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**Outcome Evaluation of the Massey University Concussion  
Clinic: A Pilot Study**

A thesis presented in partial fulfilment of the requirements for the  
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## **Abstract**

The primary aim of the present study was to evaluate the effectiveness of the intervention provided by Massey University Concussion Clinic for individuals following Mild Traumatic Brain Injury (MTBI). Concussion Clinics were set up across New Zealand to provide early intervention and assessment for individuals with MTBI to prevent long term complaints. Treatment outcomes at these clinics have not been empirically examined before. The current study compared the levels of post concussion symptoms, anxiety, depression, and psychosocial functioning between an intervention and a control group using a quasi-experimental design. In addition, reasons for non-attendance to the clinic, and participants' perceptions of their recovery were also explored. The main outcome measures used were the Rivermead Postconcussion Symptoms Questionnaire, the Hospital Anxiety and Depression Scale, and the Sydney Psychosocial Reintegration Scale-2. Outcomes were initially assessed soon after injury or referral to the clinic and then three months later. Participants were recruited from the Palmerston North Hospital Emergency Department and the Massey University Concussion Clinic. With 20 participants in the intervention group and 15 in the control group, the main results showed that the Concussion Clinic intervention significantly decreased the level of anxiety and depression reported by participants in the intervention group over the control group. Greater improvements in post concussion symptoms and psychosocial functioning were also indicated in the intervention group. Additional findings suggest difficulty with transportation as a reason for non-attendance, which could be a potential barrier to recovery. Furthermore, participants highlighted the benefits of attending the service and its role in their recovery. Important issues relating to the referral processes were also identified. Findings of the current

study suggest that the Concussion Clinic intervention is effective in improving recovery for those accessing the service. Nevertheless, these results must be interpreted with caution due to the small sample size. Further research is warranted to examine the effectiveness of the Concussion Clinics with larger samples, and the current study may serve as a valuable pilot for these future investigations.

## Dedication

ماما و بابا

*(To my beloved Mum and Dad)*

*Mamma and Bappa, you have sacrificed so much to give your children the opportunities that you did not have. You have taught me the meaning of hard work and commitment. You inspire me to strive for the best in all I do. I am eternally grateful for your unconditional love and support in pursuing all my dreams.*

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## Overview

Mild Traumatic Brain Injury (MTBI) is a common injury which can cause significant functional difficulties and ongoing problems. Although the majority of individuals sustaining a MTBI recover within a few days of the injury, some individuals go on to experience the difficulties weeks or even months after the injury. These can be tremendously frustrating and devastating for the individuals and their family. Investigation and management of these problems can help these individuals recover from the symptoms and return to pre-injury activities.

Many approaches exist to manage difficulties endured by individuals after a MTBI. In New Zealand, the Accident Compensation Corporation (ACC) has set up and provides funding for several Concussion Clinics throughout the country, to carry out assessments and interventions for individuals sustaining a MTBI. Receiving referrals from Emergency Departments, General Practitioners (GPs) and the ACC, the Concussion Clinics play an important part in helping affected individuals in their recovery. The current study is based at one such clinic, the Massey University Concussion Clinic.

An important aspect of any treatment service is its' evaluation- assessing if the treatment it provides benefit those who access it. Of note, there has been some evaluation studies conducted at the Massey University Concussion Clinic. However, these have focused more on the service delivery and client satisfaction as a measure of success, rather than head injury recovery related outcomes for the clients. No study to date has looked at the overall effectiveness of any of these Concussion Clinics in

reducing the impact of MTBI in individuals. Hence, the present research is proposed as a pilot study on evaluating the impact of these clinics on specific outcomes for individuals with MTBI.

Chapter 1 presents an introduction to the present thesis by providing relevant background literature, to arrive at the objectives of the current study. Chapter 2 details the methodology undertaken, while Chapter 3 presents the results of the current research. Lastly, Chapter 4 discusses the main findings of the investigation, along with methodological and measurement issues pertaining to the current study. Limitations of the research, implications, and suggestions for future research are also discussed.

## Chapter 1: Introduction

### *Traumatic Brain Injury*

Before exploring issues related to MTBI, it is first necessary to acknowledge the wider context of all severity Traumatic Brain Injury (TBI). TBI can be broadly defined as an injury to the brain resulting from an externally inflicted trauma, which can significantly impair an individual's physical, cognitive, and psychosocial functioning (National Institute of Health [NIH] Consensus Development Panel, 1999; New Zealand Guidelines Group, 2006). Insults to the brain due to a congenital or degenerative condition are not considered under the definition of TBI (Brain Injury Association, 1997, cited in Gertenbrand & Stepan, 2001).

### **Impact of TBI**

TBI is a leading cause of death and disability, and has become one of the major public health concerns worldwide (Lanter & Zink, 1999). In New Zealand, the total incidence of TBI including those who do not seek medical attention is speculated to fall between 20,000 and 30,000 cases per year (New Zealand Guidelines Group, 2006). In the United States, it is estimated that 1.4 million TBI related deaths, hospitalisations, and emergency department visits occur each year (Langlois, Rutland-Brown, & Thomas, 2006). Such figures reflect why TBI has become a problem of global and public significance.

TBI not only impact the life and functioning of the people affected, but also their families, friends and the wider community. The economic impact of TBI is enormous, with direct and indirect costs associated with it rising every year, with the emergence of

new cases and due to the chronic nature of the symptoms. McCrea (2008) postulated that the cost of TBI in the United States can be in the order of \$100 billion in today's dollars, basing his assumption on epidemiologic data, inflation and rising health care costs. In New Zealand, ACC figures indicate it had paid \$100 million a year for post-acute treatment and rehabilitation of claimants with concussion and TBI (Larking, 2004 cited in New Zealand Guidelines Group, 2006).

### **Classifications of TBI**

TBI is commonly classified according to type and the severity of injury. The two types of head injuries often described are open and closed head injury. Open head injuries or penetrating head injuries involve skull and dura penetration by foreign objects, whereas in closed head injuries, also called blunt head injuries, the skull remains intact and the brain is not exposed (Hannay, Howieson, & Loring, 2004). Closed head injuries are usually caused either as a result of rapid acceleration of the head due to a blow by an object, or rapid deceleration of the head due to contacting a blunt and relatively immovable object or surface (Richardson, 2000). The distinction between open and closed head injury is important in acute management due to the risk of infection, but has limited use thereafter as both entail similar clinical and neuropsychological consequences (Richardson, 2000).

In contrast, classification according to initial severity has more utility. It is an important aspect in the treatment of TBI as this determines the level of care and establishes which facilities are required by individual patients (van Baalen et al., 2003). Along a scale of severity, TBI is commonly classified as mild, moderate or severe. Several criteria for assessing severity exist. A common indicator of severity is level of altered consciousness. This can be measured with the Glasgow Coma Scale (GCS), developed

by Teasdale and Jennett in 1974, and widely accepted as a standardised measure for this purpose (van Baalen et al., 2003). The GCS score comprises of three response scores (eye opening, motor score and verbal score) and ranges from 3 to 15 (Lucas & Addeo, 2006). Scores between 13 and 15 are regarded as mild, between 8 and 12 as moderate, and scores between 3 and 9 are taken as indicative of severe TBI (Jennett & Teasdale, 1981, cited in McCrea, 2008).

Another criteria used for assessing severity is the duration of loss of consciousness (LOC). An immediate LOC is typical following an impact, and the amount of time it takes a patient to regain consciousness can be an indication of severity (Lucas & Addeo, 2006). LOC less than 30 minutes can imply mild TBI; LOC lasting up to 24 hours can indicate moderate TBI and those lasting beyond 24 hours can signal severe TBI (Kraus, 1999). Similarly, presence and duration of post traumatic amnesia (PTA) can also be used to gauge the severity of TBI. Patients with PTA have no continuous memory for new information. PTA of less than one hour implies a mild injury, PTA of 1 to 24 hours a moderate injury, and longer than 24 hours can be classified as severe injury (Kraus, 1999; Lucas & Addeo, 2006).

### ***Mild Traumatic Brain Injury***

A range of terms such as concussion, mild closed head injury and mild head injury have been used synonymously in the literature to describe MTBI, which has been the term acquired by the scientific community in recent years (McCrea, 2008). Concussion is one of the most common neurological conditions seen in accident and emergency departments (Wood, 2007). In the United States, over 85% of TBIs that occur are considered “mild” (Bazarian et al., 2005). A report by the World Health Organisation

(WHO) Collaborating Centre Task Force on Mild Traumatic Brain Injury quoted the incidence of hospital treated MTBI as 100 to 300 per 100,000 population (Cassidy et al., 2004). The report acknowledged that this can be an under representation of the true incidence of MTBI, since much of the MTBI are not treated at hospitals. The report also proposed that the true population-based rate is probably above 600 per 100,000.

In New Zealand, MTBI incidence for those seen at hospitals for ages 15 and over was 437 per 100,000 per year, and 252 per 100,000 per year for those under 15 (Wrightson & Gronwall, 1998). By taking the population-based rate proposed by the WHO report and projecting it to the New Zealand population, an incidence of 24,000 cases of MTBI cases each year was estimated by the New Zealand Guidelines Group (2006). They also reported that ACC records have shown 17,514 new cases of concussions in the year 2003.

Higher incidence rates of MTBI have been recorded for males and children younger than five years (Bazarian et al., 2005). In addition, higher frequencies have been recorded for those in the age group 15 to 24, mostly due to road accidents and sports (Wrightson & Gronwall, 1998).

### **Definitions of MTBI**

A major issue in the area of MTBI is the heterogeneity in the case definitions. The first definition for MTBI was proposed by the University of Virginia, where the following criteria were considered to indicate MTBI: head injury with a GCS score greater than 12, loss of consciousness of less than 20 minutes, and hospitalisation less than 48 hours (Barth, Freeman, & Broshek, 2002). In this definition, all the criteria needed to be met for a diagnosis of MTBI.

Since then, one of the most commonly used and cited case definition for MTBI has been suggested by the Mild Traumatic Brain Injury Committee of the Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine (ACRM; Kay et al., 1993) and is summarised in Table 1.1. Under this definition, meeting just a single criterion is sufficient for a diagnosis of MTBI. In addition, as Ruff (2005) highlighted, this definition allows for a diagnosis of MTBI even in the absence of definite loss of consciousness.

Table 1.1

*American Congress of Rehabilitation Medicine (ACRM) Definition of MTBI*

ACRM states that “a patient with mild traumatic brain injury is a person who has had a traumatically induced physiological disruption of brain function, as manifested by at least one of the following:

- (1) Any period of loss of consciousness
- (2) Any loss of memory for events immediately before or after the accident
- (3) Any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, confused)
- (4) Focal neurological deficits (s) that may or may not be transient

But where the severity of the injury does not exceed the following:

- (1) Loss of consciousness (LOC) of 30 minutes
- (2) After 30 minutes, an initial Glasgow Coma Scale (GSC) score of 13-15; and
- (3) Post-traumatic amnesia (PTA) not greater than 24 hrs

(Kay et al., 1993)

The ACRM definition has subsequently been used to derive the WHO operational definition of MTBI, upon a systematic review of explicit case definitions (Carroll,

Cassidy, Holm, Kraus, & Coronado, 2004) and is presented in Table 1.2. In addition to outlining the clinical criteria, this definition also includes certain exclusion criteria. Recently, this definition has been adopted by the New Zealand Guidelines Group (2006) to describe the lower threshold of 'definite TBI'.

Table 1.2

*WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury Operational Definition of MTBI*

<p>MTBI is an acute brain injury resulting from mechanical energy to the head from external physical forces. Operational criteria for the clinical identification include:</p> <p>(a) 1 or more of the following:</p> <ul style="list-style-type: none"> <li>i) Confusion or disorientation</li> <li>ii) Loss of consciousness for 30 minutes or less</li> <li>iii) Post-traumatic amnesia for less than 24 hours</li> <li>iv) Other transient neurological abnormalities such as focal signs, seizure, and intracranial lesion not requiring surgery</li> </ul> <p>(b) Glasgow Coma Scale score of 13-15 after 30 minutes post-injury or later upon presentation for health care.</p> <p>(c) These manifestations of MTBI must not be:</p> <ul style="list-style-type: none"> <li>i) Due to drugs, alcohol, medications</li> <li>ii) Caused by other injuries or treatment for other injuries (e.g., systemic injuries, facial injuries or intubation)</li> <li>iii) Caused by other problems (e.g., psychological trauma, language barrier or coexisting medical conditions)</li> <li>iv) Caused by penetrating craniocerebral injury</li> </ul> <p>(Carroll et al., 2004)</p>
--

## **Neuropathophysiology of MTBI**

Following an injury to the head, primary damage and secondary damage are considered to be the main stages in the development of brain damage (Graham, 1995). Primary damage occurs at the time of impact as a direct result of the forces applied to the brain and includes injuries such as contusions, diffuse axonal injury, intracerebral haemorrhages, ischemic infarcts, injury to scalp and fractures of skull (Gennarelli & Graham, 2005; McAllister, Sparling, Flashman, & Saykin, 2001). Secondary injury although initiated at the moment of injury is not mechanically induced and may not present clinically for sometime after the injury (Graham, 1995). In this category includes injuries such as cerebral edema, increased intracranial pressure, hypoxia/ischemia, swelling and infection (Gannarelli & Graham, 2005;Graham, 1995).

Primary injuries can be further broken down into focal lesions such as contusions, and diffuse injuries such as diffuse axonal injury; the latter which is caused by shearing and stretching of axons often due to rotational forces at the time of impact, most commonly from an acceleration/deceleration injury (Gottesman, Komotar, & Hillis, 2003).

Evidence from animals and humans support the notion that “axonal injury is the most consistent feature of minor to moderate injury” (Povlishock & Coburn, 1989, p. 51).

Parasagittal deep white matter spreading from cortex to brainstem is thought to be the primary distribution of injury, which could be responsible for the attentional and executive deficits often observed in even mild cases of TBI (Alexander, 1995).

Damage to the brain due to a head injury has also been classified into macroscopic damage (such as contusions, skull fractures) and microscopic damage (such as shock induced neuronal depolarisation), with MTBI most commonly associated with the latter

(Anderson, Heitger, & Macleod, 2006). Neuronal depolarisation occurs as a result of acute release of glutamate following head injury (Lucas & Addeo, 2006), which in turn causes an influx of sodium and calcium ions and an increase in extra cellular potassium ions (Wrightson & Gronwall, 1999). Changes in potassium concentration results in increased glycolysis leading to accumulation of lactic acid in cells, which decreases metabolism and cerebral blood flow (CBF; Lucas & Addeo, 2006). Increased glycolysis reflects an increased demand for energy, while reduction of CBF compromises the supply of nutrients needed, ultimately causing an energy crisis. Animal studies of experimental TBI have shown CBF reduction of 50% of normal, and in humans increased glucose metabolism after TBI along with reduced CBF has been demonstrated following TBI (Barth et al., 2002).

### **Post Concussion Symptoms**

While the majority of those sustaining a MTBI may not experience any observable symptoms, at least half of them develop a number of post concussion symptoms (King, 2003). These consist of a number of physical, cognitive and affective symptoms including headache, fatigue, photosensitivity, dizziness, irritability, memory deficits, problems with attention and concentration, visual disturbances, aggravation by noise, judgement problems, anxiety and depression (Cullum & Thompson, 1999; Gouvier, Cubic, Jones, Brantley, & Cutlip, 1992). These symptoms are additional evidence that a MTBI has occurred (Kay et al., 1993). Although these symptoms frequently present following a MTBI, they can also occur with moderate and severe TBIs (Ryan & Warden, 2003).

## ***Post Concussion Syndrome***

It has been recognised in the literature that symptoms associated with MTBI usually resolve within 1 month (Ryan & Warden, 2003), 3 months (King, 2003; Ruff, Camenzuli, & Mueller, 1996; Wood, 2004), or within 3 to 6 months (Hall, Hall & Chapmen, 2005) of sustaining an MTBI, in the majority of patients. Prevalence rates ranging from 24% to 84% have been observed at three months post event (Rutherford, 1989). A small percentage of individuals continue to experience the symptoms over longer periods, and have been referred to as ‘the miserable minority’ (Ruff et al., 1996). The constellation of persisting symptoms experienced by these individuals represents the Post Concussion Syndrome (PCS; Wood, 2004) or Persistent Post Concussion Syndrome (PPCS; Ryan & Warden, 2003).

In a recent review, Hall and colleagues (2005) have noted that 7 to 15% of patients sustaining a TBI of any severity have post concussion symptoms at one year post injury. However, McCrea (2008) has postulated that when problems with defining and diagnosing the syndrome are taken into consideration, the true incidence of PCS is bound to be less than 5% of all MTBI patients.

### **Diagnosis of PCS**

The International Classification of Diseases (ICD-10) has provided a set of criteria for diagnosis of Postconcussional Syndrome (WHO, 1992) while the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association [APA], 2000) has outlined their criteria under the term Postconcussional Disorder (PCD). ICD-10 criteria specifies symptom onset to be within four weeks of head trauma. DSM-IV criteria specifies symptoms to last at least

three months. McCrea (2008) has scrutinised both classification systems to claim that they consequently exclude 90% of patients from being diagnosed with PCS or PCD, due to the requirement of head injury to occur in conjunction with loss of consciousness. The researcher has highlighted additional problems such as the criteria not being specific for MTBI, being commonly found in many other medical and psychological conditions and its subjective nature. Furthermore, Boake et al. (2005) found the level of agreement between the two systems in diagnosing PCS to be low, with a prevalence rate of 64% when using the ICD-10, and 11% when using the DSM-IV criteria.

### **Aetiology of PCS**

The extent to which PCS is caused and maintained by organic or psychological factors remains a subject of heated debate (King, 2003). This controversy is further reinforced by the subjective and non-specific nature of PCS (Ryan & Warden, 2003). The pathophysiology of MTBI provides strong evidence for a neurogenic explanation. For example, post-mortem studies involving humans and animals with mild head injury have demonstrated diffuse microscopic axonal injury (Oppenheimer, 1968, cited in King, 2003).

Meanwhile, some research point to the persistence of symptoms as the result of psychological processes. Such processes have been shown to contribute to formation of symptoms (Fenton, McClelland, Montgomery, MacFlynn, & Rutherford, 1993). History of psychiatric illness has been implicated (Lishman, 1988), in addition to emotional factors such as anxiety and depression, the latter being predictive of severity of PCS three months after injury (King, 1996). Furthermore, post concussion symptoms have been linked to stress, which possibly sheds light on circumstances where

symptoms do not appear until the individual is expected back at work or to pre-injury roles (Gouvier et al., 1992).

Additional elements associated with PCS include motivational factors such as secondary gain or malingering. A study investigating probable malingering and symptom exaggeration discovered that 39% of mild head injury cases involved malingering (Mittenberg, Patton, Canyock, & Condit, 2002). A meta-analytic review by Binder and Rohling (1996) found the effect size to be moderate (0.47) for the impact of financial incentives on symptoms and disability after closed head injury. However, it has also been noted that few individuals display substantial improvement following settlement even after a year, although twice of those seeking compensation have post concussion symptoms compared to those who do not (King, 2003).

Furthermore, female gender has been associated with a higher incidence of PCS (Bazarian et al., 1999; King, 2003). Older age, particularly those 40 years and over, has been linked with chronic symptoms (Rutherford, 1989), with older women appearing most at risk (Fenton et al., 1993). Hence, these factors are also implicated in the aetiology of PCS.

Numerous models incorporating different factors in the development and persistence of PCS have been proposed to date. Wood (2004) conceptualised a diathesis-stress model which focuses on the interaction between physiological and psychological factors that generate and maintain post concussion symptoms. The model posits that different coping strategies and motivational factors can put some people more at risk. Wood also highlighted the influence of iatrogenic forces on a patient's recovery by creating illness

perceptions or insecurities. Meanwhile, McCrea (2008) suggested a neuropsychological model, emphasising that while the neuropathophysiologic effects of MTBI initiates the symptomatology, the development and maintenance of the symptoms result from the psychological, psychosocial and other non-MTBI-specific factors. McCrea emphasised that effective methods for intervention and treatment can be provided by elucidating the specific psychological mechanisms underlying PCS.

Ruff (2005) offered an alternate model by providing a patient-based framework, to incorporate a phenomenological understanding of the impact of MTBI on a person's life. The model takes into account the interactions that occur between the person's physical, cognitive and emotional factors with the environmental (financial, spiritual, social, recreational, and vocational) factors, and how these interactions contribute to outcomes. Bender (2008) viewed this model as having moved away from the aetiological dichotomy (i.e., neurogenic vs psychogenic) and focusing more on treatment of the condition. Hence, this model taking a more holistic approach has improved practical implications in the recovery from symptoms.

### ***Outcomes of TBI***

Psychological and psychosocial functioning form important aspects of the recovery from MTBI and PCS. Depression and anxiety have been reported as the most common symptoms in patients with mild head injury (Schoenhuber & Gentilini, 1988). These emotional factors have important implications in the functional outcomes of MTBI. It has been found that TBI patients with anxiety and depression exhibit more functional disability and perceive their injury and cognitive impairment to be more severe (Fann, Katon, Uomoto, & Esselman, 1995). In addition to emotional factors, psychosocial

aspects such as returning to work and pre-injury roles are just as important in the recovery process. The associations of these factors with TBI are discussed below.

### **Depression**

Depression seems to be highly prevalent following TBI. It has been found that major depression developed in 17% of patients with mild to moderate TBI within three months post injury (Levin et al., 2001) and in 33% in a group of patients with mixed severity TBI, within the first year following injury (Jorge et al., 2004). Furthermore, Jorge and colleagues observed that development of depression was more frequent in TBI patients than in general trauma patients.

Depression following TBI could lead to the development of further problems such as increased suicidality, cognitive dysfunction and aggressive behaviour thereby aggravating outcomes of TBI (Alderfer, Arciniegas, & Silver, 2005). Increased levels of psychosocial dysfunction, psychological distress, and symptoms of post concussive disorder have been reported by patients with post traumatic depression (Rapoport, McCullagh, Streiner, & Feinstein, 2003). In addition, major depressive disorders can potentially affect brain volume size, increasing the cognitive burden in TBI patients (Bay, Hagerty, & Williams, 2007).

Jorge et al. (2004) found that among the patients who developed depression in their study, 80% were given the diagnosis of major depression during the three month period following their TBI. Referral for treatment can be facilitated by early identification of those at risk for major depression, which can prevent symptoms getting worse (Levin et al., 2005). Comprehensive evaluations to detect psychiatric disorders in TBI patients is essential, as this has implications for how treatment is paced and to increase chances of

successful rehabilitation (Handel, Ovitt, Spiro, & Rao, 2007). Treatment of posttraumatic depression not only improves the condition, but also has a positive impact on cognitive function, the number and perceived severity of post concussive symptoms, functional outcomes, and psychosocial functioning in TBI patients (Alderfer et al., 2005).

An issue pertaining to the study of depression in brain injury patients is the overlap between brain injury symptoms with somatic and cognitive complaints of depression (Bay et al., 2007). For instance, symptoms of major depression include fatigue or loss of energy, diminished ability to think or concentrate and sleep problems (APA, 2000), which are also common symptoms following TBI. This renders the differential diagnosis between the two conditions difficult and creates the possibility of misdiagnosing persistent PCS in patients with depression. Iverson (2005) found that approximately 9 out of 10 patients with depression met liberal self-report criteria for PCS, and more than 5 out of 10 met conservative criteria, suggesting the likelihood of misdiagnosing PCS in patients with depression, due to the high prevalence of post concussion like symptoms.

### **Anxiety**

Anxiety is a common reaction to any illness which could delay recovery and lead to clinical depression if left untreated (Wrightson & Gronwall, 1999). Disruption of neural circuits involved in the development of anxiety and worrying about physical injuries and possible cognitive decline can all contribute to feelings of anxiety (Warden & Labatte, 2005). Ruff and colleagues (1996), in a case study of emotional risk factors influencing outcome of MTBI, commented on the emergence of free-floating anxiety

due to stress overload. High levels of stress prior to the injury, along with additional stress following MTBI were suggested to be responsible for this overload.

With regard to the level of anxiety in individuals with TBI, rates of anxiety as high as 70% have been reported (Rao & Lyketsos, 2002, cited in Moore, Terryberry-Spohr, & Hope, 2006). A study looking at the associations between psychiatric conditions and MTBI found that 24% of the participants developed an anxiety disorder following injury (Mooney & Speed, 2001). Experience of anxiety subsequently causes difficulties in the course of recovery from TBI.

Treatment for anxiety disorders following MTBI has shown promise in improving functioning for affected individuals. Bryant and colleagues (2003) has looked at preventing the occurrence of a specific anxiety disorder, Post Traumatic Stress Disorder (PTSD), by providing brief Cognitive Behavioural Therapy (CBT) to individuals experiencing acute stress disorder following MTBI. Findings indicated there were fewer patients meeting criteria for PTSD in the CBT group compared to the control group receiving supportive counselling, in the period following treatment, and also at 6 months follow-up. The study has indicated that early provision of CBT for those at risk of PTSD following MTBI can have significant health benefits.

### **Psychosocial Functioning**

The psychosocial sequelae of head injury have been described by McKinlay and colleagues (1981) to include cognitive, emotional and behavioural changes and their effects on family, leisure and occupational life. Psychosocial problems can result from the post concussion symptoms, both at home and at work, and are seen to coincide with

neuropsychological impairments such as memory dysfunction and information processing speed (Wade, King, Wenden, Crawford, & Caldwell, 1998).

With respect to resumption of work, the first study examining outcome of mild head injury conducted by Rimel and colleagues (1981, cited in van der Naalt, 2001) found that due to significant problems with concentration, memory and attention, one-third of the patients who were employed before their injury were unable to resume work at three months. Wrightson and Gronwall (1981) reported mean time off work after MTBI as 4.7 days, a range of 0 to 26 days. On return to work, 60% of patients reported still experiencing symptoms. Forty six percent reported not being able to perform their job as before for a mean period of 14 days, with leisure activities being disrupted to a similar degree. Difficulties with memory, concentration and work capacity were still present three months after injury.

Furthermore, Dikmen, McLean and Temkin (1986) observed significant disruption in psychosocial functions such as leisure, work and social interactions, especially at one month following injury in individuals with MTBI. However, by one year, the amount of disruption had considerably declined. They believe that in addition to the head injury, system injuries such as orthopaedic problems associated with their injuries could also contribute to the psychosocial disruptions.

### ***Treatment and Intervention for MTBI***

Given the recent advances in diagnosing MTBI and PCS, there has been slow progress in the development of effective treatments (Ruff, 2005). A systematic review of the literature by Comper and colleagues (2005) identified four categories of interventions

for MTBI as being pharmacotherapy, cognitive rehabilitation, patient education and 'other'. Hypnosis and biofeedback have also been described among therapies (Mittenberg, Tremont, Zielinski, Fichera, & Rayls, 1996). While medication has been the most frequent treatment for post concussion symptoms (Mittenberg, Canyock, Condit, & Patton, 2001), the review by Comper et al. (2005) failed to provide solid evidence for the effectiveness of any specific drug treatment for treating one or more symptoms of MTBI.

### **Early Intervention Studies**

Strong evidence from several studies indicate that early intervention in the form of patient education can reduce post concussion symptoms and prevent persistence of problems. Mittenberg et al. (1996) demonstrated this by comparing two groups of patients. Individuals in the treatment group were provided with a printed manual and had met with a therapist prior to hospital discharge. Information reviewed included the nature and incidence of expected symptoms, the cognitive-behavioural model of symptom maintenance and treatment, techniques for reducing symptoms, and instructions for gradual resumption of premorbid activities. Patients in the control group received routine hospital treatment and discharge instructions in written form. At six months follow-up, patients in the treatment group reported significantly fewer of the twelve post concussion symptoms, shorter average symptom duration, fewer symptomatic days and lower mean severity levels, supporting the notion that early psychological intervention can reduce the incidence of PCS.

Wade and colleagues (1997) carried out a randomised control trial to investigate effectiveness of a routine follow-up service for patients with a head injury of any severity. Patients were randomised into two groups, an early follow-up group and a

control group. Both groups received standard hospital services. Patients in the early follow-up group were approached 7 to 10 days after injury, and were sent or given an information sheet regarding management of possible symptoms after head injury. In addition, they received further intervention according to clinical need, which included counselling, neuropsychological assessment, cognitive behavioural psychotherapy, or referral on to other specialist services. At six months follow-up, there was no difference between the two groups in terms of post concussion symptoms, although improved everyday functioning was found in the trial group, attributed by the authors to increased coping abilities in patients within this group. However, a second study by the same authors in 1998 showed patients in the trial group having less social disability and significantly less severe post concussion symptoms than patients in the control group.

Another study providing support for early psychological interventions is one comparing two treatments for MTBI patients; an education oriented single-session treatment (SS) and a more extensive assessment, education, and treatment-as-needed intervention (TAN; Paniak, Toller-Lobe, Durand, & Nagy, 1998). Participants were randomly assigned to either group and were met with no later than three weeks since injury. Patients in the SS group were given a brochure on head injury, and were educated regarding common symptoms after MTBI, given suggestions on coping with problems and encouragement on gradual return to activities, and reassured about a good outcome. In addition to this treatment, patients in the TAN group received a neuropsychological and personality assessment, physical therapy consultation, and additional sessions as required. At three months follow-up, post concussion symptoms had improved significantly in both groups. No difference between the groups were found for symptom-related, functional or vocational variables, indicating that a brief session can

be just as effective as a more intensive and standard outpatient therapy for MTBI patients. The TAN group continued to receive intervention up to 12 months, at the end of which another follow-up was carried out for both groups (Paniak, Toller-Lobe, Reynolds, Melnyk, & Nagy, 2000). Again, no group differences were found in symptoms reported, further supporting previous findings.

A further study into early intervention looked at the impact of information provision (in the form of an information booklet) and a neuropsychological assessment within five to seven days post injury on symptoms, cognitive performance and psychological adjustment three months later (Ponsford et al., 2002). It was found that participants in the intervention group reported fewer post concussion symptoms and were less stressed at follow-up, compared to control participants who only received usual emergency department treatment. This outcome study is additional evidence that provision of early intervention after MTBI is beneficial.

Further support for early interventions is provided by a meta-analysis conducted by Mittenberg et al. (2001) of five early intervention studies, where these interventions were seen to significantly reduce the incidence of post concussion symptoms when compared with usual hospital services. The researchers asserted that if provided brief psychological treatment, 16% of untreated PCS patients would be symptom free. They summarised the critical components of effective treatment to be education, reassurance, gradual return to pre-injury activities, and reattribution of PCS symptoms to benign causes.

Despite the accumulating evidence supporting early intervention, some researchers have debated the usefulness of such practices. Ghaffar and colleagues (2006) failed to find differences between the treatment group and control group in their randomised treatment trial, on measures of post concussive symptoms, psychosocial functioning, psychological distress and cognition at six months post injury. Their findings suggest that routine early treatment of all MTBI patients is of little gain. However, they have noted the benefits of the intervention for subjects in the treatment group with pre-existing psychiatric difficulties whose depressive symptoms were significantly reduced. Hence, the researchers encourage routine targeting of those at risk, as a more cost effective and rational strategy.

Aside from the issue of early intervention, longer term intensive treatments for MTBI have shown to be effective. Ferguson and Mittenberg (1996) have developed a therapist manual for cognitive-behavioural treatment of PCS, for use as a standardised treatment for patients requiring more intensive intervention (Mittenberg & Strausman, 2000). The components of treatment emphasised in the manual are 1) behavioural pacing of daily activities, through activity scheduling, 2) cognitive restructuring to identify, modify and/or replace self-defeating cognitions about symptoms experienced, and 3) anxiety management training, for management of stress related arousal brought on by symptom distress. The manual includes instructions for twelve sessions. An outcome study of this treatment by Miller and Mittenberg (1998, cited in Allen, 2007) demonstrated its effectiveness in reducing the number and intensity of PCS symptoms.

### ***Treatment of MTBI in New Zealand: Concussion Clinics***

While residential services are available for the treatment of individuals with more severe TBI in New Zealand, non residential outpatient services are targeted for those with MTBI. These MTBI clinics, also referred to as Concussion Clinics, have been designed as an early intervention service, to provide assessment and rehabilitation for individuals with MTBI and PCS. Prior to 2001, only one specialist Concussion Clinic had operated in New Zealand, located in Auckland. In 2000, ACC's Healthwise division began developing a contracting project to set up Concussion Clinics throughout the country. With the completion of this project in early 2001, nine organisations had received contracts for the MTBI service. From these, two organisations provide specific care for children with TBI (New Zealand Guidelines Group, 2006).

The Concussion Clinics accept early referrals from acute services such as Emergency Departments for those sustaining a MTBI. They also accept referrals from case managers at ACC and health professionals such as GPs for those who have persisting symptoms following MTBI, with the presumptive diagnosis of PCS (Accident Compensation Corporation, 2001). Following referral and upon assessment, the Concussion Clinics are required to provide an accurate diagnosis of MTBI and PCS, where applicable, and formulate an optimal treatment and rehabilitation plan, with the goal of early and sustainable return to work or independence. In addition, the clinics also aim to prevent long term sequelae by identifying clients at risk of developing long term disability and providing effective interventions for these individuals and for those who have developed or are developing long-term problems due to their TBI (ACC, 2001).

When accepting referrals, according to the ACC Service Specifications, ACC prior approval is not required where the claimant's clinical presentation meets the criteria in Table 1.3 (ACC, 2001). For those not meeting the criteria, this approval is required before accepting the referral and delivering any services.

Table 1.3

*Criteria under which ACC Prior Approval is not required*

- Overt significant impact on level of functioning including the inability to work or attend school for more than 1 week.
- Second or subsequent MTBI, within 6 months.
- PTA lasting more than 12 hours.
- Occupational safety is an important concern (e.g., operating machinery, driving); or
- The claimant is in a high functioning job such as engineers, medical practitioners, lawyers, or others with tertiary qualifications; or
- The claimant is a secondary or tertiary student; or
- There is a pre-existing psychiatric disorder, or substance abuse problem.

(ACC, 2001)

Following the referral, the initial assessment involves a medical assessment, a neuropsychological screening and a functional assessment if clinically indicated. The service specifications requires that after initial assessment, the claimant must, at minimum, meet the criteria for MTBI (Table 1.4) or PCS (Table 1.5).

### **The Massey University Concussion Clinic**

The clinic first opened as an outpatient service at the Palmerston North Hospital in 2001, and was then named MidCentral Health and Massey University Concussion Clinic. It was the result of the successful joint application by these two bodies for the

Table 1.4

*Criteria for MTBI as set by ACC*

MTBI occurs when a person has had a traumatically induced disruption of brain function manifested by:

A. At least *two* of the following:

- A period of loss of consciousness from a few seconds up to 30 minutes, verified by an external observer wherever possible.
- Disturbance of memory for events immediately before and/or after the accident. Memory disturbance should last at least 1 minute but no longer than 24 hours, verified by an external observer wherever possible.
- Focal neurological deficit(s) that may or may not be transient, including evidence of altered mental state such as confusion or disorientation.

**AND**

B. A Glasgow Coma Score (GCS) of 13 or higher usually present at the time of initial medical examination, preferably at 1 hour after the injury.

**AND**

C. Presenting symptoms are not attributable to pre-existing medical condition or pre-existing psychological disorder, or primarily due to drug or alcohol intoxication. The presence of any of these may still mean an injury has occurred.

**AND**

D. **ONE** of the following:

- Evidence that medical care has been sought within 7 days of injury (unless it is unavailable, e.g., the person was on a fishing boat, in the mountains, or similar).
- There is documentation from a Registered Health Professional consistent with external force to the head having occurred, such as
  - Contusion, abrasion, bruising or other injury to the skin or scalp.
  - Skull fracture, with radiological evidence.
  - Injury to the scalp, skull, meninges or brain including intracranial haematoma.
  - Acceleration-deceleration injury.
- In the absence of either of the above, review by a Registered Specialist that indicates, on the balance of probabilities, an external force to the head has occurred.

(ACC, 2001)

Table 1.5

*Criteria for PCS as set by ACC*

A. The claimant *must* have a documented history of head trauma that has caused mild (or more severe) TBI (as defined in Table 1.4). Note that Post-Concussional Syndrome may also arise following a more severe TBI.

**AND**

B. This classification may be made for a claimant who has been symptomatic *for at least 6 weeks*, but not continuously asymptomatic for the first 4 weeks.

**AND**

C. The claimant has *at least three* of the following symptoms *for at least 6 weeks*, and onset of these occurred shortly after the head trauma.

- (1) Difficulties with concentration, attention, and/or memory
- (2) Becoming fatigued easily
- (3) Disordered sleep
- (4) Headache
- (5) Vertigo or dizziness
- (6) Irritability or aggression on little or no provocation
- (7) Anxiety, depression, or affective lability
- (8) Changes in personality (e.g., social or sexual inappropriateness)
- (9) Apathy or lack of spontaneity
- (10) Distractibility due to light and/or noise

**AND**

D. There is evidence from neuropsychological testing or quantified cognitive assessment of difficulty in attention (concentrating, shifting focus of attention, performing simultaneous cognitive tasks) or memory (learning or recalling information).

**AND**

E. The symptoms in C and D had their onset following head trauma or else represent a substantial worsening of pre-existing symptoms.

**AND**

F. The disturbance causes significant impairment in social or occupational functioning and represents a significant decline from a previous level of functioning.

**AND**

G. The symptoms are not better accounted for by a psychological disorder.

(ACC, 2001)

ACC MTBI contract. In February 2004, due to MidCentral Health terminating its involvement with the contract, the Concussion Clinic came solely under the management of Massey University. The clinic started to be operated from the Massey University Psychology Clinic at the Palmerston North campus.

Concussion Clinic appointments are held one day a week where up to four clients could be seen each week. Referrals to the service are received by the Concussion Clinic administrator who arranges appointments for the clients. For the year 2008, the Concussion Clinic had received a total of 184 referrals.

Referrals received at the clinic are first screened by the Clinical Psychologist (Neuropsychology) in charge of the Concussion Clinic to determine appropriateness of the referral and to determine whether ACC prior approval is required before proceeding. If the referred individuals' clinical presentations include any of the criteria listed in Table 1.3, or if the referral is made directly by a case manager at ACC, then ACC prior approval is not needed; and these individuals can be put on the waiting list for the Concussion Clinic. If those referred by a health professional do not meet the criteria, these referrals are forwarded to ACC for approval. Case managers are expected to make a decision within five working days of receipt of the application for funding approval. Once accepted, these clients are also put on the waiting list.

Clients are advised to allow approximately three hours for the initial appointment. As mentioned earlier, this consists of a medical assessment and a neuropsychological screening. The medical assessment is done by a medical specialist, and includes

examination and clinical history taking, determining the presence of MTBI (or more severe TBI) or PCS, identifying relevant investigations such as need for Computed Tomography (CT), Magnetic Resonance Imaging (MRI) or Electroencephalography (EEG) of the head, reviewing of premorbid psychological and psychiatric status, and presence/absence of substance abuse disorders (ACC, 2001). The medical assessment usually takes about an hour.

The neuropsychological screening is carried out by a registered Clinical Psychologist. This involves a structured clinical interview and specific neuropsychological tests. The interview involves history taking to assess premorbid personality, major psychiatric morbidity (including suicide risk assessment), alcohol and drug addiction issues. Assessment of relationships, family/whanau, workplace, study and recreational issues before and after the brain injury is also carried out. Neuropsychological tests include those of premorbid functioning, attention, memory, information processing speed, executive function, comprehension, and verbal ability (ACC, 2001). The neuropsychological screening can take about one and a half hours.

Following these assessments, if indicated, a functional assessment may also be carried out. Conducted by an Occupational Therapist, it includes assessing fine motor function, occupation and recreational capabilities, identifying disabilities and impairments caused by TBI, gathering information on pre-injury roles and the impact of TBI on those, in situ assessments of any other area of functional disturbance experienced, recognising other elements that can impact on return to independence, work and study. Worksite and/or home visits can also form part of this functional assessment (ACC, 2001).

Following these assessments, a Clinical Assessment and Rehabilitation Report (CARR) is completed and provided to the case manager, the client's GP and the referrer (if other than GP) within seven days of completing the assessment. This report highlights relevant background information, current functioning, summary of test results, and puts forward recommendations which involve treatment and rehabilitation plans where program goals and corresponding interventions are identified. Implementation of these interventions is dependent upon ACC approving the recommendations in the report.

An important aspect of intervention is providing clients and their families with printed information about MTBI and PCS, which alone will often be sufficient intervention in some cases (ACC, 2001). Information about common symptoms and when to seek medical help is provided. By educating clients and their families, they are reassured that the symptoms are part of the normal recovery process.

In cases where further intervention is required, up to twelve sessions can be funded by ACC. Treatment sessions are approved by the case managers in blocks, minimum of three and a maximum of six, and in certain circumstances a further six sessions may be approved. These sessions can be either individual or group sessions and can be with the clinical psychologist or the occupational therapist. These sessions are used to help the client with symptom management, such as fatigue management, sleep hygiene, to provide therapy for depression and anxiety if these are problem areas indicated by the initial assessment. Also advice regarding graduated return to work is also provided. Concussion Clinic is required to provide a Progress Report at midway point of the block of treatment sessions. Also, at completion of all assessments and treatment

sessions, a Discharge Report is required to be sent to the case manager. And finally, the Concussion Clinic is required to provide telephone support to all clients up to six months since their start of rehabilitation (ACC, 2001).

### **Previous Research at Massey University Concussion Clinic**

Only two previous research projects have been conducted at this clinic. Leach (2003) evaluated the service provided by the MidCentral Health and Massey University Concussion Clinic, by surveying client satisfaction as an appropriate method of measuring quality of the service. A standardised measure, the Service Satisfaction Survey-30 (Greenfield & Attkisson, 1999) was included in a questionnaire sent to all clients who were referred the Concussion Clinic between September 2001 and January 2003 (105 clients). From the 20 surveys returned, data showed 70% of clients were generally satisfied with the service received. The study also identified aspects of the service that could be improved, such as waiting times at appointment, thoroughness of the main practitioner, amount of forms to fill out, and shorter sessions with the Clinical Psychologist. However, Leach did emphasise the inappropriateness of the chosen measure for the Concussion Clinic setting, due to the length and irrelevant questions. In addition, she indicated that the use of client satisfaction as a method to evaluate the service may not be justified as clients were usually seen once and nature of the outcome was unclear in this setting.

A second study was conducted by Taylor (2005), where client satisfaction was investigated once again. Taylor also studied the epidemiology of MTBI in her sample, and recovery aspects such as persisting symptoms and recovery ratings. The methodology involved reviewing cover sheets of clients referred to the clinic between the period of January 2002 to November 2004, and circulating a questionnaire

including the measure Service Satisfaction Survey-30 used in the earlier study to these clients. Incidence and epidemiology data gathered in the study were similar to the trends in international literature. With 41 questionnaires returned, the evaluation component of the study showed that clients were generally satisfied with the services they had received, although overall client satisfaction in this study was lower than that of Leach's study. Taylor speculated one reason for this to be the lower ratings on accessibility to the clinic due to its relocation from the hospital.

While the two studies do provide the clinic with useful feedback regarding clients' satisfaction with the clinic, this approach does not provide information on the outcomes of the clients in terms of head injury related variables, which would be a better method of testing the clinic's effectiveness.

### **Previous Research at other ACC Concussion Clinics**

Two recent studies have been conducted at two other ACC Concussion Clinics. One study was a retrospective analysis of referrals received at the Burwood Hospital Concussion Clinic (Christchurch) by Snell and Surgenor (2006). Aspects examined include referral source, demographic and clinical features, time since MTBI, assessment and treatment provided, follow-up and outcome at discharge. A "good" outcome was defined as resolution of MTBI symptoms and the patient having returned to pre-injury functioning. A "fair" outcome was given if patients were still symptomatic but had returned to premorbid roles. A "poor" outcome was indicated if post concussion symptoms were persisting, and the individual had failed to return to pre-injury roles at discharge from clinic. Outcome was defined "undetermined" in cases where individuals were referred onto other agencies for problems hindering rehabilitation. Findings indicated 70.2% of cases regarded as having a good outcome,

11.8% as fair, 6.2% as poor, and 11.8% as undetermined. No association was seen between variables (demographic, clinical, assessment or treatment) and cases with good outcome. Further findings suggested possible under-referral of men, and a greater than expected referral for assault-related MTBIs. In addition, age and referral source were seen to significantly contribute to the risk of non-attendance.

The second study was also a retrospective analysis, where Alexander and colleagues (2007) looked into referral demographics, mechanisms of injuries and treatment recommendations at the Capital and Coast District Health Board Adult Concussion Clinic. The main findings included that among referrals from sporting injuries, cycling was the most dominant activity. Occupational therapy was found to be the most commonly recommended treatment. Also, the authors observed a relatively small number of patients being seen in this clinic despite the high number of injuries with TBI that occur every year.

The above two studies have identified important issues pertaining to these clinics. Snell and Surgenor (2006) have even incorporated an aspect of overall outcome.

Nevertheless, by not focusing on specific outcome variables, effectiveness of these interventions cannot be ascertained. Taken together with the previous studies conducted at the Massey University Concussion Clinic, there appears a lack of research conducted into the effectiveness of the interventions provided by these clinics.

### **Client Non-attendance at the Concussion Clinics**

An important issue faced by many outpatient clinics is the failure to attend scheduled appointments (Collins, Santamaria, & Clayton, 2003; Hamilton, Round, & Sharp, 2002). This results in considerable costs to both the service provider and the recipients

of the service. For the service providers, both administrative and clinical time is lost, causing the service to be inefficient. In addition, the missed appointment time could have been potentially used to see another client (Selby-Law, 2006). For the recipients, non-attendance leads to delay in treatment or even possible cancellation of the referral, thereby missing the opportunity to receive the specialist help that was arranged.

Snell and Surgenor (2006) in their study at the Burwood Hospital Concussion Clinic found that one reason for client non-attendance at that clinic was improvement in symptoms and the clients' feelings of not needing to attend anymore. Additional reasons include clients returning to work and not wishing to take time off for the appointment. The authors also observed that client non-attendance is associated more with referrals made by the Emergency Department, as they could experience considerable improvement between discharge and the Concussion Clinic appointment. Apart from this study, there has been a lack of research looking into the non-attendance issues at the Concussion Clinics. Therefore, more research into this area is warranted to further understand reasons for non-attendance, to help improve the efficiency of the clinics.

### ***The Present Study***

The key aim of the present study was to evaluate the effectiveness of the Massey University Concussion Clinic in reducing the impact of MTBI in individuals accessing treatment. The need for testing the effectiveness of specific interventions for people with TBI has been identified as an objective for future research on TBI in New Zealand, by the New Zealand Guidelines Group (2006). Due to the apparent lack of research on the effectiveness of intervention provided by the Concussion Clinics, the

current investigation has been proposed as a pilot for a New Zealand wide study of the various outcomes at these clinics.

In the current study, effectiveness of the Massey University Concussion Clinic intervention was to be ascertained by comparing the outcomes of three groups of individuals with MTBI. The first group includes individuals being referred to the clinic for assessment and intervention and attends the clinic (referred group). A second group of individuals are those with a recent MTBI but not referred to the clinic (non-referred group) and the third group consist of individuals referred to the clinic but did not attend (non-attend group). The latter two groups serve as control groups for comparison with the intervention group.

In light of the literature, the outcomes chosen to be evaluated in the current study included post concussion symptoms, anxiety, depression and psychosocial functioning, thereby incorporating a wide range of recovery aspects. Outcomes were to be assessed soon after injury or referral (pre-treatment or baseline) and three months later (post-treatment or follow-up). Comparisons between the groups will allow for investigations into whether individuals who attend the clinic performed better across the measures in contrast to those who do not receive the intervention.

Hence, based on the key aim of the research in evaluating the effectiveness of the clinic, the following primary research questions were proposed.

**Primary research questions:**

Research Question 1: Are there initial differences in the responses to the measures between the three groups?

Research Question 2: What are the changes within and between the groups over the period of three months?

In addition to comparing the groups on specific outcomes, the current study also aimed to explore the following secondary research questions relating to clients experience at the clinic and their recovery.

**Secondary research questions:**

Research Question 3: What are the reasons for non-attendance for those referred to the Concussion Clinic?

Research Question 4: What are participants' perceptions of their recovery?

## **Chapter 2: Method**

### ***Research Setting***

Research activities relating to the current study took place at two locations, the Palmerston North Hospital ED and the Massey University Concussion Clinic.

Palmerston North Hospital ED is a 24 hour trauma centre based at Palmerston North Hospital and operates under the MidCentral District Health Board, which services a population of 158,000 people in Palmerston North City and surrounding districts. Initial participant recruitment was undertaken here.

Further recruitment, data collection and other research activities for the current study were based at the Massey University Psychology Clinic; an organisation aiding in the training of clinical psychologists through teaching, research, and practice. The clinic holds several contracts with ACC including the MTBI (Concussion Clinic) contract.

### ***Participants***

Participants were recruited into the study in two ways. Initially participants were recruited from patient presentations to the Palmerston North Hospital Emergency Department during the period of June to October 2008. Patients aged five years and over with an accident history suggestive of a MTBI (e.g., accident involving fall, trauma to head, motor vehicle accident) were invited to participate. These participants were recruited into an earlier phase of the study (see Figure 2.1). In this manner, 27 participants were recruited. From this pool of participants, 22 individuals were approached for participation in the current study based on the inclusion criteria: accident description suggests likelihood of meeting MTBI criteria as suggested by the

WHO definition, age of individual being sixteen and over and residing in areas served by the Massey University Concussion Clinic. Three individuals were excluded based on age, and two individuals based on residence. From these 22 potential participants, 15 participants signed up for the current study, giving a recruitment success rate of 68.18%. The non-participants included three individuals who did not wish to take part, and four individuals who were unable to be contacted. The resulting sample consisted of 66.7% males and 33.3% females, with a mean age of 36.13 years, a minimum age of 17 and a maximum of 79 years ( $SD = 17.36$ ).

Loss of consciousness was reported by 9 participants, with duration varying from a few seconds or minutes up to 30 minutes. Out of the 15 participants, 13 had a GCS score of 15, while the remaining two participants reported a score of 14. Duration of PTA was usually not reported in the patient notes. Indications of PTA were present in only three cases.

Participants were also recruited from the Massey University Concussion Clinic, during the period of August to September 2008, to supplement the group of participants recruited from the Emergency Department. Individuals aged 16 and over, and who were English-speakers were invited to participate. In this manner, 33 individuals who were referred to the Concussion Clinic (from all sources) were approached with an invitation to participate. Twenty four individuals signed up for the study, giving a recruitment success rate of 72.72%. From the remaining nine clients, four did not wish to take part, and four were unable to be contacted. For one person, there was no opportunity to carry out data collection before the individual attended the Concussion Clinic appointment. The resulting sample obtained from the Concussion Clinic

consisted of 58.3% males and 41.7% females, with a mean age of 36.92 years, a minimum age of 16 and a maximum of 82 years ( $SD = 17.84$ ).

LOC was reported in the referral notes for 11 out of 24 participants recruited from the Concussion Clinic, and when duration was specified, it ranged from split seconds up to 10 minutes. GCS score and presence of PTA were seldom reported.

Overall, a total of 39 participants initially took part in the study, with 61.5% of the sample recruited from the Concussion Clinic, and 38.5% from the Emergency Department. Table 2.1 shows a summary of participant characteristics. The sample comprised of 61.5% males and 38.5% females, with a mean age of 36.62, a minimum age of 16 and a maximum of 82 years ( $SD = 17.43$ ). The age group with the highest frequency was 20 to 29 (30.8%). The majority of the sample consisted of New Zealand Europeans ( $n = 29$ ). Participants also included Maori ( $n = 4$ ), and other European ( $n = 6$ ).

The causes of head injury were varied; 11 road traffic accidents (car, motorcycle, bike or pedestrian), 8 assaults, 7 sports injuries, 6 falls and 7 other causes. Among other causes, 3 constituted objects falling on head. The majority of falls involved falling onto concrete ( $n = 4$ ). Five injuries occurred during work or school activities. Among sports included injuries from rugby, dirt biking, soccer, horse riding, and skiing. The percentage of participants reporting one or more previous concussions was 53.8%. From these, 33.3% reported having sustained at least one concussion, whereas 20.5% reported between three to eight previous concussions.

Table 2.1

*Summary of Participant Characteristics (N = 39)*

Demographic Categories	Category Levels	Number	Percent
Gender	Male	24	61.5%
	Female	15	38.5%
Age bands	17-19	6	15.4%
	20-29	12	30.8%
	30-39	5	12.8%
	40-49	7	17.9%
	50-59	5	12.8%
	60 and over	4	10.3%
Ethnicity	NZ European	29	74.4%
	NZ Maori	4	10.3%
	Other European	6	15.4%
Marital status	Single	16	41%
	Engaged, cohabiting, or married	19	48.8%
	Divorced, or widowed	4	10.3%
Highest Educational Qualification	None	6	15.4%
	High School	19	48.7%
	Apprenticeship	3	7.7%
	Polytech or equivalent	4	10.3%
	University	7	17.9%
Yearly Income Level	On sickness benefit	3	7.7%
	Under \$10,000 - \$20,000	2	5.2%
	\$20,000 - \$30,000	11	28.2%
	\$30,000 - \$50,000	11	28.2%
	\$50,000 - \$70,000	3	7.7%
	Over \$70,000	2	5.1%
Employment	Student	2	5.1%
	Full time employment	27	69.2%
	Part time employment	2	5.1%
	Unemployed	6	15.4%
	Retired	2	5.1%
Mechanism of Injury	Road traffic accidents (car, motorcycle, bike, or pedestrian)	11	28.2%
	Assaults	8	20.5%
	Sports	7	17.9%
	Falls	6	15.4%
	Other	7	17.9%

The follow-up at three months was completed by 35 participants (89.7%). One participant wished not to be involved in the study further, two participants had changed

address and were unable to be reached, and one participant was unable to be reached for the follow-up interview even after rescheduling a few times.

## *Measures*

### **Main Outcome Measures**

In order to examine specific outcomes that could potentially reflect the effectiveness of the Massey University Concussion Clinic, three standardised and validated measures were chosen to assess the three areas of interest; post concussion symptoms, anxiety, depression, and psychosocial functioning. The measures were the Rivermead Postconcussion Symptoms Questionnaire (RPQ; King, Crawford, Wenden, Moss, & Wade, 1995), Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), and the Sydney Psychosocial Reintegration Scale-2 (SPRS-2; Tate, Hodgekinson, Veerabangsa, Pfaff, & Simpson, 2007) (see Appendix A). The RPQ was obtained from the Concussion Clinic, original copies of HADS were purchased through an authorised distributor and the SPRS-2 was acquired directly from the author. The three measures are discussed below under each construct.

#### *Post Concussion Symptoms*

The RPQ is a measure of the presence and severity of post concussion symptoms. It consists of sixteen of the most frequently experienced post concussive symptoms including headaches, dizziness, nausea/vomiting, noise sensitivity, sleep disturbance, fatigue, irritability, feeling depressed/tearful, feeling frustrated/impatient, forgetfulness, poor concentration, taking longer to think, blurred vision, light sensitivity, double vision and restlessness. These symptoms are rated on the extent to which they have been problematic to the individual over the last 24 hours, compared to premorbid

levels. The ratings are on a scale of 0 to 4, and ranges from not experienced at all, no more of a problem, a mild problem, a moderate problem and a severe problem. When calculating the total overall score, ratings of 1 are typically excluded as they do not indicate a significant problem.

Good psychometric properties for the RPQ have been reported by several studies. The RPQ total score has been found to be highly reliable, with Spearman rank correlation coefficients of  $R_s = .91$  and  $R_s = .87$  being demonstrated for the test-retest reliability and inter-rater reliability respectively (King et al., 1995). Individual items have also shown good reliability in the same study. In addition, the RPQ has been reported as a valid measure for the severity of post concussion symptoms (Crawford, Wenden, & Wade, 1996; Ingebrigtsen, Waterloo, Marup-Jensen, Attner, & Romner, 1998).

#### *Anxiety and Depression*

The HADS is a brief self-report screening scale, originally designed to measure emotional distress in non-psychiatric patients in hospital clinics. Containing 14 items, it measures anxiety and depression on two separate subscales, each consisting of seven items. Individuals rate the extent to which they have experienced the symptoms over the past week. Two separate scores can be calculated by summing up the respective items, an anxiety score (HADS-A) and a depression score (HADS-D). Symptoms of anxiety and depression relating to physical illnesses, such as dizziness, headaches, and loss of appetite are excluded in the HADS so that possible effects of somatic disorders on the scores can be prevented. The age group for which it was originally developed for is 16 to 65.

Interpretation of the HADS can be done in two ways; either by using normative values obtained from a sample of the general population to compare with the individual's score (Crawford, Henry, Crombie, & Taylor, 2001), or by placing the individual's score within developed scoring bands which indicate severity of the states (Snaith & Zigmond, 1994). The four score ranges are "normal" (0-7), "mild" (8-10), "moderate" (11-14), and "severe" (15-21).

HADS is reported in the literature as both a reliable and valid instrument. In a recent review by Bjelland and colleagues (2002) of 747 studies utilizing HADS, it was found that the Cronbach's alpha coefficient of internal consistency varied for HADS-A from .68 to .93, and for HADS-D from .67 to .90 (coefficient should be greater than .60 for a self-report instrument to be valid). The review also found the concurrent validity of HADS to be good to very good (correlation to HADS-D and HADS-A between .60 and .80), when compared to other questionnaires for anxiety and depression commonly used such as Beck's Depression Inventory and Spielberger's State-Trait Anxiety Inventory.

### *Psychosocial Functioning*

The SPRS-2 is a 12-item rating scale designed to measure psychosocial functioning in the community for people with TBI. It draws on the participation domain of WHO's framework for conceptualising health and disability, the International Classification of Functioning, Disability and Health, commonly known as ICF (WHO, 2001). The ICF focuses on body structures, body functions, activity and participation, while incorporating contextual factors such as environmental and personal factors, hence taking a biopsychosocial approach. Participation has been defined as involvement in a

life situation and offers a good conceptual basis for measuring psychosocial outcomes after TBI (Dahl, 2002).

Two forms of the instrument exist, Form A which measures change since injury, and Form B, which measures current competency. Since the current study is a program evaluation, Form B was used, as it would provide data at two points in time for comparison. There are three response formats for the scale; clinician ratings, informant ratings and self-ratings. The authors advise against the latter if the injured person experiences significant cognitive impairments (especially those involving memory, insight and judgement) that could compromise the validity of the responses (Tate et al., 2007).

The SPRS begins with a 15 item background interview, which was not used in the current study as similar items were already included in the background initial interview specifically drawn up for this study. The 12 items of the scale falls under the three domains of functioning: Occupational Activities (OA), Interpersonal Relationships (IR), and Independent Living Skills (IL), with four items under each domain.

SPRS has undergone considerable revision since it was first published. In the initial version a 7-point rating scale was used to indicate change since injury or current competence. SPRS-2, which the current study used, includes a 5-point rating scale. In both versions, higher scores indicate better psychosocial functioning. But in the present study, scores were reversed in order to make it similar to the first two measures, where lower scores indicate better functioning.

Excellent psychometric properties of both forms of the initial version of SPRS have been reported. A study establishing the psychometric properties of the Form B found high internal consistency (Cronbach's alpha coefficient = .90) and high inter-rater reliability (Intra Class Correlation [ICC] = .84) (Tate, Pfaff, Veerabangsa, & Hodgekinson, 2004). The same study also found stability to be high (ICC = .90). There is currently no data available for the psychometric properties of the SPRS-2, but it appears that a psychometric study is currently being undertaken to formally establish the psychometric properties of the SPRS-2 (Tate et al., 2007).

Traditionally, interview methods have been used to evaluate psychosocial functioning in patients following TBI. In recent times, such tools especially designed for the TBI population have started to be used. The advantage of these tools over interview methods are that they are less time consuming, have a standardised format, and are able to be scored thus making statistical analysis possible (Tate et al., 2004).

### **Other Materials**

In addition to the main measures, further information as outlined below was sought during data collection (see Appendix A).

#### *Demographics and Background Information*

Demographic and background information at baseline was sought through the background initial interview, a semi-structured interview constructed to gather information such as demographics (age, marital status, ethnicity, occupation, income brackets), details surrounding the injury (mechanism of injury, date of injury), employment and previous head injuries. At follow-up, the background follow-up interview was used to collect information on changes since initial interview, and also

about referral and attendance at the Concussion Clinic. For those referred and had not attended, reasons for non-attendance were also investigated.

#### *Items Exploring Participants' Perceptions of their Recovery*

Four questions were asked at follow-up to assess participants' perceptions of their recovery from the concussion. The first item required the participant to rank their recovery on three levels; back to normal, mostly back to normal, or still having major problems. The second item was a recovery rating scale, where participants had to note how happy they were with their recovery, on a scale of 1 to 10 (1 being not happy at all, and 10 being most happy). The third and fourth items were open ended questions, one exploring participants' opinions on what they found the most helpful in their recovery from the concussion, and one asking participants who had attended the Concussion Clinic what they had found most helpful about the clinic.

#### ***Procedure***

The present study evaluating the Concussion Clinic incorporated a repeated measures design, where data collection occurred at two time points (see Figure 2.1). The figure also shows that the current study was designed as the second phase of a larger research project concerned with the overall aims of examining access to the service and evaluating the service. The first phase of the study looked at access to the Concussion Clinic by examining the percentage of individuals not referred from the Emergency Department at Palmerston North Hospital following an MTBI, and by investigating the demographic factors which predict a referral to the clinic from the department. This phase was named Access Study and the present study was named Evaluation Study. The procedures involved are described below in detail, including difficulties faced with the original procedure and changes brought to the design.

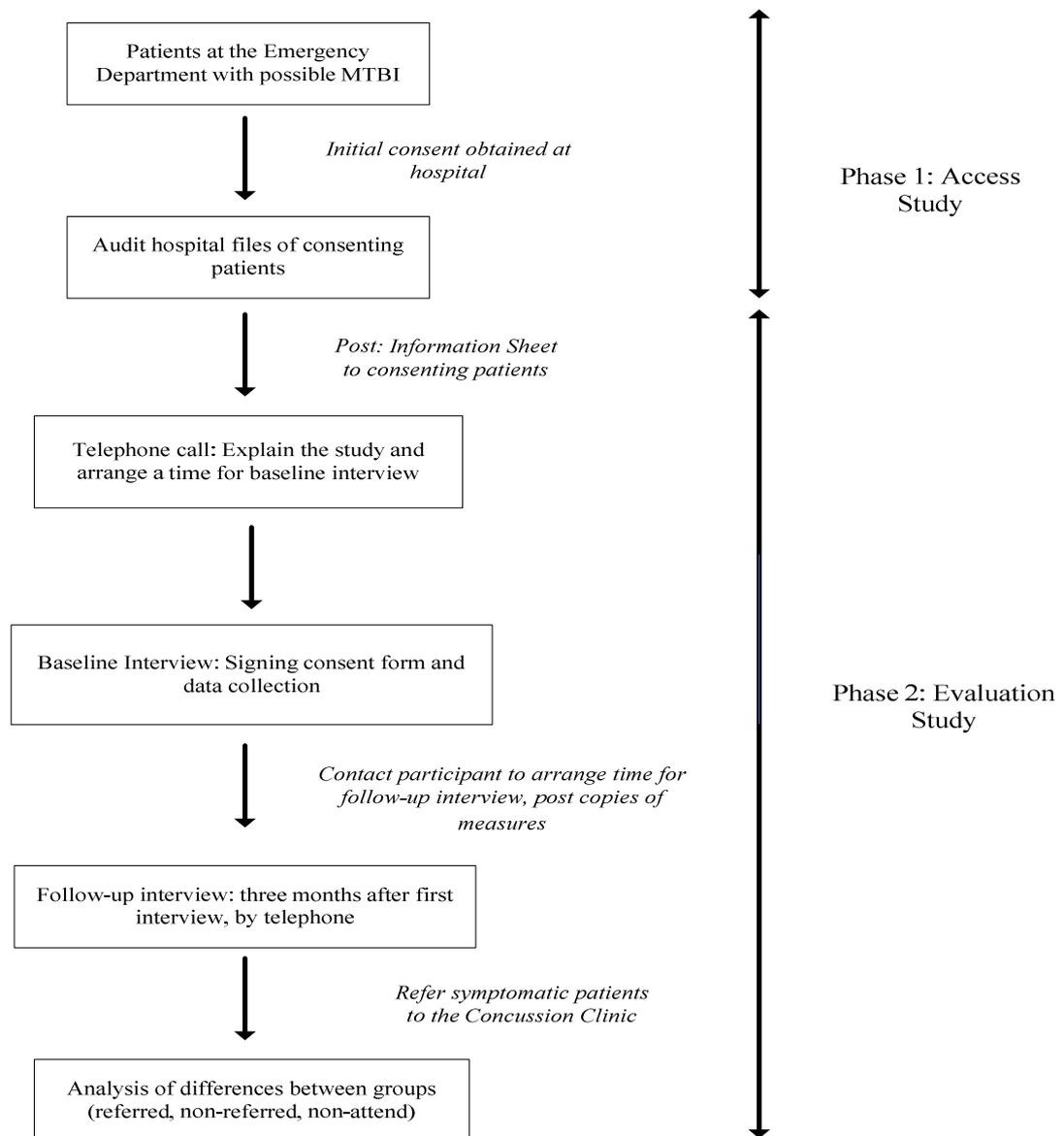


Figure 2.1. Original procedure followed for the overall project

### Obtaining Potential Participants

Consecutive presentations to Palmerston North Hospital Emergency Department whose accident description suggested likelihood of sustaining a MTBI, were approached by the departments' triage nurses with the Information Sheet for Phase 1 and Consent form for Phase 1 (see Appendix B). The information sheet outlined the objectives of the study and emphasised that by consenting to the study, the participants were allowing

access to their notes, and were giving approval to be contacted regarding involvement in Phase 2 of the research. The study was further explained to patients by the triage nurses, and the consent form attached to the patient notes whether or not they agreed to participate.

Patient notes are kept for seven days in ED before being sent to Medical Records at the hospital. The notes were checked twice a week for any consent forms received. For patients who had consented to the research, an audit of their hospital notes was carried out to obtain data for the Access Study.

Contact details obtained from the Access Study were then used to send consenting participants who fit the inclusion criteria for the Evaluation Study, the Information Sheet for Phase 2 (see Appendix B) the Massey University Turitea Campus map (with location of the Psychology Clinic marked), and clinic parking details. A follow-up telephone call was made to these prospective participants within a few days to further explain the research, answer any questions, and to check if they would like to participate. An appointment was then made with the willing participants for the baseline interview. Some participants opted to be interviewed by telephone, in which case a time was arranged and copies of questionnaires posted to them prior to the interview to guide them through the items. The Consent Form for Phase 2 (see Appendix B) was also included along with a return postage paid envelope.

### **Baseline Interview**

Twenty six participants attended the baseline interview at the Psychology Clinic. Prior to beginning the interview, written consent was obtained. Background information was then gathered through the Background Initial Interview. Participants were then asked to

complete the main measures, at completion of which they were given a \$10 MTA voucher as promised in the Information Sheet as compensation for their travel to Massey University campus for the research.

Thirteen participants who elected to have the initial interview by phone (usually due to travel difficulties) were contacted at the arranged time, and consent obtained before beginning the interview. They were requested to post back the signed Consent Form in the envelope provided. Background information and responses to the measures were then gathered. Participants were sent copies of the RPQ and SPRS-2 to guide them through the items on these measures. Due to copyright issues, a copy of HADS was unable to be sent, and therefore the items on this measure were read out for the participants.

The average number of days between obtaining contact information for participants (from the Emergency Department or the Concussion Clinic) and the baseline measurement was 14 days ( $SD = 7.51$ ; range 2-36). The baseline was conducted at a mean of 37.5 days after injury. For the participants recruited from the ED, the average was 14.33 days ( $SD = 7.44$ ; range 8-32). For Concussion Clinic participants, this was 52.08 ( $SD = 42.51$ ; range 10-166).

### **Follow-up Interview**

Three months after the baseline interview, phone contact was made with participants to arrange a time for the follow-up telephone interview. To ensure that a high percentage of follow-up was achieved, every attempt was made to get in touch with the participants, for example by calling after hours, calling on weekends as well as making several calls. For those who were reached, a time was arranged and copies of

questionnaires were posted. For the participants who were unable to be reached after several attempts, a letter was sent reminding them of the follow-up interview, with a request to make contact (contact numbers provided). Along with the letter, they were provided with a form on which they could indicate a suitable date and time for follow-up, a return envelope and copies of questionnaires.

Thirty three follow-up interviews were then conducted by phone at the arranged dates and times. The mean number of days between baseline and follow-up was 101 days (between 3 to 4 months), while the mean duration since injury to follow-up was 128 days. The follow-up included collecting information on changes to their situation through the background follow-up interview, the three questionnaires RPQ, HADS, and SPRS-2, and recording responses for the questions exploring participants' perceptions of their recovery. Two follow-ups were conducted face-to-face for practical reasons. For one person this was due to a hearing impairment and for the other person this option was more convenient.

At follow-up interview, permission was obtained from participants who were still reporting moderate to severe scores, to share the information with the Concussion Clinic to enable intervention. Those who were still experiencing mild symptoms on the RPQ (items rated 2) were advised to consult their GP or ACC case manager if they were concerned or if problems persist.

### **Difficulties with Recruitment under the Original Procedure**

Difficulties encountered with obtaining participants from Palmerston North Hospital Emergency Department resulted in lower rates of recruitment into the project, which as a flow-on effect restricted the number of potential participants who can be approached

for the current study. The following reasons could have contributed to the low rate of recruitment.

1. Potential participants presenting with a head injury were frequently too dazed to read the information sheet at the time of their presentation to the department.
2. Many potential participants appeared not to have been offered the opportunity to participate. This was deducted from the discrepancy between the number of presentations which involved accident histories indicating a possible MTBI and the number of consent forms received (either agreeing to participate or declining). This could have been due to:
  - a) a high workload for triage nurses at time of the patient presentations therefore not getting the opportunity to provide the potential participants with the study materials,
  - b) some nurses not being aware of the study procedures, although every attempt was made to inform and remind all triaging nurses of the study through communication by the Charge Nurse, and by regular contact with the department receptionists,
  - c) filtering of potential participants by the department staff resulting in suitable participants not being approached for the study, based on whether they thought the patient had suffered a MTBI.

### **Changes to the Design**

Due to the low recruitment faced at the Emergency Department, a decision was made to separate the two phases of the project. The Access Study was carried out as an internal audit, so that the need for triaging nurses to recruit participants was eliminated. There were no further associations of this study with the current evaluation study.

To improve recruitment into the current study, a change to the original procedure was made, whereby clients referred to the Concussion Clinic from all sources were to be approached. Names and contact details of clients referred to the Concussion Clinic from any source on the waiting list for assessment were obtained from the Concussion Clinic Administrator. They were then sent a slightly modified Information Sheet (see Appendix B) and contacted by phone to ascertain their willingness to participate in the research. For those who agreed, the procedure was followed as described earlier, with the baseline data being collected before their assessment at the clinic. These participants included seventeen individuals referred to the service from the Palmerston North Hospital, two individuals referred via their GP, and five referred by ACC for an assessment.

### Data Collection Durations

Figure 2.2 shows the time taken for recruitment of participants and collection of baseline and follow-up data.

	Jun 08	Jul 08	Aug 08	Sep 08	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09
Recruitment and baseline data:									
Initial procedure (from the Emergency Department)	■								
Revised procedure (from the Concussion Clinic) :			■						
Follow-up:				■					

*Figure 2.2.* Summary of data collection durations

### *Ethical Considerations*

Ethical approval for the project was granted by the Central Regional Ethics Committee of the Health and Disability Ethics Committee, protocol CEN/08/04/017. A Locality Assessment was completed by the Palmerston North Hospital Emergency Department's Clinical Director as evidence that appropriate local study arrangements had been made. Subsequent variations to the design were also approved by the Central Regional Ethics Committee.

Participants were recruited under voluntary participation with informed consent. The Information Sheet for the current study focused on aims of the study, explaining what happens during the study, and issues of confidentiality. Confidentiality was to be maintained during data collection and analysis by recording subject numbers instead of participant names. In addition, only grouped data were to be used in the analysis to avoid individuals being identified.

Ethical issues which could arise from the study were discussed and addressed. One such issue was if during the course of the study, severe problems such as suicidality, and significant cognitive disturbances were uncovered in participants involved, the crisis team at the Community Mental Health Service were to be informed for intervention. Another issue was if participants were still considerably symptomatic at follow-up, arrangements were to be made for referral to the Concussion Clinic for an assessment, through discussion with the Project Supervisor. Participants' permission was to be first obtained before their information could be discussed.

## Chapter 3: Results

Participant data were processed using the Statistical Package for the Social Sciences Software (SPSS Version 15). Data was screened for accuracy of coding and missing values prior to analyses. For consistency in direction of scores, the scoring on the measure SPRS-2 was reversed. Statistical analyses included independent samples t-tests and split-plot Analyses of Variance (SPANOVA) procedures. An alpha level of .05 was used for all statistical tests.

### *Data Screening*

#### **Missing Values**

Due to the small number of participants in the study, missing values on specific measures were replaced with group means to allow inclusion of all cases into the analyses. The techniques pairwise deletion or listwise deletion were not utilised as they both result in reduction of sample size, consequently reducing the power of statistical significance testing (Cool, 2000). Missing values can be estimated by using the mean for the condition or by using the overall mean in situations where sample sizes are unequal in between-subjects designs (Clark-Carter, 2004). Using the overall sample mean for missing values can be problematic as it reduces sample variability (de Vaus, 2002). The group means approach utilised for this study, although overcoming this problem of reducing sample variability, has the limitation that it can exaggerate the extent to which people in a group are similar to one another (de Vaus, 2002).

Apart from two missing values on RPQ items at baseline, the majority of missing values were present on SPRS-2 items at both baseline and at follow-up. The items

affected include the first two items on the Occupational Activities domain (Work and Work skills), and the first two items on the Interpersonal Relationships (IR) domain (Relationship with spouse, relationship with family). The reasons behind missing values for the Work and Work skills items were that the participants were either retired, or currently unemployed, making these items not applicable for them. For the Interpersonal Relationship items, the reasons for not answering included not wishing to answer, not looking for a relationship (older adults), and not having any family.

### ***Primary Research Questions***

**Research Question 1: Are there initial differences in the responses to the measures between the groups?**

#### *Descriptive Statistics*

Table 3.1 shows the descriptive statistics of scores on the four dependent variables for the three groups, referred ( $n = 22$ ), non-referred ( $n = 11$ ), and non-attend ( $n = 6$ ) at baseline.

#### *Post Concussion Symptoms*

Table 3.1 shows that mean post concussion symptoms at baseline for the referred group and the non-attend group were higher than the mean score of the non-referred group. The range of symptoms reported for the non-referred group was smaller than for the other two groups; 0-28 compared with 0-56 for the referred and non-attend groups.

Table 3.1

*Descriptive Statistics of Scores on the Dependent Variables for the three groups at Baseline*

Variables	Group	<i>M (SD)</i>	<i>Range</i>
Post Concussion	Referred <sup>a</sup>	18.91 (18.16)	0-56
Symptoms	Non-referred <sup>b</sup>	12.45 (10.56)	0-28
	Non-attend <sup>c</sup>	24.17 (24.32)	0-56
Anxiety	Referred <sup>a</sup>	7.27 (4.82)	0-18
	Non-referred <sup>b</sup>	5.36 (3.59)	1-13
	Non-attend <sup>c</sup>	7.67 (8.64)	0-19
Depression	Referred <sup>a</sup>	5.59 (4.21)	0-14
	Non-referred <sup>b</sup>	2.27 (2.05)	0-6
	Non-attend <sup>c</sup>	4.83 (6.37)	0-13
Psychosocial	Referred <sup>a</sup>	7.87 (6.12)	0-23
Functioning	Non-referred <sup>b</sup>	4.19 (3.53)	0-12
	Non-attend <sup>c</sup>	9.12 (10.48)	0-26

*Note.* <sup>a</sup>*n* = 22, <sup>b</sup>*n* = 11, <sup>c</sup>*n* = 6

#### *Anxiety and Depression*

Table 3.1 shows that the referred and non-attend groups reported higher anxiety and depression compared to the non-referred group. The non-referred group also reported a lower range of symptoms compared to the other groups. In addition, it was found that all groups reported higher levels of anxiety compared to depression.

Using the clinical cut off categories of the HADS (see Table 3.2), it appeared that the majority of individuals in all the groups fell within the normal category for both anxiety

and depression, with all participants in the non-referred group reporting depression scores in the normal range. One individual in the referred group and two individuals in the non-attend group reported severe anxiety. No individuals reported severe depression in any group.

Table 3.2

*Frequencies of cases falling within cut off scores as measured by the HADS at Baseline: Anxiety and Depression*

Variables	Group	Normal (n)	Mild (n)	Moderate (n)	Severe (n)
		(0-7)	(8-10)	(11-14)	(15-21)
Anxiety	Referred <sup>a</sup>	13	1	7	1
	Non-referred <sup>b</sup>	7	3	1	0
	Non-attend <sup>c</sup>	4	0	0	2
Depression	Referred <sup>a</sup>	13	7	2	0
	Non-referred <sup>b</sup>	11	0	0	0
	Non-attend <sup>c</sup>	4	0	2	0

Note. <sup>a</sup>n = 22, <sup>b</sup>n = 11, <sup>c</sup>n = 6

### Psychosocial Functioning

Table 3.1 shows that the non-referred group performed better than the referred and the non-attend groups on overall psychosocial functioning. The range of scores was also lower for the non-referred group compared to the other groups.

The group means for the domains of SPRS-2 were also compared and are shown in Table 3.3. The non-referred group performed better across the three domains compared

to the other groups. Furthermore, higher scores were reported for the Occupational Activity (OA) domain compared to the other domains.

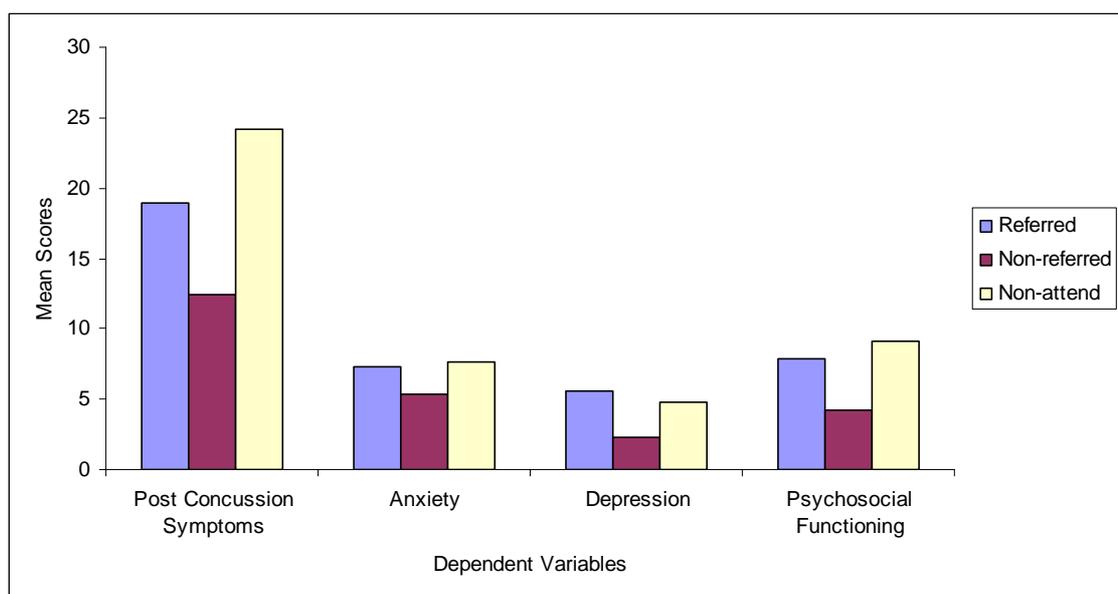
Table 3.3

*Means for the Domains of the SPRS-2 for the three groups at Baseline*

Group	Occupational Activity (OA)	Interpersonal Relationships (IR)	Independent Living Skills (IL)	Total score SPRS-2
Referred <sup>a</sup>	5.02	1.71	1.14	7.87
Non-referred <sup>b</sup>	2.7	0.94	0.55	4.19
Non-attend <sup>c</sup>	3.67	2.62	2.83	9.12

*Note.* <sup>a</sup> $n = 22$ , <sup>b</sup> $n = 11$ , <sup>c</sup> $n = 6$

In summary, the descriptive statistics at baseline for the three groups indicate that the scores on the dependent variables were higher for the referred and the non-attend groups, compared to the non-referred group, indicating better functioning of the non-referred participants at baseline. This trend can be seen in Figure 3.1.



*Figure 3.1.* Mean scores on the dependent variables at baseline for the three groups

### *Inferential Statistics*

For the purposes of statistical significance testing, due to the low number of participants in the non-referred and non-attend groups, these groups were combined to form the control or the non-intervention group ( $n = 17$ ). The referred group was named the Intervention group ( $n = 22$ ).

Table 3.4 shows the means and standard deviations for scores on each dependent variable for the intervention and control group. Overall, the means for the intervention group were higher on all dependent variables compared to the control group. A series of t-tests were conducted to examine whether these differences were statistically significant.

Prior to conducting the t-tests, the scores were checked to see if they fulfilled the assumptions of carrying out a t-test. These include checking for normality and homogeneity of variance. Testing for normality was done by computing the Kolomogorov-Smirnov statistic (Pallant, 2007), for baseline scores for each group across each dependent variable. From the eight scores checked, three scores corresponded to a statistic less than .05, meaning that the assumption of normality were violated in these cases. The Levene's Test for equality of error variances performed across the scores were not significant ( $p > .05$ ), suggesting that the homogeneity of variance assumption was not violated. As for the violation of the normality assumption, Pallant (2007) emphasise that scores on dependent variables often do not form a normal distribution, particularly in the social sciences. In addition, de Vaus (2002) posits that statistical experimentation has shown that violating the normality assumptions of tests has less severe effects on results than previously believed. Hence, in the current study,

although non-normal distributions were obtained, it was deemed appropriate to continue analyses with the parametric method.

After checking for assumptions, four t-tests were carried out, one for each dependent variable. None of the tests resulted in a significant difference being detected between the scores of the intervention and control group for post concussion symptoms, anxiety, depression and psychosocial functioning.

Table 3.4

*Means on the Dependent Variables at Baseline compared for the t-tests*

Variables	Group	<i>M</i>	<i>SD</i>
Post Concussion Symptoms	Intervention <sup>a</sup>	18.91	18.16
	Control <sup>b</sup>	16.59	16.96
Anxiety	Intervention <sup>a</sup>	7.27	4.82
	Control <sup>b</sup>	6.18	5.71
Depression	Intervention <sup>a</sup>	5.59	4.21
	Control <sup>b</sup>	3.18	4.11
Psychosocial Functioning	Intervention <sup>a</sup>	7.87	6.11
	Control <sup>b</sup>	5.93	6.93

*Note.* <sup>a</sup>*n* = 22, <sup>b</sup>*n* = 17

**Research Question 2: What are the changes within and between the groups over the period of three months?**

*Descriptive Statistics*

Table 3.5 shows the descriptive statistics of scores on the four dependent variables for the three groups, referred, ( $n = 20$ ), non-referred ( $n = 11$ ), and non-attend ( $n = 4$ ) at follow-up. Two participants from the referred group and two from the non-attend group were unable to be followed up.

Table 3.5

*Descriptive Statistics of Scores on the Dependent Variables for the three groups at Follow-up*

Variables	Group	<i>M (SD)</i>	<i>Range</i>
Post Concussion Symptoms	Referred <sup>a</sup>	9.30 (10.37)	0-35
	Non-referred <sup>b</sup>	7.09 (10.05)	0-28
	Non-attend <sup>c</sup>	28.25 (23.89)	0-50
Anxiety	Referred <sup>a</sup>	4.60 (3.66)	0-11
	Non-referred <sup>b</sup>	4.91 (3.65)	1-12
	Non-attend <sup>c</sup>	11.50 (6.46)	3-17
Depression	Referred <sup>a</sup>	3.30 (3.20)	0-9
	Non-referred <sup>b</sup>	2.18 (1.99)	0-6
	Non-attend <sup>c</sup>	9.50 (7.19)	0-16
Psychosocial Functioning	Referred <sup>a</sup>	4.58 (4.68)	0-16
	Non-referred <sup>b</sup>	2.58 (2.05)	0-6
	Non-attend <sup>c</sup>	12.48 (12.02)	0-27

*Note.* <sup>a</sup> $n = 20$ , <sup>b</sup> $n = 11$ , <sup>c</sup> $n = 4$

### Post Concussion Symptoms

Table 3.5 shows that mean post concussion symptoms scores at follow-up for the referred group and the non-referred group were lower than the mean score of the non-attend group. The highest score was also reported from the non-attend group, where the maximum score was 50, compared to 35 and 28 in the referred and non-referred groups.

### Anxiety and Depression

Tables 3.5 shows that the non-attend group reported more anxiety and depression compared to the referred and the non-referred group at follow-up. Also, the non-attend group had the highest maximum score for both anxiety and depression.

Using the clinical cut off categories of the HADS (see Table 3.6), it appeared that the majority of individuals in the referred and the non-referred group reported anxiety in the normal range. Two individuals in the non-attend group reported severe anxiety. For depression, the majority of participants in the referred group and all participants in the non-referred group were in the normal range. One individual reported severe depression in the non-attend group.

### Psychosocial Functioning

Table 3.5 shows that the referred and the non-referred group performed better than the non-attend group on overall psychosocial functioning at follow-up. The non-attend group also reported the highest maximum score among the three groups. Table 3.7 shows the group means on the domains of SPRS-2, which shows that the non-attend group was performing poorly across the domains compared to the other groups.

Table 3.6

*Frequencies of cases falling within cut off scores as measured by the HADS at Follow-up: Anxiety and Depression*

Variable	Group	Normal (n)	Mild (n)	Moderate (n)	Severe (n)
		(0-7)	(8-10)	(11-14)	(15-21)
Anxiety	Referred <sup>a</sup>	15	4	1	0
	Non-referred <sup>b</sup>	9	1	1	0
	Non-attend <sup>c</sup>	1	1	0	2
Depression	Referred <sup>a</sup>	17	3	0	0
	Non-referred <sup>b</sup>	11	0	0	0
	Non-attend <sup>c</sup>	1	1	1	1

*Note.* <sup>a</sup>*n* = 20, <sup>b</sup>*n* = 11, <sup>c</sup>*n* = 4

Table 3.7

*Means for the Domains of the SPRS-2 for the three groups at Follow-up*

Group	Occupational	Interpersonal	Independent Living	Total score
	Activity (OA)	Relationships (IR)	Skills (IL)	SPRS-2
Referred <sup>a</sup>	2.49	1.19	0.9	4.58
Non-referred <sup>b</sup>	0.96	1.07	0.55	2.58
Non-attend <sup>c</sup>	4.39	4.34	3.75	12.48

*Note.* <sup>a</sup>*n* = 20, <sup>b</sup>*n* = 11, <sup>c</sup>*n* = 4

In summary, the descriptive statistics indicate that the non-attend group seem to be functioning at a lower level across the dependent variables than the referred and non-referred groups at follow-up. This trend can be seen in Figure 3.2.

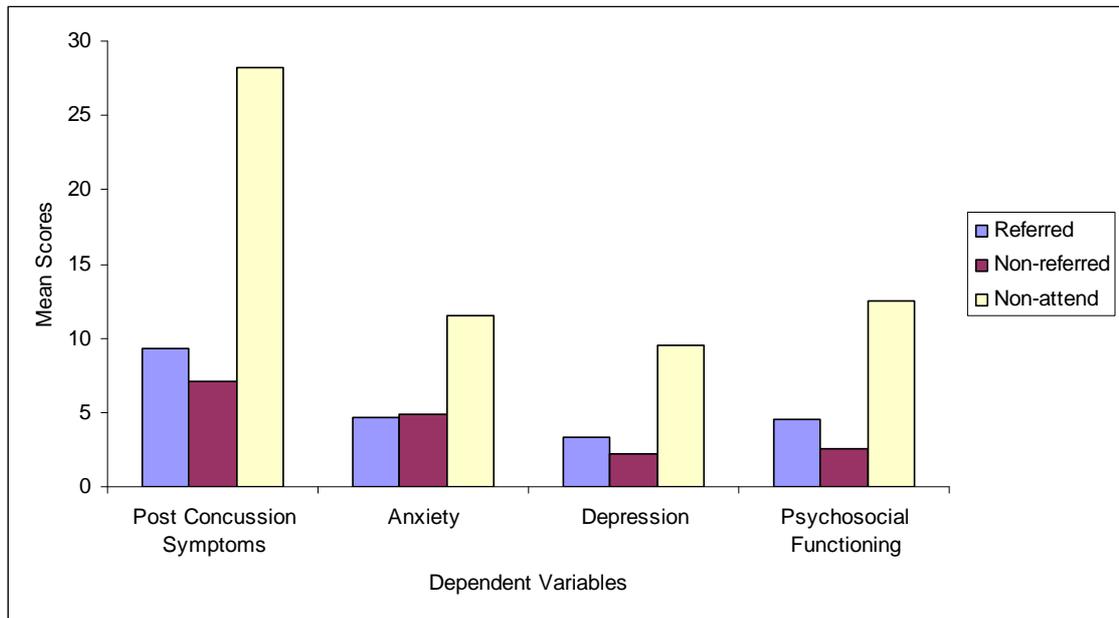


Figure 3.2. Mean scores on the dependent variables at follow-up for the three groups

### *Inferential Statistics*

Table 3.8 shows the descriptive statistics of the dependent variables scores for the intervention ( $n = 20$ ) and control group ( $n = 15$ ) at baseline and follow-up. To statistically analyse the differences between the means, a series of 2 x 2 (group x time) split-plot analyses of variance (SPANOVA) procedures were conducted. In the current study, the two independent variables were the time of measurement (baseline and follow-up) as the within subjects variable and the group (intervention and control) as the between-subjects variable. Four SPANOVAs were conducted in the current study, one for each dependent variable.

Table 3.8

*Descriptive Statistics of Scores on Dependent Variables used for SPANOVA procedures*

Variables	Group	Time	<i>M</i>	<i>SD</i>
Post Concussion Symptoms	Intervention <sup>a</sup>	Baseline	20.30	18.49
		Follow-up	9.30	10.37
	Control <sup>b</sup>	Baseline	17.4	17.68
		Follow-up	12.73	16.98
Anxiety	Intervention <sup>a</sup>	Baseline	7.95	4.51
		Follow-up	4.60	3.66
	Control <sup>b</sup>	Baseline	6.80	5.80
		Follow-up	6.67	5.24
Depression	Intervention <sup>a</sup>	Baseline	6.10	4.06
		Follow-up	3.30	3.19
	Control <sup>b</sup>	Baseline	3.53	4.26
		Follow-up	4.13	5.01
Psychosocial Functioning	Intervention <sup>a</sup>	Baseline	8.44	6.12
		Follow-up	4.58	4.61
	Control <sup>b</sup>	Baseline	6.47	7.19
		Follow-up	5.22	7.38

*Note.* <sup>a</sup>*n* = 20, <sup>b</sup>*n* = 15

The SPANOVA tests for main effects for each of the independent variables and tests for significance of the interaction between these two variables (Pallant, 2007). The main effect for time tested whether the scores on the dependent variables differed

significantly from baseline to follow-up. The main effect for group tested whether there were any significant differences between the intervention group and the control group on the dependent variables. The interaction effect tested whether the change in scores on the dependent variables over time is different between the intervention and control groups.

Effect sizes were calculated using the partial eta squared statistic (partial  $\eta^2$ ). This statistic points to the proportion of variance of the dependent variable that is explained by the independent variable (Pallant, 2007). To interpret the strength of the effect, the guidelines proposed by Cohen (1988, cited in Pallant, 2007) was used, where .01 indicates a small effect, .06 a medium effect, and .14 indicates a large effect.

Prior to conducting each analysis, the assumptions underlying the SPANOVA were tested. These assumptions include normality, homogeneity of variance, and a further assumption specific for these analyses, the homogeneity of intercorrelations (Coakes, Steed, & Price, 2008). Testing for normality was done by computing the Kolomogorov-Smirnov statistic (Pallant, 2007), for baseline and follow-up scores for each group across each dependent variable. Almost half of the scores corresponded to a statistic less than .05, meaning that the assumption of normality was not met in these cases.

Following this, the Levene's Test for equality of error variances was performed across the scores for both baseline and follow-up, all of which were not significant ( $p > .05$ ), meaning that this assumption was not violated. Lastly, the Box's M statistic was conducted to test the homogeneity of intercorrelations assumption. A more conservative alpha level of .001 was used as recommended (Pallant, 2007). This

assumption was met for all the scores being subjected to the SPANOVAs, with the alpha levels being greater than .001. In summary, apart from the normality assumption, all other relevant assumptions were met for the SPANOVAs. Care should be taken when interpreting the results due to this violation of the normality assumption, and also due to the unequal sample sizes of the groups being compared. The results of the SPANOVAs are described below under each dependent variable.

### *Post Concussion Symptoms*

Table 3.9 shows that there was a statistically significant and large effect for time,  $F(1,33) = 12.52, p = .001, \text{partial Eta}^2 = .28$ . This indicates that the post concussion symptoms scores did change significantly from baseline to follow-up. There was no significant main effect for group for post concussion symptoms scores indicating that post concussion symptoms scores for the two groups did not differ significantly. Lastly, no interaction effect was found between time and group,  $F(1,33) = 2.05, p = .162, \text{partial Eta}^2 = .06$ . It is worth noting that although the interaction was non-significant, the effect size was medium for the interaction. Figure 3.3 shows reductions in post concussion symptoms scores from baseline to follow-up for both the intervention and control groups. The interaction between time and group is depicted here, where at baseline the intervention group had a higher score in comparison to the control group, and at follow-up, this group reported a lower post concussion symptom score compared to the control group.

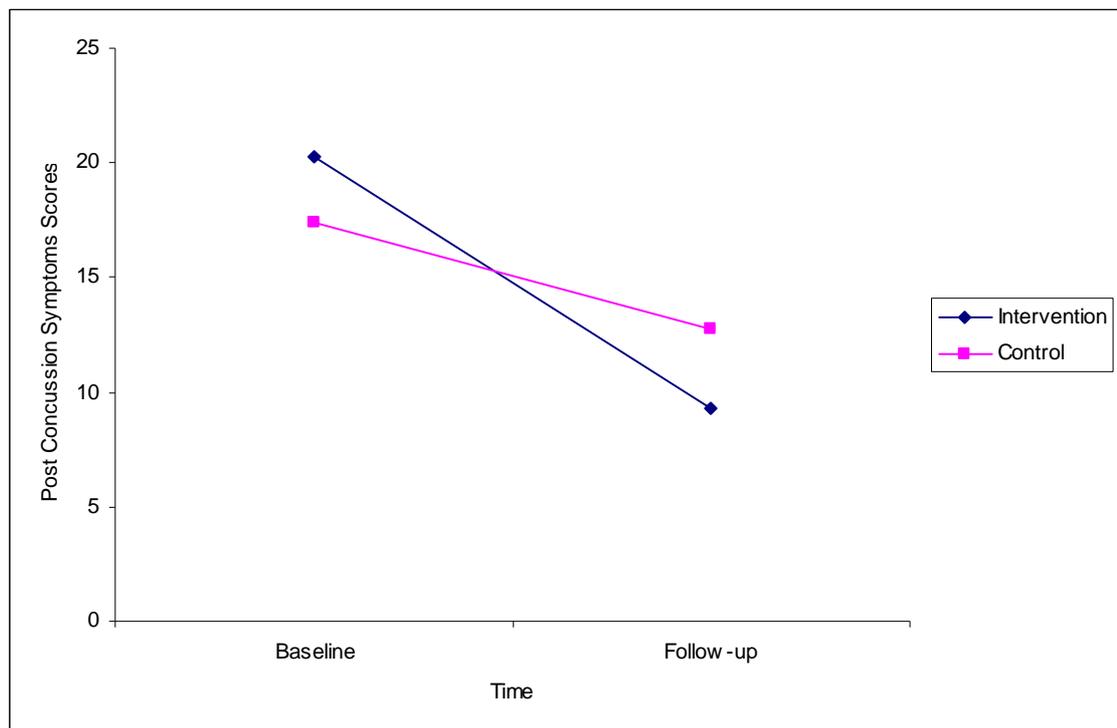
Table 3.9

*Split Plot Analysis of Variance of Post Concussion Symptoms Scores for Intervention and Control Participants*

Source	<i>F</i>	<i>p</i>	Partial Eta <sup>2</sup>
Time	12.52	.001*	.28
Group	0.003	.96	.000
Time x group	2.05	.16	.06

*Note.* Hypothesis *df* = 1 and error *df* = 33

\**p* < .05.



*Figure 3.3.* Post concussion symptoms mean scores at baseline and follow-up for intervention and control participants

### Anxiety and Depression

Table 3.10 shows that there was a significant effect observed for time for the anxiety scores,  $F(1,33) = 7.27$ ,  $p = .011$ , partial  $\text{Eta}^2 = .18$ , indicating a strong and significant difference between anxiety scores from baseline to follow-up. There was no significant main effect for group to be found, however, a statistically significant effect was found between time and group for the anxiety scores,  $F(1,33) = 6.20$ ,  $p = .018$ , partial  $\text{Eta}^2 = .16$ . Figure 3.4 shows that anxiety score significantly decreased for the intervention group only. In addition, the intervention group reported a lower anxiety score at follow-up compared to the control group.

Table 3.11 shows that the SPANOVA conducted for the depression scores did not yield a significant result for the time effect,  $F(1,33) = 4.09$ ,  $p = .051$ , partial  $\text{Eta}^2 = .11$ . Of note is that the  $p$  value obtained was very close to reaching significance, and that a medium-sized effect was observed for this result. There was no significant effect observed for group. However, the interaction effect for the depression scores was found to be significant,  $F(1,33) = 9.77$ ,  $p = .004$ , partial  $\text{Eta}^2 = .23$ . Figure 3.5 shows the shape of this interaction. The significant reduction in the depression score for the intervention group from a higher baseline to a lower follow-up is contrasted with little change for the control group.

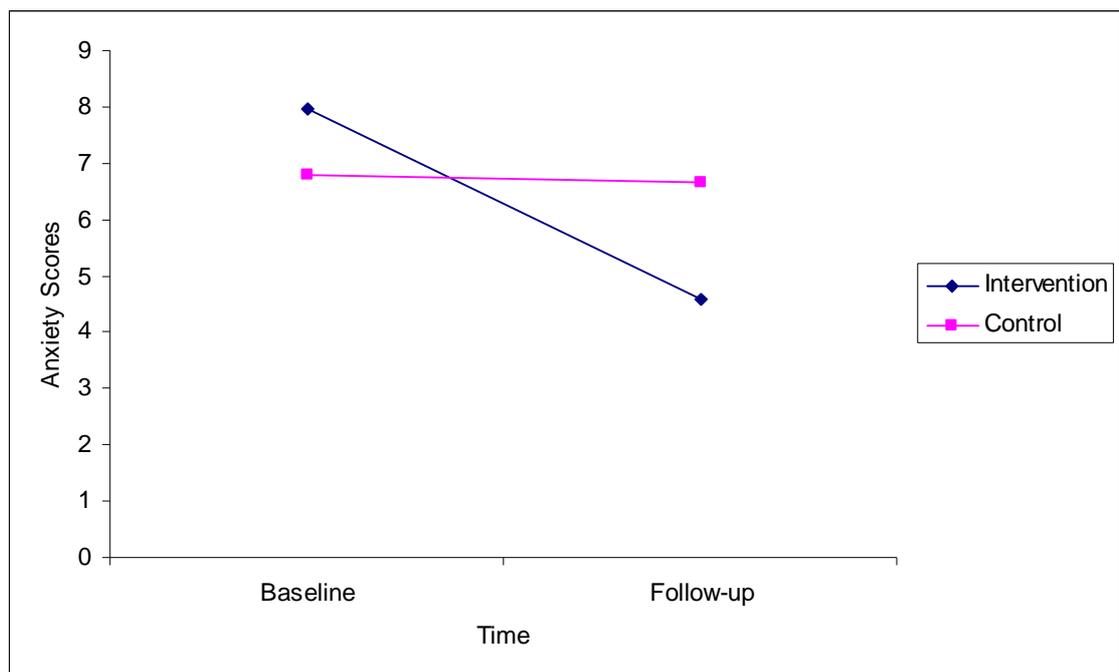
Table 3.10

*Split Plot Analysis of Variance of Anxiety Scores for Intervention and Control**Participants*

Source	<i>F</i>	<i>p</i>	Partial Eta <sup>2</sup>
Time	7.27	.011*	.18
Group	0.09	.76	.003
Time x group	6.20	.018*	.16

*Note.* Hypothesis *df* = 1 and error *df* = 33

\**p* < .05.



*Figure 3.4.* Anxiety mean scores at baseline and follow-up for intervention and control participants

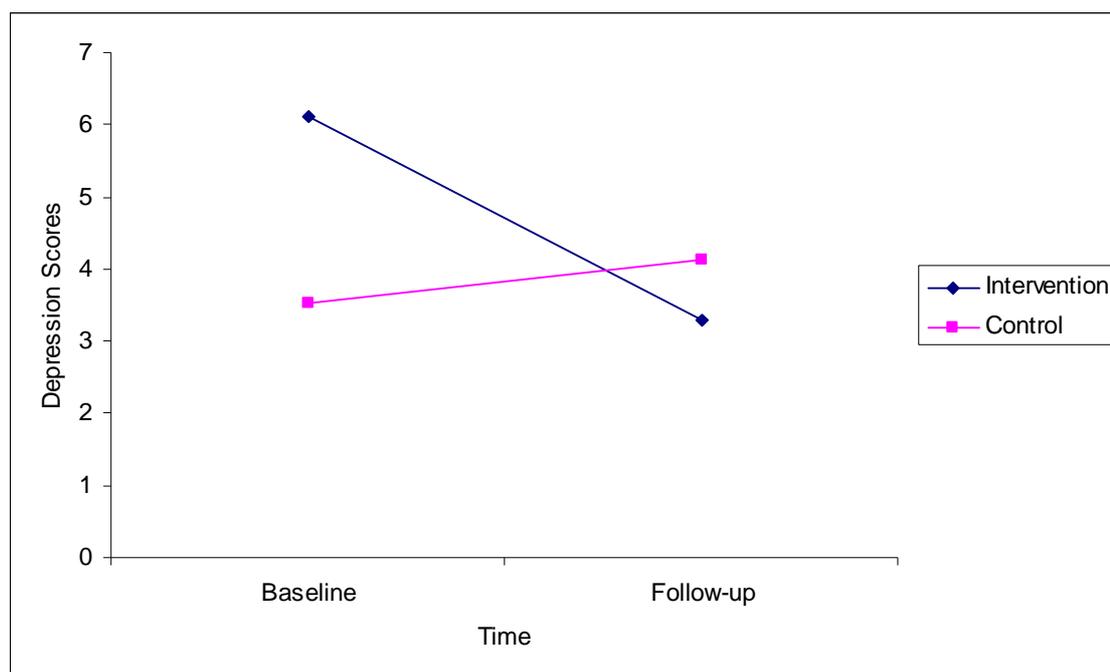
Table 3.11

*Split Plot Analysis of Variance of Depression Scores for Intervention and Control**Participants*

Source	<i>F</i>	<i>p</i>	Partial Eta <sup>2</sup>
Time	4.09	.051	.11
Group	0.45	.51	.01
Time x group	9.77	.004*	.23

*Note.* Hypothesis *df* = 1 and error *df* = 33

\**p* < .05.



*Figure 3.5.* Depression mean scores at baseline and follow-up for intervention and control participants

*Psychosocial Functioning*

Table 3.12 shows that there was a significant effect for time,  $F(1,33) = 6.81, p = .014$ , partial  $\text{Eta}^2 = .17$ , for scores on psychosocial functioning. However, a significant main effect was not found for the group. In addition, a significant interaction for scores on psychosocial functioning was not found  $F(1,33) = 1.76, p = .19$ , partial  $\text{Eta}^2 = .051$ , although a medium-sized effect was observed for this result. Figure 3.6 shows that while the psychosocial functioning scores decreased over time for both groups, the intervention group which had a higher score at baseline reported a much lower score at follow-up indicating better psychosocial functioning and more improvement than the control group.

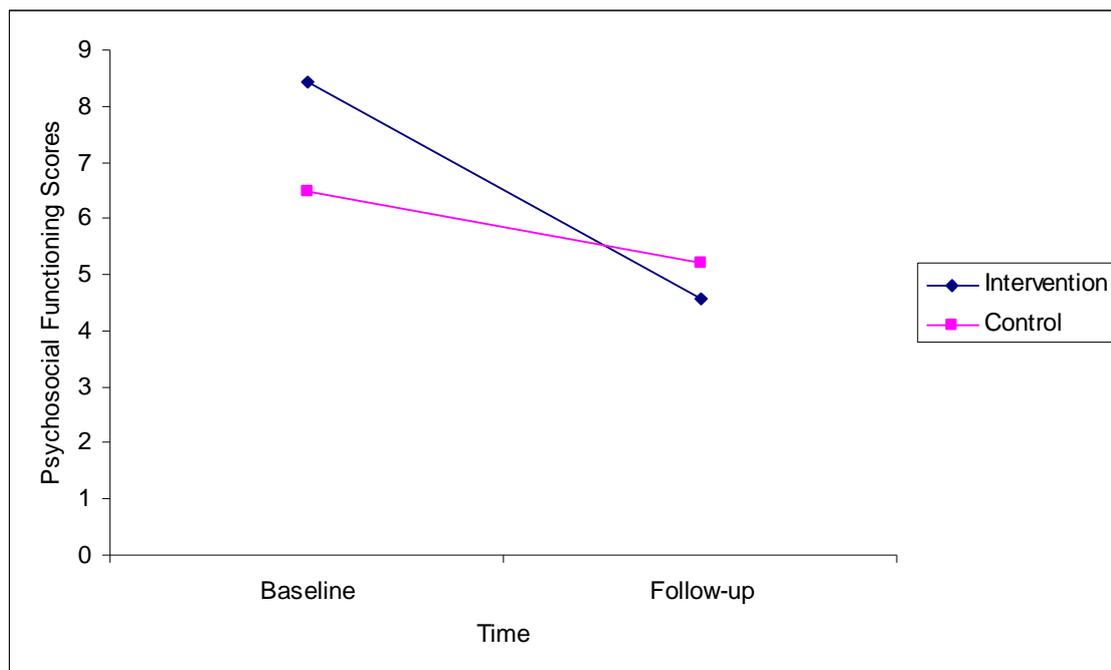
Table 3.12

*Split Plot Analysis of Variance of Psychosocial Functioning Scores for the Intervention and Control Participants*

Source	<i>F</i>	<i>p</i>	Partial $\text{Eta}^2$
Time	6.81	.014*	.17
Group	0.12	.73	.004
Time x group	1.76	.19	.051

*Note.* Hypothesis  $df = 1$  and error  $df = 33$

\* $p < .05$ .



*Figure 3.6.* Psychosocial functioning mean scores at baseline and follow-up for intervention and control participants

In summary, main effects for time were observed for all dependent variables except depression, which was also very close to reaching significance. No main effects were observed for groups across the measures. Interaction effects were significant for anxiety and depression.

### ***Secondary Research Questions***

#### **Research Question 3: What are the reasons for non-attendance for those referred to the Concussion Clinic?**

From the six participants who were referred to the Concussion Clinic but failed to attend the initial appointment, four were able to be followed up at three months.

Information regarding the reason for non-attendance was gathered by means of an open ended question during the follow-up interview. Two participants reported that

they did not attend because they had difficulties getting to the clinic; mainly issues with transportation, inferred from the statements “difficulties with getting transport to the clinic”, “trouble getting to the clinic for the appointment”; “transportation”. From the remaining two participants, one reported “did not need to attend”, while the other stated “was too busy at the time to come”.

#### **Research Question 4: What are participants’ perceptions of their recovery?**

In response to the first item exploring participants’ perception of their recovery, Table 3.13 shows that 48.6% of the sample felt that they were back to normal, while 42.9% felt mostly back to normal. Three individuals reported still having major problems, one belonging to the non-referred group, and two to the non-attend group. When results were considered individually for each group, it appeared that a large proportion of individuals reported being mostly back to normal (60%) in the referred group. In the non-referred group, most individuals reported being back to normal (63.3%).

Table 3.13

#### *Participant Responses in the three groups to the Recovery Ranking Question*

Group	Back to normal ( <i>n</i> ) %	Mostly back to normal ( <i>n</i> ) %	Still have major problems ( <i>n</i> ) %
Referred	8 (40%)	12 (60%)	0
Non-referred	7 (63.6%)	3 (27.3%)	1 (9.1%)
Non-attend	2 (50%)	0	2 (50%)
Total	17 (48.6%)	15 (42.9%)	3 (8.5%)

When participants were asked about how happy they were with their recovery from the concussion, a number of individuals ( $n = 14$ ) reported a score of 10, as being most happy with their recovery (41.2%). A further 15 individuals reported a score between 7 and 9 (44.1%). Five individuals reported ratings of 6 and below (14.6%). For the individual groups, 85% of the participants in the referred group and 90% of those in the non-referred group reported ratings equal to 7 and above.

When participants' opinion was sought on what they found the most helpful in their recovery from the concussion, they noted the benefits of resting, taking time, slowing down, being patient, having small goals, taking things easy on self and reducing work hours. Treatment and information received from the hospital was also found to be useful. Another helpful factor was support and understanding by family and friends. Apart from these factors, participants also noted the benefits of going to the Concussion Clinic, the information they had received from the clinic, understanding of the symptoms, and the reassurance provided by the clinic.

In response to the last question on participants' perception of their recovery, those who had attended the service commented on the helpful nature of the reassurance received from the clinic. Some responses also related to the therapeutic alliance, where the participants appreciated the clinic taking an interest in their welfare and checking up and being there for them. In addition, responses in which participants expressed the usefulness of doing the assessments, of explaining the difficulties they had been facing, and of being helped to recognise the issues, provided support for the clinic treatment.

Furthermore, participants noted improved awareness upon going to the clinic regarding existence of symptoms and problems. Participants also highlighted the psycho-education they had received from the clinic, such as understanding the impact of a concussion, understanding why and how it was affecting them, explaining what to expect, answering questions they had about what had happened to them, and providing them with further resources such as useful websites. Lastly, participants also appreciated the ongoing support from the clinic.

### ***Other Findings***

#### **Participants needing Intervention at Follow-up**

As was promised in the information sheet, arrangements were made to refer the participants who were still experiencing a high level of post concussion symptoms at follow-up, for a Concussion Clinic appointment. Three participants reported high levels of post concussion symptoms at follow-up. Two participants belonged to the non-attend group, whereas one participant belonged to the non-referred group.

#### **Referrals to the Concussion Clinic**

Another finding relates to the referral practices for the Concussion Clinic. The first incident explains how referrals are often not carried out by the Emergency Department following patient presentation to the service, but are later referred by others such as GPs due to ongoing problems. This was demonstrated in this study by one participant who at baseline had not been referred to the clinic by the Emergency Department, but prior to being followed up at three months, had been referred to the service by the participant's GP and had attended the appointment. This participant who had showed high symptoms at baseline had shown improvement on all measures at follow-up.

The second incident relates to missed referrals from the hospital. In this study, according to the hospital notes, one participant who had been recruited from the hospital was referred to the clinic, but the referral was never received at the clinic. This individual was still reporting high level of symptoms at three months and was one of the individuals whose information was passed onto the clinic as needing further intervention upon the follow-up research interview.

## Chapter 4: Discussion

The current study aimed to investigate the effectiveness of the Massey University Concussion Clinic, by comparing post concussion symptoms, anxiety, depression and psychosocial functioning in individuals with MTBI receiving intervention at the clinic with control participants. The study also sought to identify reasons for non-attendance for the clinic appointment, in addition to exploring participants' perceptions of their recovery from their concussion. In the following sections, findings from the study relating to these aims will be discussed. In addition, methodological and measurement issues pertaining to the current study will be pointed out followed by a discussion of the limitations and implications arising from the study. Finally, recommendations for future research will be presented, before arriving at a brief conclusion of the current investigation.

### *Primary Research Questions*

**Research Question 1: Are there initial differences in the responses to the measures between the three groups?**

Descriptive statistics at baseline indicated that there were differences between the three groups, referred, non-referred, and non-attend on level of post concussion symptoms, anxiety, depression and psychosocial functioning. Statistical testing had to be done between the two groups, intervention and control group, rather than these three groups due to the small number of participants. This depicted the differences to be non-significant.

Nevertheless, a pattern was observed across the results for all outcomes that supported expectations. The observed trend was that the referred and the non-attend group reported higher post concussion symptoms, anxiety, depression and lower psychosocial functioning compared to the non-referred group. These findings suggest that participants referred to the clinic reported more problems at baseline compared to non-referred participants regardless of their attendance status later on. These observations support the appropriateness of these referrals to the Concussion Clinic for intervention.

The non-referred participants on the other hand reported lower post concussion symptoms, anxiety, depression and better psychosocial functioning at baseline. It is possible that these individuals belong to the majority of those sustaining an MTBI, who recover relatively soon after such an injury, thereby functioning better in comparison with others. Larger numbers of participants with more power to detect the significance of these differences is needed in future research.

**Research Question 2: What are the changes within and between the groups over the period of three months?**

Descriptive statistics indicated that at follow-up, the referred and the non-referred group were reporting lower post concussion symptoms, anxiety, depression and better psychosocial functioning compared to the non-attend group. These findings suggest that attendance at the Concussion Clinic for those referred had resulted in better outcomes.

Comparison of the intervention and control group found that post concussion symptom scores significantly reduced over time for both groups. This is in keeping with the understanding that post concussion symptoms decrease over time following injury, as

part of the natural recovery process. For the intervention group, in addition to the natural recovery, this improvement could also have roots in the intervention they had received.

The intervention group reported lower post concussion symptoms at follow-up compared with the control group. However, the difference between the two groups was non-significant. These results fail to support previous research findings of intervention groups reporting significantly fewer, or less severe post concussion symptoms than control groups at follow-up (Mittenberg et al., 1996; Ponsford et al., 2002; & Wade et al., 1998). However, the general trend observed with lower symptoms at follow-up for the intervention group points towards the possibility of obtaining significant differences with larger samples.

Of more importance is which group had the best improvement over time. Although the observed interaction effect was not significant, the effect size was medium, indicating greater improvement for participants in the intervention group over the control group. The non-significant result could have been due to low power in the study to detect a significant effect, due to the small sample sizes involved. Pallant (2007) has pointed to the possibility of non-significant results being due to insufficient power in studies involving small samples such as less than 20.

With regard to anxiety, a significant difference between baseline and follow-up scores was observed for participants in the intervention group only, with a lower mean score at follow-up compared to the control group. The significant interaction effect indicates that the intervention group had significantly greater change in anxiety scores, compared

with the control group. This substantial drop in reporting of anxiety in the intervention group can be attributed to the intervention received by the participants in this group, providing support for the Concussion Clinic intervention. Mittenberg et al. (1996) has emphasised that anxiety reductions following intervention can come from the education received regarding the normal base rate of symptoms and reattribution of these symptoms to benign causes, thereby allowing challenging of negative self-statements. In addition, a reduction in anxiety exacerbating post concussion symptoms could impact on the level of anxiety being reported (Wade et al., 1998).

For depression, the difference between baseline and follow-up scores was approaching significance. The interaction effect was significant. Since the depression scores decreased from baseline to follow-up for the intervention group only, it can be said that the intervention received by the participants in that group had made a positive impact on their reporting of depression at follow-up. One way that the intervention could impact on depressive symptoms is by encouraging and assisting clients in the gradual return to their pre-injury activities. Mittenberg et al. (1996) has postulated that gradual increase in rewarding activities can directly reduce depression by providing behavioural evidence of intact abilities.

In terms of psychosocial functioning, there was a significant difference observed between baseline and follow-up scores for both groups meaning that over time, aspects of work, leisure, relationships and living skills had improved for the two groups. The interaction effect, although insignificant, was medium-sized. This could indicate that the improvements made by the intervention group were greater than those of the control group.

In summary, the Concussion Clinic intervention has resulted in significant improvements in the level of anxiety and depression reported by individuals receiving treatment in comparison to those who did not. Improvements in the level of post concussion symptoms and psychosocial functioning for those who received intervention over those who did not were also evident and may be seen to be significant with larger samples.

### ***Secondary Research Questions***

#### **Research Question 3: What are the reasons for non-attendance for those referred to the Concussion Clinic?**

Reasons for non-attendance were investigated in the current sample to identify factors that could improve the non-attendance issues. A range for non-attendance of between 5.5 to 15% has been reported by a study investigating outpatient department attendance in New Zealand hospitals (Reti, 2003). In the current sample, the non-attendance rate was 15%, which falls at the top of this range.

The reasons reported for not attending the Concussion Clinic appointment include transportation difficulties, not needing to attend and being too busy to attend. These findings are consistent with those of Snell & Surgenor (2006) that clients do not attend their Concussion Clinic appointment due to improvements in symptoms and feelings of not needing to attend anymore, and their returning to work and not wishing to take time off for the appointment.

The additional finding that non-attendance was associated with transportation difficulties raises an important issue, coupled with the finding that the two individuals who reported this were still symptomatic at follow-up. This indicates transport difficulty could be a barrier to recovery. Transport issues such as not having a car, inability to drive or access public transport, or to get a ride from family and friends have been reported as common reasons for non-attendance at the Ambulatory Service Outpatient Clinic at MidCentral Health (Selby-Law, 2006).

At present, transport to and from the clinic for Concussion Clinic appointments are not covered by the ACC MTBI contract. The current findings could have implications for ACC to address this issue in their contract, by considering options such as reimbursement for travel. Further research is called upon to sufficiently describe the specific transportation difficulties faced by clients, so that they can be addressed by putting procedures in place for the clinics when making appointments with clients.

In addition, further research is also needed to identify other potential reasons for non-attendance. A distinction could be made between the 'did not attend' clients and the 'no show' clients. Reti (2003) has used the term 'no show' to represent clients who were expected to turn up but did not, which sets them apart from the 'did not attend' clients which includes those who cancel their appointments. This differentiation will allow for better understanding of reasons underlying this issue, and help identify ways to improve the clinics' efficiency.

#### **Research Question 4: What are participants' perceptions of their recovery?**

Participant rankings of their recovery indicated that most of them felt that they were back to normal or mostly back to normal at follow-up, with the exception of three

individuals who reported still having major problems. The majority of the participants also reported being happy with their recovery at follow-up.

Participants in the intervention group also commented on the benefits of attending the clinic, such as being reassured, therapeutic gains, usefulness of assessments, increased awareness, psycho-education and ongoing support. These comments provide validation for the clinic treatment and reinforce the helpful nature of providing education and reassurance to Concussion Clinic clients.

### ***Other Findings***

#### **Participants needing Intervention at Follow-up**

There were three individuals who self-reported still having major problems, and had higher levels of symptoms across the dependent variables which warranted further intervention. Two of them belonged to the non-attend group and one to the non-referred group. This finding indicates that there were individuals identified in the control group whose functioning had not returned to normal since their MTBI, and who could be experiencing post concussion syndrome. Although these individuals form only a very small proportion, their presence in the control group suggests that more such individuals could be identified in a larger sample. Hence, future studies with more participants could demonstrate that individuals not receiving any intervention are more likely to continue experiencing symptoms.

#### **Referrals to the Concussion Clinic**

The current study also identified some issues relating to the referral practices pertinent to the clinic. One issue is the non-referral from the Emergency Department of

individuals sustaining a MTBI. These individuals continue to have problems for which they are later referred via other means. In the current study, one individual who had attended Emergency Department but was not referred at that time was later referred to the Concussion Clinic through a GP due to ongoing issues. If the individual had been referred to the Concussion Clinic for a screening straight from the Emergency Department, intervention could have been commenced sooner. This could have led to an earlier alleviation of anxiety and symptoms on the part of the patient.

Currently, the Concussion Clinic sends an information sheet to all agencies from which the clinic accept referrals, outlining the purpose of the clinic and the criteria for referring patients to the clinic for screening and intervention. This information sheet is included in the information pack for all new doctors at the Emergency Department informing them of the referral procedures. More education among the doctors at the department regarding the referral practices, and regular reminding of these practices are required if individuals meeting the necessary requirements for screening are not being referred to the clinic, as the current study has shown.

A case was also identified for whom patient notes at the Emergency Department had indicated a referral but the referral was not received at the clinic, and therefore intervention had not been initiated for this individual. On follow-up, this individual was still experiencing a high level of symptoms and was identified as needing intervention. It was found that there is no system organised by the Emergency Departments to confirm the receipt of a referral at outpatient clinics (H. Cosgrove, personal communication, November 11, 2008) and as a result, individuals might not be followed-up for the specialist services. Hence this finding raises an important issue

regarding the administrative procedures behind referrals, which could ultimately impede access to intervention for individuals in need. Currently, referrals are either faxed or sent by post. The possibility of making electronic referrals could be investigated in the future.

### ***Methodological and Measurement Issues***

The current study is different from previous early intervention studies in the respect that the Concussion Clinic intervention occurs much later than those reported in these studies, therefore the timing of the intervention is different. The ACC specifications outline that the intervention be provided within five working days of acceptance of the referral by the case manager, but in practice this is often not the case. Clients' appointments are not scheduled until at least three to four weeks since injury to allow natural recovery to take place. This ensures that the intervention relates to enduring symptoms rather than immediate ones that often vanish soon after injury. In addition, this policy by the Concussion Clinic Coordinator also avoids utilising the costly resources of assessment and treatment on people who recover without any intervention. Furthermore, at times, there are insufficient resources (often medical and occasionally psychological) to carry out assessments and interventions as quickly as desired, due to the fluctuations of referrals and waitlist throughout the year.

The therapeutic value of the baseline assessment is an aspect rendered relevant to the current study due to its methodology. Contacting all participants and carrying out the initial data collection could have been of some therapeutic value for all participants and might account for improvements in participants functioning to some extent. Wade et al. (1997) has pointed out that some level of information provision and reassurance cannot

be avoided. Ponsford et al. (2002) has also highlighted the therapeutic nature of assessments done soon after injury. To minimise this, care was taken not to provide participants with specific feedback on their performance on the measures at baseline in the current study, so that improvements can relate to the intervention received by the Concussion Clinic.

A methodological aspect of the study which has the potential to create systematic error is that two modes of data collection were employed at baseline due to practical reasons, namely face-to-face and telephone interviews. Attempts to achieve some level of standardisation and minimise this error included sending copies of questionnaires to the participants prior to the telephone interviews, with the exception of HADS.

A strength of the current methodology was that the percentage of participants followed up (89.7%) was higher compared to some of the previous early intervention studies, such as 69% in the study by Wade et al. (1998) or 77% in the one by Ponsford et al. (2002). One possible reason for this could be that the follow-up in the current study did not involve a face-to-face meeting, but a telephone interview which was expected to be more convenient for participants. Ponsford and colleagues carried out face-to-face meetings at follow-up, while Wade and colleagues conducted both face-to-face and telephone follow-ups. In addition, the latter study included a six month rather than a three month follow-up, therefore a higher attrition can be expected due to the longer duration.

Another reason for the low attrition observed in the current study could be that unlike previous studies, baseline data was collected from both groups, not just the intervention

group. This created more engagement with the control group right from the start. In addition, it was hoped that meeting the participants face-to-face for baseline assessment, rather than calling them up would enable better establishment of rapport, giving rise to improved follow-up rates. It is interesting to note that the four participants lost to attrition at follow-up had all been interviewed over the phone at baseline.

A further strength of the current study was the longitudinal nature of the design which allowed collection of prospective data. Generally, prospective data is considered more reliable than retrospective accounts due to limitations and biases of the human memory (Scott & Alwin, 1998). In the study by Mittenberg et al. (1996), frequency of initial symptoms was reported retrospectively by participants, which was a potential limitation in their study. In the current investigation, baseline data was also collected prospectively, which is a substantial strength of the design.

One of the measurement issues in the study of MTBI and PCS is that post concussion symptoms are not unique to just individuals with TBI. High base rates of some post concussion symptoms such as headaches, irritability, anxiety and fatigue have been reported in uninjured populations (McLean, Dikmen, & Temkin, 1993). In addition, a review conducted by Iverson (2005) demonstrated that post concussion like symptoms are common in healthy individuals, in patients with no history of brain injury, depressed university students, outpatients seen for minor medical problems, personal injury claimants, patients with post traumatic stress disorder, patients with orthopaedic injuries, individuals with chronic pain, and patients with whiplash, thereby posing

problems in the differential diagnosis. Therefore, this could mean that in the current sample, the symptoms could be explained by factors other than the MTBI itself.

An additional measurement issue relates to the selection of appropriate outcome measures to use with individuals with MTBI, as most existing measures have been targeted for use with patients with moderate or severe head injuries (Santa Clara Valley Medical Center, 2006; Tate, 2007). Wade et al. (1997) has raised concern that this could miss significant problem areas or might not be sensitive enough to detect some changes in patients with MTBI. The measure SPRS which was utilised in the current study to measure psychosocial functioning has been mostly used in studies involving moderate to severe traumatic brain injury patients (e.g., Kuipers, Kendall, Fleming, & Tate, 2004; Tate, Hodgkinson, Veerabangsa, & Maggioto, 1999; Tate et al., 2004). It was felt that this measure was not sufficiently sensitive or responsive to pick up the subtle difficulties faced by the participants in the current study and the changes experienced by them from baseline to follow-up.

### ***Limitations of the Research***

One of the main limitations in the current study is the small sample size. As a result, the groups non-referred and non-attend had to be combined to form the control group for the purposes of statistical significance testing. This could have resulted in a much diversified control group, as non-referred and non-attend are likely to represent very different populations, as was indicated by the different levels of recovery experienced by the two groups at both baseline and follow-up. Therefore, direct comparisons between the intervention and control group will have to be interpreted with caution.

In addition, the small sample obtained could have potentially limited the power of the study to detect differences between groups, which can be improved in future studies with more participants in each group. Furthermore, the small sample size could have accounted for the violations of the normality assumption in the significance testing. It also limited controlling for confounding variables such as age and gender in the statistical comparisons between the two groups in the current sample. Future studies with more participants should take some of these variables into account in order to examine the impact of other confounding variables.

A further limitation of the current research lies in the selection of participants for the study. Initially the study involved individuals presenting to the Emergency Department following a recent injury involving an MTBI, and examine outcomes based referral and attendance status at the Concussion Clinic. Due to the problems faced with recruitment, the decision was made to approach participants from the Concussion Clinic from all referral sources. Clients referred to the Concussion Clinic from other sources are usually done so due to ongoing difficulties since their MTBI, and could be referred weeks or months after the injury. Therefore, this group of participants are likely to involve not just MTBI, but individuals with post concussion syndrome, resulting in a mixed group. These differences in duration of illness between individuals could present as a confounding variable, which was unable to be controlled for. Hence, the findings of the present study comparing these groups should be interpreted with caution.

Another possible limitation could relate to the design of the study. The current study examined the impact of the Concussion Clinic intervention on those receiving services and those who do not, therefore the research called for a quasi-experimental design.

This meant that the assignment of participants to groups were non-random but based on their referral and attendance status. While it was the most suitable design for the current research, it places limitations on the interpretation of final outcomes. The lack of random assignment compromises the internal validity of the research, leading to less straightforward conclusions on cause and effect. Even so, quasi-experimental designs have better ecological validity i.e., more relevance to real world events (Clark-Carter, 2004), hence improving generalisability of findings.

An additional limitation of the current study was that due to the nature of the questions under investigation, the researcher could not be made blind to the participant groups. This has the potential to create experimenter bias in research. Nevertheless, the researcher being independent from the Concussion Clinic treatment team and the use of a structured interview should have minimised this problem.

### ***Implications of the Research***

The current study was proposed as a pilot for a New Zealand wide study of outcomes and service delivery by the Concussion Clinics. Also referred to as feasibility studies, pilot studies offer valuable insights into the process and outcomes of research designs for others wishing to use similar methods and instruments (van Teijlingen & Hundley, 2001). This is deemed crucial as pilot studies can be “time-consuming, frustrating, and fraught with unanticipated problems, but it is better to deal with them before investing a great deal of time, money, and effort in the full study” (Mason & Zeurcher, 1998, cited in van Teijlingen & Hundley, 2001). Hence, the current study has several implications for future outcome studies at Concussion Clinics by providing an improved understanding of the processes involved.

The current research also extends previous research conducted at the ACC Concussion Clinics by evaluating outcomes for those treated at the Concussion Clinic with those exposed to MTBI but had not received treatment. Leach (2003) had indicated in her thesis that this would be the most obvious form for outcome research but this was not possible as locating individuals not referred to the clinic would be difficult. However, the current research has obtained a sample of individuals with MTBI not referred to the Concussion Clinic through the Emergency Department, and found that it can be done, though a number of challenges were faced. This has implications for future research, in showing that the methodology is feasible, but has to be developed further by addressing the problems faced in the current research.

The present study is also the first study to assess specific outcomes for those treated at the Concussion Clinics, thereby contributing to further understanding of how the intervention improves the functioning of those receiving services at the clinics. The current study demonstrated that intervention provided by the clinic has a large positive impact on the reporting of anxiety and depressions. Improvements in level of post concussion symptoms and psychosocial functioning may also be due to the clinic intervention although more research is needed to confirm this.

The current research provides valuable feedback to the Massey University Concussion Clinic regarding the effectiveness of their interventions on individuals, and also how clients perceive their recovery and help received from the clinic. It also provides feedback for ACC regarding indications of potential barriers to recovery that can be

addressed to improve rehabilitation. The current research also uncovered issues relating to referral practices which can potentially be addressed to improve the service.

### ***Recommendations for Future Research***

Future research evaluating other ACC Concussion Clinics in New Zealand could successfully utilise and improve the design of the present study. One of the issues faced with the present study that should be addressed in future studies is improving recruitment of individuals with MTBI not referred to the Concussion Clinics. The present study demonstrated that involvement of the hospital staff in the recruitment process was not as effective as expected, therefore other avenues for recruitment need to be explored. Future studies should also include more time for recruitment, so as to allow for larger samples. Furthermore, longer term follow-ups can be done such as follow-up at six months, which will allow the investigation of maintenance of treatment gains for the intervention groups and also establishment of incidence of persistent post concussion syndrome in samples studied.

Future investigations of outcomes at Concussion Clinics could extend their analyses by evaluating the clinical significance of their findings. Clinical significance is an additional strategy for evaluation, and in the assessment of treatment outcome, both statistical and clinical significance are of great importance (Kendall, Holmbeck, & Verduin, 2004). Different procedures for addressing clinical significance exist, such as calculating the Reliable Change Index, or conducting normative comparisons (Kendall, 1999). Employing these methods can provide more practical significance than just statistical significance testing.

Future studies could extend the current research design by including reports of significant others in addition to self-report measures, particularly in areas such as social integration, vocational and educational activities and functional abilities. When assessing behaviours that are socially undesirable or ones that people are unaware of or are defensive about, a second informant can be helpful (Newman, Ciarlo, & Carpenter, 1994). Doing so will provide a better picture of the individuals' functioning by way of verifying and adding to the information already collected. Comparisons can be performed to check the level of agreement between the two response methods. In the present study, the measure employed to assess psychosocial functioning, SPRS-2 does include a response format designed for informant ratings, but was not utilised as it was outside the scope of the current investigation.

Future research could also examine outcomes at Concussion Clinics as a function of level of treatment/care received at the clinic. Upon assessment at the initial appointment, clients are given different treatment recommendations, which can be taken into account. For example, outcomes can be examined in relation to those receiving more occupational therapy or more psychological intervention, to see which group of individuals show more improvement. In addition, the relationship between the number of intervention sessions and recovery can be looked at. These longitudinal investigations can be carried out over longer periods of time to allow for more follow-up data.

The current study only examined outcomes for individuals with MTBI over 16 years of age. As the Concussion Clinics receive several referrals under this specified age, it would be important to include these individuals in future investigations. In the

assessment of children, reports by a second informant such as a parent and teacher will prove especially useful in evaluating treatment outcomes.

### ***Conclusion***

The present study sought to evaluate the effectiveness of the Massey University Concussion Clinic by comparing the outcomes for an intervention group and a control group. In this sample, with the available resources and time, it was found that the intervention significantly decreased the level of anxiety and depression reported by those who received intervention over those who did not, demonstrating support for the clinic intervention. The possibility of a greater change in post concussion symptoms and psychosocial functioning for those in the intervention group over the control group was also indicated by the medium-sized effects. Further findings suggest that transportation difficulties could be a potential barrier to recovery. In addition, participants in the current study acknowledged the helpful nature of the clinic intervention. Results also indicated that more care needs to be taken in the referral processes. Further studies, with larger samples, more time and resources are required for more conclusive results. As a pilot study, the current investigation demonstrated that the design can be implemented for future studies evaluating the effectiveness of the Concussion Clinics.

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## Appendix A

The materials used in the current study are presented in the following order:

Main outcome measures:

- Rivermead Post Concussion Symptoms Questionnaire (RPQ; King, Crawford, Wenden, Moss, & Wade, 1995)
- Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)
- Sydney Psychosocial Reintegration Scale-2 (SPRS-2; Tate, Hodgekinson, Veerabangsa, Pfaff, & Simpson, 2007)

Other materials:

- Background Initial Interview
- Background Follow-up Interview
- Items Exploring Participants' Perceptions of their Recovery





















## **Appendix B**

Information Sheets and Consent Forms utilised in the current study are presented in the following order:

- Information Sheet Phase 1
- Consent Form Phase 1
- Information Sheet Phase 2
- Consent Form Phase 2
- Revised Information Sheet for Evaluation Study
- Revised Consent Form for Evaluation Study



















