I sleep somewhat less than usual. **2a** I sleep a lot more than usual **2b** I sleep a lot less than usual. **3a** I sleep most of the day **3b** I wake up 1-2 hours early and can't get back to sleep	20	**0** A am no more tired or fatigued than normal **1** I get more tires or fatigued easily than usual. **2** Its hard to keep my mind on anything for very long **3** I am too tired or fatigued to do most of the things that I used to do.
17	**0** I am no more irritable than usual **1** I am more irritable than usual. **2** I am much more irritable than usual. **3** I am irritable all the time.	21	**0** I have not noticed any change in my interest in sex. **1** I am less interested in sex than I used to be **2** I am much less interested in sex now. **3** I have lost interested in sex completely.
18	**0**I have not experienced any change in appetite. **1a** My appetite is somewhat less than usual **1b** My appetite is somewhat greater than usual **2a** My appetite is much less than usual **2b** My appetite is much greater than usual **3a** I have no appetite at all **3b** I crave food all the time		

Thank you for taking the time to complete this questionnaire

Appendix 11: Modified Fatigue Impact Scale

Following is a list of statements that describe how fatigue may affect a person. Fatigue is a feeling of physical tiredness and lack of energy that many people experience from time to time. In medical conditions like MS, feelings of fatigue can occur more often and have a greater impact than usual. Please read each statement carefully, and then circle the one number that best indicates how often fatigue has affected you in this way during the past 4 weeks. (If you need help in marking your responses, tell the interviewer the number of the best response.) Please answer every question. If you are not sure which answer to select, please choose the one answer that comes closest to describing you. The interviewer can explain any words or phrases that you do not understand.

Because of my fatigue
during the past 4 weeks....

		Never	Rarely	Sometimes	Often	Almost always
1.	I have been less alert	0	1	2	3	4
2.	I have had difficulty paying attention for long periods of time	0	1	2	3	4
3.	I have been unable to think clearly	0	1	2	3	4
4.	I have been clumsy and uncoordinated	0	1	2	3	4
5.	I have been forgetful.	0	1	2	3	4
6.	I have had to pace myself in my physical activities	0	1	2	3	4
7.	I have been less motivated to do anything that requires physical effort	0	1	2	3	4
8.	I have been less motivated to participate in social activities	0	1	2	3	4
9.	I have been limited in my ability to do things away from home.	0	1	2	3	4
10.	I have had trouble maintaining physical effort for long periods	0	1	2	3	4
11.	I have had difficulty making decisions	0	1	2	3	4
12.	I have been less motivated to do anything that requires thinking	0	1	2	3	4
13.	My muscles have felt weak	0	1	2	3	4
14.	I have been physically uncomfortable	0	1	2	3	4
15.	I have had trouble finishing tasks that require thinking	0	1	2	3	4
16.	I have had difficulty organizing my thoughts when doing things at home or at work	0	1	2	3	4
17.	I have been less able to complete tasks that require physical effort	0	1	2	3	4
18.	My thinking has been slowed down.	0	1	2	3	4

19.	I have had trouble concentrating	0	1	2	3	4
20.	I have limited my physical activities	0	1	2	3	4
21.	I have needed to rest more often or for longer periods.	0	1	2	3	4

Appendix 12: Consent Form to Collect Demographic Information

ASSESSMENT AND REHABILITATION SERVICE AGREEMENT

CLAIMANT CONTACT DETAILS

Name:			
Address:			
Phone:		Date of Birth:	

CONSENT FOR REHABILITATION PROGRAMME

Abano Rehabilitation has invited me to participate in **(Please tick):**

☐ Assessment of my clinical status to identify suitable treatment and rehabilitation options.

☐ Treatment planning, evaluating, and reviewing current services for my rehabilitation programme.

INPUT INTO TREATMENT/ ASSESSMENT PLANNING (Please tick)	Yes	No
I have had a clinician explain treatment/ assessment options to me.		
The clinician has explained to me what the rehabilitation/ assessment process involves		
I have had the opportunity to ask questions about treatment/ assessment options.		

RECEIPT OF SERVICES (Please tick)	Yes	No
I authorise Abano Rehabilitation employees or agents to enter my property for the purpose, or related to the purpose, of providing me with rehabilitation services at times agreed by me.		
I understand that I have the right to a support person when receiving services		
I understand that I have the right complain about services without penalty (see Code of Rights pamphlet for how to do this)		
I understand that I can withdraw my consent to specific rehabilitation treatment or services at any time, and that this may affect my ACC entitlement.		

HEALTH INFORMATION PRIVACY CODE

Abano Rehabilitation routinely collects personal and health information for the purpose of providing me with rehabilitation services. This information is gathered according to the Privacy Act 1993 and the Health Information Privacy Code.

INFORMATION GATHERING (Please tick)	Yes	No
I authorise Abano Rehabilitation to obtain information from the Accident Compensation Corporation ("ACC"), my doctor, my employer, my school or any other health professional or third party concerned with my rehabilitation programme.		
I understand that the information gathered may be shared with other organizations involved in my rehabilitation/ assessment, my insurance company or ACC		
I understand that I can request access to my clinical information held by Abano Rehabilitation and correct any information, by contacting the local branch or my rehabilitation clinician		
I acknowledge that Abano Rehabilitation may use my health information for general statistical, clinical presentations, or research purposes as long as privacy and anonymity are maintained.		

SIGNATURE: _____ DATE: _____

(NAME OF AND RELATIONSHIP OF SIGNATORY TO CLIENT, IF CLIENT IS UNABLE TO SIGN)

WITNESSING CLINICIAN:

SIGNATURE: _____ DATE: _____

Appendix 13: Introduction for Fatigue Scale

Introduction letter

RE: Employment outcome after Traumatic Brain Injury in New Zealand

Dear First name, Second Name:

Abano Rehabilitation is currently collaborating with the Department of Occupational Medicine, University of Auckland to investigate the effect of fatigue and depression on employment outcomes of individuals who have sustained a Traumatic Brain Injury.

Abano rehabilitation warmly invites you to participate in this research by filling out a questionnaire. This questionnaire:

- Will ask you about your current employment status, fatigue levels and mood.
- Will be very helpful to help health professionals find ways of assisting people to gain employment after they have had a brain injury.
- Should take no more than 20 minutes to complete.
- Will be sent in a self addressed envelope.

We will be sending you a questionnaire over the next fortnight.

You have been selected to participate in this research because you have attended Abano rehabilitation or assessment services such as Burtons rehabilitation, or Health Partners assessment services between 2004-2005.

Your participation in this research is entirely your choice. You do not have to participate in this research, however your response will aide health professionals develop ways of helping individuals with Traumatic Brain Injury return to work.

If you wish to know more about the study:

- You can wait until detailed information sheets are sent out to you along with questionnaires.
- You can contact the principal investigator, Tim Dyer, by email at t.dyer@auckland.ac.nz or by phone on (09) 373-7599 extn 89296.

Thank you for your consideration

Tim Dyer
(Department of Occupational Medicine, University of Auckland).

Appendix 14: Fatigue Study Participant Information Sheet

Employment after Traumatic Brain Injury in New Zealand

Participant information sheet

Principal investigator: Tim Dyer, Doctoral candidate
Address: Occupational Medicine
University of Auckland
Private Bag 92019
Auckland
Telephone: (09) 373-7599 extn. 89295 or 0212500251
Email: t.dyer@auckland.ac.nz

You are invited to take part in a study investigating employment outcomes of people who have sustained a Traumatic Brain Injury in New Zealand. Please note that you are under no obligation to take part in this research and can decide over the next week whether you wish to contribute to this research.

About the study:

- This study aims to investigate the employment outcomes of individuals in New Zealand who have sustained a Traumatic Brain Injury. Additionally, this study aims to investigate the effect of fatigue levels and mood on occupational status after Traumatic Brain Injury.
- You have been invited to participate in this research because you attended Abano assessment or rehabilitation services for Traumatic Brain Injury. It is anticipated that 100 people in New Zealand will participate in this research.
- Your participation in this research will involve filling out a confidential questionnaire and consent form which will take approximately 20 minutes.

Benefits and Risks

The information from questionnaires will help us gain a clearer understanding of the factors unique to your condition. This understanding will help health professionals find ways of assisting people to gain employment after they have had a Traumatic Brain Injury.

You have been selected for this study because you have sustained a Traumatic Brain Injury, have undergone vocational rehabilitation or assessment and can speak English.

Your participation

Your participation in this study is entirely your choice. You do not have to take part in this study. And if you choose not to take part, this will not affect any future care or treatment.

If you do agree to take part you are free to withdraw from the study at any time, without having to give a reason and this will in non way affect your future health care.

General

- You do not have to answer all the questions.
- Please feel free to contact the principal investigator, Tim Dyer, at the contact number at the top of the sheet if you have any further questions about the study.
- If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact a Health and Disability Advocate, telephone 0800 555 050.

Confidentiality

No material that could personally identify you will be used in any reports of this study. Questionnaires will be stored in a locked cabinet throughout the duration of the study and will only be seen by the principal investigator and his supervisor, Professor Des Gorman. Questionnaires will be destroyed (burnt) once the study is finished.

Results

A summary of results will be sent to all participants. This may take more than a year after your participation as analysis of results can take some time. The results of this study will be used in Tim Dyer's Doctorate (PhD thesis).

Statement of approval

This study has received ethical approval from the Northern X ethics Committee.

Appendix 15: Fatigue Study Consent Form

Consent Form

TITLE OF THE PROJECT: Employment after Traumatic Brain Injury in New Zealand.

INVESTIGATOR: Tim Dyer

PARTICIPANTS NAME:_____

POSTAL ADDRESS: _____

_____

_____

TELEPHONE NUMBER: _____

English:	I wish to have an interpreter.	Yes	No
Maori:	E hiahia ana ahua ki tetahi kaiwhakamaori/kaiwhaka pakeha korero.	Ae	Kao
Samoan:	Ou te mana'o ia i ai se fa'amatala upu.	Ioe	Leai
Tongan:	Oku ou fiema'u ha fakatonulea.	Io	Ikai
Cook Island:	Ka inangaro au I tetai tanagata uri reo.	Ae	Kare
Niuean:	Fia manako au ke fakaaoga e taha tagata fakahokohoko kupu.	E	Naki

- I have read the information sheet dated 27th September 2004 for volunteers taking part in a study designed to investigate the personal views of individuals who have sustained a Traumatic Brain Injury, Vocational Rehabilitation Professionals and ACC case managers as to the factors that influence an individual's employment after a Traumatic Brain Injury.
- I have had the opportunity to discuss this study. I am satisfied with the answers I have been given.
- I have has the opportunity to use whanau support or a friend to help me ask questions and understand the study. I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time and this will in no way effect my continuing health care.
- I understand that my participation in this study is confidential and that no material that could identify me will be used in any reports on this study. I have had time to consider whether to take part and know whom to contact if I have any questions about the study.

I_____(full name) hereby consent to take part in this study

Signed:_____ Date:_____

I wish to receive a copy of the results (please circle one).	Yes	No

Project explained by Tim Dyer, Researcher

Signed:_____ Date:_____

Appendix 16: Fatigue Study Reminder Letter

Reminder letter

RE: Employment outcome after Traumatic Brain Injury in New Zealand

Dear First name, Second Name:

By now you will have received your questionnaire investigating Employment outcome after Traumatic Brain Injury in New Zealand. We have sent you another questionnaire in case you have misplaced your questionnaire as each persons input is important and we highly value your participation in this research.

If you have any questions, please do not hesitate to contact the principal investigator, Tim Dyer, by email at t.dyer@auckland.ac.nz or by phone on (09) 373-7599 extn 89296.

Thanks you for your consideration.

Tim Dyer
(Department of Occupational Medicine, University of Auckland).

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