FACTORS THAT INFLUENCE FUNCTIONAL MOBILITY OUTCOMES OF PATIENTS POST - TRAUMATIC BRAIN INJURY

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Declaration

I, Sameera Haffejee declare that this research report is my own work. It is being submitted for the degree of Master of Science in Physiotherapy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

_______________________ (Signature of candidate)

__________ day of _________________ (month) 2011

Dedication

- To my Creator and Benefactor, Allah, for gifting me with the opportunity to further my knowledge and use this knowledge for the benefit of my patients.

- To my husband, Sameer, for always loving and supporting me and for being my pillar of strength.

- To my unborn baby, for completing my life. This work is dedicated to you in the hope that it gives you the strength to always stand up for what is right in life.

- To my parents for their hard work and perseverance in ensuring that I received the best education and upbringing and for helping me reach my dreams.

- To my sisters (Faseeha and Shaheen) for all your assistance and support.

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Abstract

Introduction: The incidence of traumatic brain injury was reported to be 360 per 100 000 in South Africa. The consequences of traumatic brain injury include physical, cognitive, psychological, behavioural and emotional deficits. Prognostic factors such as age, mechanism of injury and severity of injury as well as medical history (extent of intervention) assist in determining the outcome of the patient. It is believed that the predictors of recovery assist both the patient as well as family members in determining the duration of rehabilitation as well as potential outcomes for the patient.

Aim: The aim of this study was to determine the factors that influence the functional mobility outcome of patients with traumatic brain injury.

Method: A cross sectional study was used to collect data where participants were assessed pre-discharge. A self designed questionnaire was administered by the interviewer and the Modified Mini Mental State questionnaire and the Rivermead Mobility Index were also administered.

Results: Of the 60 participants, 56 were male and four were female. Half of the patients were able to walk indoors with an assistive device at the time of assessment, with only 36.7 percent of the patients having a higher functional level than walking indoors.

The following factors increased the likelihood of functional mobility: the gender of the patient, Grade 12 education, being either self employed or unemployed, an income of between R800 and R2000 as well as more than R5000, having both bowel and bladder continence and Occupational therapy sessions. Factors that were found to have a negative influence on functional mobility include: age, premorbid smoking and drinking, having a craniotomy and physiotherapy sessions.

Conclusion: Male gender, high education, being either self employed or unemployed, high income, bowel and bladder continence positively impacted on

the functional mobility of the patient on discharge. Older age, premorbid smoking and drinking, having a craniotomy has a negative impact on the physical function of the patient with traumatic brain injury on discharge.

Chapter 1

1. Background and Need

1.1. Introduction:

Approximately one third of all deaths in the world caused by injury are due to traumatic brain injuries (Chua et al., 2007). Furthermore, between eighty and ninety thousand people experience lifelong disability associated with Traumatic Brain Injury (TBI) (Chua et al., 2007). Traumatic brain injury (TBI) is a major cause of disability, morbidity and mortality and is responsible for a significant proportion of all traumatic deaths in the United States of America (Bruns et al., 2003). In South Africa, the incidence of TBI was reported to be 360 per 100 000 (Bruns et al., 2003). Traumatic brain injury results in the disruption of neuronal activity as well as changes in oxidative metabolism and blood within the brain (Grealy et al., 1999). Thus, the consequences of TBI are vast and include physical, cognitive, psychological, behavioural as well as emotional deficits (Chua et al., 2007).

Males are at a higher risk of sustaining TBI than females, with the male to female ratio in Johannesburg being greater than 4:1 (Bruns et al., 2003). The causes of TBI in South Africa were mainly interpersonal violence and motor vehicle accidents (Bruns et al., 2003). However, from personal clinical experience, it has been noted that a proportion of TBIs in South Africa is due to pedestrian vehicle accidents. Assault is also becoming one of the leading causes of TBI, especially in the lower socio-economic groups and in war-torn countries (Chua et al., 2007). According to Bruns et al. (2003), motor vehicle accidents and assaults result in more severe injuries in patients with TBI than do all other aetiologies combined. The prevalence of TBI in South Africa was found to be higher in people with a lower socioeconomic status as well as in black people (Bruns et al., 2003). These findings are similar to those of other countries. However, the greatest discrepancy in race-specific TBI ratios has been reported in South Africa (Bruns et al., 2003).

Most studies in traumatic brain injury research focus on factors related to the acute medical and surgical severity (Finch et al., 1997). Prognostic factors such as age, mechanism of injury and severity of injury as well as medical history (extent of intervention) assist in determining the outcome of the patient (Englander et al., 2003). Further information is required to provide patients and their families with a better understanding of their prognosis (Englander et al., 2003). In addition, these factors are more useful in determining the global outcome of a patient as opposed to specific outcomes (Englander et al., 2003). However, a study by Finch et al. (1997) showed that individual items like cognitive tests are useful in predicting the outcome of patients post traumatic brain injury. Another study by Rao et al. (1988) also showed that the main factors indicating poorer prognosis include prolonged unconsciousness, extensive neurological damage as well as severe mental changes. Furthermore, it has been stated that other subjective factors including family support, patient denial and rapport with the patient, may have an effect on the outcome of a patient (Rao et al., 1988).

According to Whyte et al. (2001), many other investigators have considered the duration of unconsciousness as a predictive factor for functional outcome in TBI. Increased duration of unconsciousness has been associated with greater neurological deficits at both one month as well as one year (Whyte et al., 2001). It has also been shown that time to follow commands is the best single predictor of function (Whyte et al., 2001).

Rao et al. (1988) showed that the variables that are predictive of the functional outcome of patients with TBI have no external quantification available. However, Grealy et al. (1999) reported that stimulating environments showed beneficial effects on both the brain as well as the behaviour of the patient. On the other hand, Glenn et al. (2006) showed that programmes for the rehabilitation of patients with traumatic brain injury must take into consideration many factors that include length of hospital stay as well as the level of family involvement in the rehabilitation of the patient, all of which have an impact on the patient’s functional outcome.

1.2. Problem Statement:

The factors that influence the functional mobility outcome of patients with traumatic brain injury have not been clearly defined in the literature and specifically so in South Africa.

1.3. Aim of the Study:

The aim of this study was to determine the factors that influence the functional mobility outcome of patients with traumatic brain injury.

1.4. Objectives of the study:

- To establish the functional mobility outcome of patients with traumatic brain injury at discharge from hospital.
- To identify the factors that influence the functional mobility outcome of patients who have sustained traumatic brain injury.

1.5. Significance of the Study:

It is hoped that the identification of the factors that influence functional mobility outcome post traumatic brain injury will enable health professionals involved with the rehabilitation of patients with traumatic brain injury to make decisions that facilitate a better functional outcome for these patients. Identifying the factors that influence functional mobility will enable health professionals to determine whether the patient requires admission to a rehabilitation facility or not, predict the required rehabilitation length of stay and also determine if the patient would benefit from attending therapy as an out patient. In addition, the family will be able to plan for the patient's return home as well as for any additional assistance and costs required when the patient returns home.

Chapter 2

2. Literature Review

2.1. Introduction:

This literature review was conducted in order to ascertain the quantity of evidence there is available that focuses on traumatic brain injury (TBI), especially in the area of factors that impact on the functional outcome of a patient post TBI.

The search engines used in order to conduct this review were Pubmed, Pedro, Science Direct, Cochrane Collaboration as well as Google Scholar. Keywords used were: Traumatic brain injury, Functional outcome, Epidemiology, Rehabilitation, Factors influencing outcome, Prognosis, Consequences, Neural plasticity, effects of age, effects of educational level, effects of employment, Rivermead Mobility Index, Glasgow Coma Scale and Modified Mini Mental State Examination. This review has been subdivided into the following sub topics:

2.2 Prevalence and Incidence of TBI
2.3 Causes of TBI
2.4 Consequences of TBI
2.5 Functional Outcome post-TBI
2.6 Factors that Influence Functional Outcome post-TBI
2.7 Review of Methodology
2.8 Conclusion

2.2 Prevalence and Incidence of Traumatic Brain Injury

Traumatic brain injury (TBI) can be defined as an external force that results in damage to the brain tissue as evidenced by a loss of consciousness or post traumatic amnesia or objective neurological findings (Englander et al., 2003). Traumatic brain injury is believed to be responsible for approximately one third of all deaths in the world caused by injury and between eighty and ninety thousand people experience lifelong disability associated with TBI (Chua et al., 2007). It is recognised as a major cause of disability, morbidity and mortality and is responsible for a significant proportion of all traumatic deaths in the United States of America (Bruns et al., 2003). In South Africa, the incidence of TBI was reported to be 360 per 100 000 (Bruns et al., 2003).

Males are at a higher risk of sustaining TBI than females, with the male to female ratio in Johannesburg being greater than 4:1 (Bruns et al., 2003). This finding is similar to that of Chua et al. (2007), who stated that males are approximately three to four times more likely to sustain a traumatic brain injury. The differences in exposure to risk as well as differences in lifestyle can be used to explain higher mortality rates in males from traumatic brain injury (Chua et al., 2007).

Bruns et al. (2003) found that the highest incidence of traumatic brain injury was in young adults (15 to 24 year old people). This has largely been attributed to interpersonal violence and motor vehicle accidents occurring in adolescence and young adulthood. This age range has been known as the testosterone years and during this period the male to female ratio of TBI patients can approach or exceed 3 to 4:1. However, in the geriatric group, the incidence of females with traumatic brain injury exceeded that of males (Bruns et al., 2003). A reason for this was not provided.

The prevalence of TBI was found to be higher in people with a lower socioeconomic status as well as in black people (Bruns et al., 2003). It was found that the race specific annual incidence in the United States between 1992 and 1994 was 582 per 100 000 for blacks, 429 per 100 000 for whites and 333 per 100 000 for other races (Bruns et al., 2003). The greatest discrepancy in race-specific traumatic brain injury ratios was found in South Africa, with the ratio being 3.3 for blacks, 2.7 for coloureds and 1.9 for Asians as compared with whites (Bruns et al., 2003). The exact figure for white people was not specified. Similar findings were reported by Brown et al. (1992) who found that the incidence of traumatic brain injury in Johannesburg was 355 per

100 000 for blacks as compared to 109 per 100 000 for whites. An explanation as to the reasons for the higher number of injuries in people with a lower socioeconomic status has not been clearly given in the literature. However, according to Bruns et al. (2003) interpersonal violence, drug-abuse and crime are more rampant in lower socioeconomic areas (as populated by black and coloured people), thus resulting in a higher number of traumatic brain injuries. This was further augmented by Chua et al. (2007), who stated that males are approximately three to four times more likely to sustain a traumatic brain injury. The differences in exposure to risk as well as differences in lifestyle can be used to explain higher mortality rates in males from traumatic brain injury (Chua et al., 2007).

Traumatic brain injury is one of the leading causes of mortality and morbidity in both young adults and children in the United States of America (Gill et al., 2006). According to Bruns et al. (2003), the general incidence of TBI in developed countries has been found to be 200 per 100 000 of the population who are at risk every year. However, the incidence of traumatic brain injury in the Netherlands was reported to be 836 of 100 000 population with only eleven percent admitted to hospital (Bruns et al., 2003).

On the other hand, a survey in China showed that the estimated number of traumatic brain injuries was 56 per 100 000 in 1982 (Bruns et al., 2003). The low incidence was thought to reflect a country with low number of automobiles as well as a low violence rate (Bruns et al., 2003). Brown et al. (1992) reported the annual incidence of traumatic brain injury in South Africa to be 316 per 100 000 as compared to Bruns et al (2003) who found the incidence of traumatic brain injury in South Africa to be 360 per 100 000. This shows that the incidence of traumatic brain injury has increased over the years. It is thought that this is due to a possible increase in the number of motor vehicle and pedestrian vehicle accidents as well as an increase in violence.

The incidence of traumatic brain injury has also been found to increase in the elderly in the USA, France and Australia (Bruns et al., 2003). This has been explained by

Bruns et al. (2003), to be due to an increase in motor vehicle accidents as well as falls, occurring predominantly due to motor, sensory, cognitive and conscious deficits. However, the incidence in South Africa in people older than 64 years old was found to decline (63 per 100 000). (Bruns et al., 2003).

2.3 Causes of Traumatic Brain Injury

The causes of TBI in South Africa were mainly interpersonal violence and motor vehicle accidents (Bruns et al., 2003). Assault is also becoming one of the leading causes of TBI, especially in the lower socio-economic groups and in war-torn countries (Chua et al., 2007). Adolescents and young adults, males and ethnic minorities have a higher risk of sustaining traumatic brain injury due to violence and motor vehicle accidents (Bruns et al., 2003).

According to Bruns et al. (2003), motor vehicle accidents and assaults result in more severe injuries in patients with TBI than do all other aetiologies combined. Bruns et al. (2003) stated that the mechanism of injury is strongly associated with the individual's demographics in developed countries, with motor vehicle, automobile and bicycle collisions being responsible for the half of all traumatic brain injuries.

Assault, according to Chua et al. (2007), is becoming one of the leading causes of trauma to the brain. This occurs more in lower socioeconomic groups as well as in war-torn countries (Chua et al., 2007). In densely populated areas affected by poverty, high unemployment rates; crime as well as substance abuse and violence were the major cause of traumatic brain injuries (Bruns et al., 2003).

The risk factors for traumatic brain injury in Johannesburg were identified to be unemployment, working in the security or transport business as well as speaking Afrikaans (Brown et al., 1992). According to Brown et al. (1992), the reason for increased risk of TBI in people who speak Afrikaans was unknown, while the link between the transport industry and motor vehicle accidents was established. Furthermore, a low socioeconomic status, disadvantaged living conditions combined with overcrowding and substance abuse served to increase the risk of traumatic brain injury (Brown et al., 1992).

Other causes which are becoming more significant are firearms being responsible for approximately 12% of traumatic brain injuries as well as sports and recreational activities (Chua et al., 2007). This was followed by falls, especially in children under the age of 10 and people older than 70 years (Bruns et al., 1992).

The cause of the injury is not an independent predictor of prognosis but the mechanism of injury is important as it determines the effect of the injury to the brain (Butcher et al., 2007a). This will alert the doctor treating the patient that the patient has a lesion that could be treated surgically. In addition, knowledge of the cause of injury is vital in awareness campaigns that target specific causes of TBI (eg. motor vehicle accidents) (Butcher et al., 2007a).

2.4 Consequences of Traumatic Brain Injury

The primary cause of death in one third to one half of all traumatic deaths has been found to be traumatic brain injury (Bruns et al., 2003). Approximately half of all deaths caused by traumatic brain injury occur at the scene of the accident, during transportation by ambulance or during emergency medical treatment. It was found that in Johannesburg, twenty percent of all traumatic brain injuries resulted in death (Bruns et al., 2003). These statistics corresponded to forty three percent of all non natural deaths occurring in Johannesburg being due to traumatic brain injury (Bruns et al., 2003).

Closed traumatic brain injury is one of the leading causes of death or permanent disability, while open traumatic brain injuries usually results in focal damage to the cerebrum (Grados et al., 2001). In humans, lesions to the basal ganglia and thalamus are additional markers indicating more severe lesions, while in non-humans lesions to the corpus callosum and brain stem indicate more severe lesions. Furthermore, deeper lesions have been associated with psychological impairments and/or persistent vegetative states (altered levels of consciousness) (Grados et al., 2001). Traumatic brain injury results in the disruption of neuronal activity as well as changes in oxidative metabolism and blood within the brain (Grealy et al., 1999). Thus, the consequences of TBI are vast and include physical, cognitive, psychological, behavioural as well as emotional deficits (Chua et al., 2007). Alterations in neurotransmitter and endocrine activity can be linked to behavioural changes and result in abnormalities in arousal, movement and cognition (Grealy et al., 1999).

According to Englander et al. (2003), people with lesions greater than fifteen centimetres, diffuse swelling and a midline shift of more than three millimetres have a mortality rate of more than fifty percent. The Westmead Head Injury Project (1993) showed that cerebral oedema, effaced mesencephalic cisterns, a midline shift and intraventricular haemorrhage were associated with greater mortality. However, subarachnoid haemorrhages, intracerebral contusions and haematomas were associated with disability (Englander et al., 2003).

Pulmonary complications, urinary tract infections as well as the derangement in electrolytes and liver function occur in between sixty to seventy percent of traumatic brain injuries (Chua et al., 2007). This inevitably results in prolonged acute hospital stay. Patients may also fail to improve or may deteriorate and may develop hydrocephalus (Chua et al., 2007).

Less severely injured patients may also experience a range of symptoms after experiencing a concussion which usually resolves between three and six months post concussion (Wade et al., 1997). However, some patients' symptoms may persist for up to one year. These symptoms include slowing of information processing which usually recovers after between four and eight weeks but can worsen if the patient has a recurrent injury. Other symptoms include headaches, dizziness, fatigue, irritability, and decreased concentration, disturbances in sleep, memory dysfunction, anxiety, depression, blurred or double vision as well as sensitivity to noise and/or light. These symptoms may result in significant psychosocial problems (Wade et al., 1997).

Psychological deficits have been shown to worsen with time (Brown et al., 1992).These include problems with controlling emotion as well as problems with memory, moodiness and unhappiness. Furthermore, caregivers reported worsening of forgetfulness, irritability, anger, aggression, inappropriate behaviour and impaired understanding in patients with traumatic brain injury (Brown et al., 1992). In addition, patients reported that during the six and twelve month period, they became unhappier, more rude, less energetic, less creative, more tense, and more emotionally labile as well as less attentive (Brown et al., 1992). According to Grealy et al. (1999), patients with traumatic brain injury present with an impaired ability to allocate attentional resources resulting in many deficits in performance. The reason for this has been explained to be a decreased level of cerebral arousal-activation as well as a “generalised slowing” caused by a diffuse axonal injury (Grealy et al., 1999).

Patients with traumatic brain injury may also present with a wide range of cognitive deficits in addition to motor and sensory deficits (Chua et al., 2007). Due to the attentional deficit, patients with traumatic brain injury may present with behavioural inactivity as they require more effort to perform nonautomated tasks (Grealy et al., 1999). This results in constant feelings of fatigue. Grealy et al. (1999) further states that patients with traumatic brain injuries may lack the physical fitness that is required for intensive cognitive rehabilitation. In addition, behavioural inactivity may exacerbate endogenous changes in neurotransmitter activity underlying changes in mood (Grealy et al., 1999).

Brown et al. (1992) reported that the severity of injury had a direct correlation to the employment status of patients. According to Corrigan et al. (2007), twenty seven percent of patients in the Traumatic Brain Injury Model Systems (TBIMS) dataset were competitively employed one year post injury, while twenty nine percent were competitively employed five years post injury. It was further found by Corrigan et al.

(2007) that women were more likely to reduce the number of hours worked post injury compared to men. However, regardless of race, most people remain unemployed for at least one year post –traumatic brain injury (Arango-Lasprilla et al., 2008). Family relationships are one of the areas most affected by traumatic brain injury (Brown et al., 1992). Some authors, however, found that there was an inconsistent relationship between the severity of injury and family relationships. For instance, Brown et al. (1992) found that family relationships did not worsen with time, especially in severely injured patients. However, the caregiver's perception of the family functioning was associated with the severity of the injury (Brown et al., 1992). According to Perlesz et al. (2000), relatives of patients with traumatic brain injury other than the primary caregiver were negatively affected by the patient's injury. Siblings of patients with traumatic brain injury identified many concerns both at a personal and at family level. These concerns included high levels of family distress, concern for the future of their sibling, negative changes to the lifestyle of the family, as well as an increase in their personal responsibility. According to Perlesz et al. (2000), it was found that patients with traumatic brain injury as well as their spouses encountered equal levels of anxiety and depression.

2.5 Functional Outcome Post – Traumatic Brain Injury

Patients with traumatic brain injury may also present with a wide range of motor as well as sensory deficits, extra pyramidal symptoms, dystonia and spasticity which influence functional outcome (Chua et al., 2007). Motor and sensory dysfunction includes slowed motor responses, problems with balance and co-ordination and sensory perceptual issues. In addition, the motor and sensory deficits may result in patients presenting with bowel and bladder incontinence, especially if the frontal lobe is affected further impeding social functioning (Chua et al., 2007).

Many aspects of motor control have been found to be affected in patients with TBI (Hillier et al., 1997). Reduced cortical command results in changes in muscle timing as well as alterations to muscle tone. These have impact on both postural and phasic motor behaviour due to decreased muscle strength and hypertonia. Furthermore, major problems in the central nervous system may include motor programmes that are either ineffective or absent, impaired motor memory (especially for motor sequences and postural alignment) and impaired feedback as well as feedforward mechanisms (Hillier et al., 1997).

Trauma to the cerebellum as well as other structures may result in ataxia, dysmetria, dysdiadochokinesis and intention tremor (Hillier et al., 1997). Other less common disorders include tremor, myoclonus, chorea, athetosis, ballismus, tics and Parkinson – type signs (Hillier et al., 1997).

Intracranial haemorrhage (in 34% of cases), intracranial haemorrhage with a midline shift (in 65% of cases) and midline shift out of proportion to intracranial haemorrhage (in 88% of cases) result in a poorer functional outcome (Englander et al., 2003). There is variance in functional outcome whereby some activities of daily living (i.e. leisure activities, home chores, mobility and self care) improve while others worsen (Brown et al., 1992). With time low level ADL functions tended to improve, while high level skills tended to worsen. It was further found that leisure activity within the home tended to improve, while leisure activities outside the home seemed to worsen (Brown et al., 1992). Nonetheless, patients who were found to have high levels of home leisure before the injury tended to experience a greater degree of change after the injury. Patients also reported that over time they made greater contributions to household chores but a lack of mobility did inconvenience them at times. With time patients were found to become more self reliant and were able to carry out more activities for themselves (Brown et al., 1992).

Diffuse axonal injuries were found to result in the greatest disability, especially in the areas of activities of daily living (ADL) and ambulation (Englander et al., 2003). Dickinson et al. (2000) also found that seventy nine percent of patients experienced headaches, fifty nine percent had problems with memory and thirty four percent were unemployed three months after sustaining the injury, thus affecting their social functioning.

During the period of two to eight years post-injury, patients tend to require more emotional support, especially patients with a lower level of education (Tomberg et al., 2007). However, a higher level of social support promoted the use of task-oriented coping strategies, while avoidance strategies were used when the patient had a low level of social support. This resulted in an increased need for medical assistance; more health related complaints and more injuries as well as lower sociality. Low social/family support and low satisfaction of social support, as well as the resumption of work post-injury were both associated with poor health-related quality of life (Tomberg et al. 2007).

2.6 Factors that Influence Functional Outcome Post - Traumatic Brain Injury

Most studies on traumatic brain injury research focus on factors related to the acute medical and surgical severity (Finch et al., 1997). Prognostic factors such as age, mechanism of injury and severity of injury as well as medical history (extent of intervention) assist in determining the outcome of the patient (Englander et al., 2003). Further information is required to provide patients and their families with a better understanding of their prognosis. In addition, these factors are more useful in determining the global outcome of a patient as opposed to specific outcomes (Englander et al., 2003).

However, a study by Finch et al. (1997) showed that individual items like cognitive tests are useful in predicting the outcome of patients post traumatic brain injury as the prognosis for patients at six months post-injury was poorest in patients who had cognitive deficits. Another study by Rao et al. (1988) also showed that the main factors indicating poorer prognosis include prolonged unconsciousness, extensive neurological damage as well as severe mental changes. Patients who go into a coma for six days or less are more likely to be ambulant (Rao et al., 1988). Other subjective factors including family support, patient denial and rapport with the patient, may have an effect on the outcome of a patient (Rao et al., 1988).

Common acute predictive factors of functional outcome post-TBI include the length as well as the depth of the coma immediately after the injury (Chua et al., 2007). The duration of unconsciousness has been used by many investigators to predict the functional outcome of patients post traumatic brain injury (Whyte et al., 2001). According to Whyte et al. (2001), the time to follow commands was the single best predictor of all the outcomes on the Glasgow Outcome Scale, followed by the time to motor localisation. An increased duration of unconsciousness is associated with greater neuropsychological deficits at both one month and one year (Whyte et al., 2001). The Glasgow Coma Scale is most commonly used to predict recovery (Brown et al., 1992). However, this is more possible in people that have a Glasgow Coma Scale of eight or more, while a Glasgow Coma Scale ranging between seven and five has an unpredictable outcome (Brown et al., 1992).

According to Gill et al. (2006), some studies showed that the total Glasgow Coma Scale and the motor component of the Glasgow Coma Scale has as much predictive value as other additive scores and are able to predict both mortality as well as admission into the intensive care unit (Gill et al., 2006). A score of thirteen to fifteen is considered to be a mild traumatic brain injury, while a score of nine to twelve is considered to be moderate and a score of less than nine is considered to be severe (Bruns et al., 2003). A study conducted in South Africa showed that seventy eight percent of cases were very mild traumatic brain injuries, ten percent were mild and five percent were severe (Bruns et al., 2003).

Marmarou et al. (2007), stated that lower GCS scores and compromised pupil reactivity have a greater range for improvement, while patients with higher GCS scores and less compromised pupil reactivity have a greater range for deterioration. In addition, dilation of the pupil as well as poor reactivity of the pupil is thought to be due to cranial nerve three involvements which indicate a lesion in the area of the brainstem. This is indicative of a neurological emergency and a poor prognosis (Marmarou et al., 2007).

McNett (2007) also found that initial Glasgow Coma Scale scores of between fifteen and eight resulted in good recovery or moderate disability, while patients with Glasgow Coma Scale of between three and four were found to be in a persistent vegetative state or died, thus assisting in predicting functional outcome post-injury (McNett, 2007).

The duration of post traumatic amnesia is also used as an acute predictor of outcome post - traumatic brain injury (Chua et al., 2007). Post traumatic amnesia lasting for more than 24 hours is considered severe traumatic brain injury, while post traumatic amnesia lasting longer than four weeks is considered very severe traumatic brain injury (Chua et al., 2007).

The mechanism of injury as well as the patient's medical history was also thought to be important predictors of outcome (Englander et al., 2003). Englander et al. (2003) found that subcortical contusions occur predominantly in high speed injuries like motor vehicle accidents and are more likely to damage the parenchyma compared to more superficial injuries. It is expected that a wide variety of functional skills may be affected and these include activities of daily living and ambulation (Englander et al., 2003). In addition, Grados et al. (2001) found that high speed injuries tend to produce deeper lesions associated with diffuse axonal injuries particularly in the corpus callosum, basal ganglia, thalamus and brain stem/ cerebellum, while low speed injuries tend to produce more superficial injuries. The greater the number of lesions, the greater the impairment on functional outcome (Grados et al., 2001). Butcher et al. (2007a) also stated that high-velocity injuries tended to increase the risk of internal injuries, thus increasing the severity of the lesion and hence resulting in poorer functional outcome.

Age, systolic blood pressure, the presence of intracranial haematoma, motor response and heart rate at admission are significant predictors of functional disabilities (Oh et al., 2006). In patients with a mild/moderate brain injury, motor response, abnormal papillary reflex and heart rate on admission were found to be significant predictors of functional disability (Oh et al., 2006). Motor response and the presence of intracranial haematoma in severe traumatic brain injuries, as well as age, systolic blood pressure and pupil reflex in mild/moderate traumatic brain injuries have been established to be significant predictors of cognitive disability (Oh et al., 2006).

The blood pressure level post injury is also associated with functional outcome (Butcher et al., 2007b). Lower systolic blood pressure (less than 120 mmHg), which also results in lower levels of haemoglobin and platelets, is associated with poorer outcome as it results in a decrease in the cerebral perfusion pressure (Butcher et al., 2007b). On the other hand higher systolic blood pressure (greater than 150 mmHg), is indicative of lower motor scores as well as a higher number of patients with mass lesions. Butcher et al. (2007b) hypothesised that a higher blood pressure was due to the Cushing response (an increase in systolic blood pressure in response to an increased intracranial pressure), thus indicating more severe lesions.

Computed Topography (CT) scans of the brain can assist medical practitioners in guiding the acute management of patients with traumatic brain injury (Englander et al., 2003). However, their use in predicting long term outcomes of patients has not yet been established. CT scans are able to assist in predicting mortality in people with severe closed brain injury (Englander et al., 2003). Important structures that need to be looked at closely include the presence of mesencephalic cisterns, the degree of midline shift and the presence of surgical masses (Englander et al., 2003). Thus, the study by Englander et al. (2003) highlights that the anatomy, size and location of injuries are suggestive of unexplored relationships between CT scans and functional outcome.

Pillai et al. (2003) found that the effacement of ventricles and cisterns, presence of midline shift and a subarachnoid haemorrhage have a significant bearing on the outcome of the patient. In addition, to the Glasgow Coma Scale, the pupillary reflex and the oculocephalic reflex is also a significant predictor of outcome. The oculocephalic reflex, the motor component of the Glasgow Coma Scale as well as the presence of a midline shift on CT scan are able to predict a poor outcome (death, persistent vegetative state or severe disability), as measured with the Glasgow Outcome Scale, with a seventy five percent sensitivity (Pillai et al., 2003).

A midline shift, compression and/or obliteration of the mesencephalic cisterns as well as a subarachnoid haemorrhage are associated with increased intracranial pressure (ICP) or death (Michael et al., 1994). CT scan findings which are consistent with herniation are strongly associated with death or an increased ICP. ICP higher than 25mmHg within the first twenty four hours and ICP above 30mmHg between twenty four and forty eight hours were indicative of poorer outcome (Signorini et al., 1999). In addition, the presence of a subarachnoid haemorrhage is associated with poor outcomes. However, according to Michael et al. (1994), it has been reported that projectile injuries, the site of injury and the presence or absence of foreign material does not have a significant impact on the outcome of the patient.

The location of the lesion may be a vital factor in determining the outcome following traumatic brain injury (Lehtonen et al., 2005). The anterior cortical areas are more vulnerable to injury and result in deficits in executive functioning. These executive functions include planning, goal-setting, control of behaviour as well as cognitive flexibility. Lehtonen et al. (2005) stated that focal lesions caused more persistent and severe memory deficits than did diffuse axonal injuries. In addition, focal lesions to the frontal lobe resulted in behavioural symptoms as well as impaired concept formation and verbal fluency. According to Lehtonen et al. (2005), it was found that focal lesions in the temporal lobe tend to cause impairments in non-verbal problem solving and non-verbal fluency as do lesions to the frontal lobe, ultimately affecting the patient’s communicative abilities. Temporal horn enlargement and hippocampal atrophy is associated with verbal intellectual and memory dysfunction especially in focal temporal lesions (Lehtonen et al., 2005). This has an impact on the patient’s ability to work, socialise as well as partake in activities that require higher functioning. In order to accurately predict the outcome of a patient post- traumatic brain injury, multiple risk factors need to be considered (Mushkudiani et al., 2008).

The predictors of recovery from traumatic brain injury include general health, intelligence, personality, social class, employment status, family structure, previous head injuries as well as substance abuse (Brown et al., 1992). Pre-injury factors associated with poorer outcome after traumatic brain injury includes: extremes of age, history of previous head injury, alcohol abuse, lower socio-economic as well as educational status (Chua et al., 2007).

According to Rao et al. (1988), patients younger than 21 were more likely to achieve independent behaviour levels, while patients with only high school education had a greater degree of interaction on discharge (Rao et al., 1988). According to Ik - Chan et al. (2008), fewer years of education may predispose individuals to be more vulnerable to the functional impact of TBI on the intelligence quotient (Ik - Chan et al., 2008). This has been re-iterated by Mushkudiani et al. (2007), who found that higher educated patients (with more than 12 years of education) have a more favourable outcome compared to those with a lower education level (Mushkudiani et al., 2007). However, Mushkudiani et al. (2007) did not provide further explanations as to the reason for this finding. Ik - Chan et al. (2008) found that higher educational level and intelligence may preserve the cognitive function of a patient regardless of the severity of the injury, thus indicating that a higher level of education may further aid the recovery of the patient.

Patients who have moderate or maximum levels of attention, concentration as well as realism are more likely to be ambulant at discharge and are also thought to be independent in functional items pertaining to behaviour and interaction (Rao et al., 1988). The most important outcomes to patients with traumatic brain injury as well as their families are the ability to ambulate independently and to resume productive ability (Englander et al., 2003).

Extremes of age have been linked to poorer outcomes (Chua et al., 2007). Chua et al. (2007) also stated that the elderly form the second peak in prevalence for traumatic brain injury. They are more at risk of TBI due to medical co-morbidities and frailty, thus resulting in a poorer prognosis and functional outcome. In addition, they tend to have a higher incidence of traumatic intracranial and subarachnoid haemorrhage, both of which are associated with a poorer outcome, thus resulting in a higher mortality rate. Another reason for a poorer prognosis is due to poorer neuronal reserve and quality found in the elderly, usually due to cerebrovascular disease and dementia (Chua et al., 2007). According to Roller et al. (2002) it has been found that neural plasticity in animals is found to occur throughout their lifespan. However, it has been found to decline with increasing age. Rosenzweig et al. (2003), found that age – related plasticity deficits may also have an effect on cognitive function as the dynamics of hippocampal functioning are affected.

Pre-injury factors affecting employment level post injury includes age, education level and prior employment (Gary et al., 2009). However, Gary et al. (2009) found that within all race groups the level of employment steadily increased one year post injury. In addition, Gary et al. (2009) found that the likelihood of returning to work over time (eg. after five years) was less in people that were older, thus highlighting the effect of age on return to work post injury. Moreover, it was found that the rate of unemployment was higher in black people both before and after the injury (Gary et al., 2009). This was further re-iterated by Arango-Lasprilla et al. (2008), who found that the odds of minorities, in the United States of America, (predominantly consisting of black people) being unemployed is 2.2 times greater than the odds of a white person being unemployed. Ethnic minorities were found to be twice as likely to have worse productivity one year post injury as compared to non minority groups. It was also found that minority groups were more likely to be employed as manual labourers or professional jobs on the lower end of the spectrum (Arango-Lasprilla et al., 2008). Thus, even though minority groups were less likely to be employed one year post injury, those who were employed were more likely to be manual labourers (Arango-Lasprilla et al., 2008).

According to Cifu et al. (2003), the acute care length of hospital stay is a significant predictor of therapeutic services. Cifu et al. (2003), stated that more intensive therapy provided on a daily basis has been suggested to reduce the length of hospital stay as well as improve the short as well as long term outcomes (Cifu et al., 2003). Recent investigations found that outcomes improved with an increase in intensity of therapy. It should, however, be noted that as stated by Cifu et al. (2003), there are many other studies that found that there is no meaningful relationship between the patient's outcome and the intensity of therapy. According to Heinemann et al. (1995), the intensity of physical, occupational and speech therapy was not related to motor or cognitive outcomes. Heinemann et al. (1995) attributed variations in length of hospital stay to factors like age and functional status on admission. Functional status on admission was more predictive of intensity of speech therapy services as compared to physiotherapy and occupational therapy. Heinemann et al. (1995) also found that younger people were found to have a greater functional reserve and better endurance thus allowing them to receive more intense therapy.

Optimum levels of therapy are unclear, but many centres outside the United Kingdom are required to provide more than three hours of therapy a day (Slade et al., 2002). Slade et al. (2002) conducted a randomised controlled trial and increased the level of therapy provided to patients to sixty seven percent more than the normal therapy time. This sixty seven percent increase in therapy time translated into patients still only having one and quarter hours of occupational therapy and physiotherapy a day. It was not explained why a sixty seven percent increase in therapy time only translated into one and quarter hours of therapy. Nonetheless, with the increased intensity of therapy, it was found that the length of stay at the rehabilitation facility was reduced by five days. This indicated that an increased intensity of rehabilitation decreases the length of stay at a rehabilitation facility. However, no significant difference in discharge Barthel scores were noted meaning very little if any impact on function was noted (Slade et al., 2002). In other words the study showed that increased intensity of therapy can result in decreased length of stay at the rehabilitation facility, thereby allowing the patient to return to their homes and communities early, but does not show the direct correlation to an improvement in functional ability.

During rehabilitation after traumatic brain injury, the development of movement does not only occur due to constraint induced movement but also occurs when the patient engages in activities that are both functionally and developmentally appropriate in the environmental context (Braga et al., 2005). Moreover, the movement has to meet certain requirements of that task (Braga et al., 2005). The process of motor learning can result in the arborisation of dendrites as well as the growth of synapses in the cerebral and the cerebellar cortex (Dobkin, 1993). Therefore, activities that retrain movement may aid motor learning. Dobkin (1993) reported that the use of treadmill training for hemiplegic patients resulted in an increase in overground velocity, thus providing one example of rehabilitation.

Community based rehabilitation is an imperative part of the rehabilitation process for patients with traumatic brain injury as it allows them to re-engage with their lives as fully as possible (Powell et al., 2002). But, there is limited evidence that a multi-disciplinary community-based rehabilitation program for patients with severe traumatic brain injury can improve their functional outcome at the level of activity. However, current research shows that fatigue plays a role in flagging the recovery from many cognitive and motor deficits, more so than mood disorders (Chua et al., 2007). Without community based rehabilitation, the advances made during inpatient rehabilitation may not be integrated into the home, social and vocational areas of the patient’s life (Powell et al., 2002). This trend has been increasing throughout North America, whereby the duration of inpatient rehabilitation was reduced, while improving the community based rehabilitation. Powell et al. (2002) concluded that a structured multidisciplinary rehabilitation program delivered in the community can improve the social functioning of a patient after traumatic brain injury. It was also found that the aetiology is less relevant to the success of the treatment than is psychological and social factors like motivation as well as the level of family support (Powell et al., 2002).

The success of rehabilitation programmes can be measured on the basis of whether a patient returns to work (Johnstone et al., 1999). It allows people to enjoy individual as well as societal benefits, including financial benefits, an increased sense of self worth as well as a decreased reliance on financial aid from the government. For those patients with traumatic brain injury who receive no or an unspecified amount of rehabilitation, fifty percent have been found to be unemployed. Of those patients that do return to work seventy five percent lose their jobs within the first ninety days (Johnstone et al., 1999). Johnstone et al. (1999) also found that patients with severe traumatic brain injury have considerable difficulties in returning to work, predominantly due to the severity of their injury.

Worse vocational outcomes were found in males, patients with lower Glasgow Coma Scale scores, longer hospital stay, and longer duration of post traumatic amnesia as well as more severe motor deficits (Johnstone et al., 1999). In addition, pre-injury factors predicting a decreased rate of return to work include older age, poor work history prior to injury, lower levels of education, as well as personality variables. These personality variables include a history of substance abuse, risk-taking behaviour and a history of psychiatric problems (Johnstone et al., 1999).

2.7 An Overview of the Instruments

In this section, the instruments that were used in the data collection process are reviewed.

a. Glasgow Coma Scale:

The Glasgow Coma Scale (GCS) is a tool used to record the level of consciousness in a large number of patients, especially in patients who sustained traumatic brain injury (McNett, 2007). It provides a quick and easy way to evaluate the severity of a traumatic brain injury, and has three components, which evaluate the responsiveness of a patient (McNett, 2007). These include: eye opening, motor and verbal responses. Findings have supported the assumption that high GCS scores are associated with better outcomes, while low GCS scores are associated with poorer outcomes (McNett, 2007).

The Glasgow Coma Scale is thought to assist with communication, affect decisions regarding the outcome of the patient as well as the allocation of resources (Gill et al., 2005). It is the most accurate at predicting the outcome of patients with traumatic brain injuries when combined with the age and pupillary response of the patient (McNett, 2007). Furthermore, the motor component of the Glasgow Coma Scale was able to accurately predict the patient’s functional outcome with a similar accuracy as the total Glasgow Coma Scale. The GCS scale has become a standard for reporting the level of consciousness. However, no research was conducted to investigate whether the scale is a reliable and valid measure (McNett, 2007). Other predictors of severity of injury include computed tomography (CT), intracranial pressure (ICP), cerebral perfusion pressure as well as the Head Abbreviated Injury Score (McNett, 2007). However, these predictors are not as easy to use and access. It is for this reason that the GCS is more commonly used to ascertain the severity of injury (McNett, 2007).

According to Brown et al. (1992), a Glasgow Coma Scale score ranging from five to seven has been associated with an unpredictable outcome. When compared to a study in San Diego, seventy three percent of cases were mild with eight percent being moderate and severe respectively (Bruns et al., 2003). This was further compared by Bruns et al. (2003), with a French study revealing that eighty percent were mild, eleven percent was moderate and nine percent were severe. Furthermore, it was found that traumatic brain injury caused by assaults and motor vehicle accidents were more severe than all other aetiologies combined (Bruns et al., 2003).

As aforementioned, the GCS assists in predicting the severity of injury and it was for this reason that the GCS was chosen as a tool to determine the severity of the patient’s injury. In addition, GCS is commonly used by doctors on initial assessment of the patient.

b. Rivermead Mobility Index:

The Rivermead Mobility Index (RMI) has been used in many studies that ascertain treatment effect on mobility (Hsueh et al., 2003). This scale was designed and validated by Collen et al. (1991) in order to obtain a quick and easy-to-use outcome measure (Antonucci et al., 2002). It is used in patients who have suffered from a stroke or traumatic brain injury and spans a range of disabilities from being bedridden to being able to run. In addition, it has been found to be sensitive in its ability to monitor the change in the patient's mobility status (Antonucci et al., 2002). The RMI is also able to identify the patient's perception of their personal improvement during rehabilitation (Antonucci et al., 2002). It is the only tool that measures an activity level beyond walking and the use of stairs (Williams et al., 2004).

Reliability and validity

Antonucci et al. (2002) measured the scale stability as well as the reliability of the RMI using a Rasch analysis and found that this was reliable and sensitive to change. The critical statistical fit was stated to be 1.64 and all items but one were found to be within one standard deviation of this. Green et al. (2001) also measured the reliability of this score and found a reliability co-efficient of 2.2 with 90% of patient's scores being different by two points or less. In addition, Chen et al. (2007) found the intraclass reliability to be 0.96, with the standard error of measurement being 0.8 and the smallest real difference being 2.2.

In addition, it was found that this scale was also a valid measure of the patient's functional ability, both in the hospital as well as after a rehabilitation program (Antonucci et al., 2002). According to Hsueh et al. (2003), the RMI showed moderate to high concurrent validity ($p \geq 0.78$). The reason for choosing this tool is to assess the level of physical functional ability of the patient post-TBI.

The Rivermead Mobility Index is an extremely simple tool to use, however, very little research has been published (Forlander et al., 1999). Thus, it was decided by the researcher that a score of zero out of fifteen denotes an extremely severe injury with an extremely low level of functioning (vegetative states). A score of seven out of fifteen indicates that the patient is able to walk with assistance (the aid of furniture, walking aid etc.). This indicated that the patient was functional within the home environment as they could mobilise within the home (eg. to the toilet etc.). A score of thirteen to fifteen out of fifteen indicates that the patient is high functioning as they are able to climb stairs, climb into and out of a bathtub and run. As aforementioned not much information on interpretation of RMI scores could be found in the literature therefore, this was the opinion of the researcher.

c. Modified Mini Mental State Examination:

The Mini Mental State Examination is a brief screening test used for cognitive screening of neurological patients (Elhan et al., 2005). This is crucial both at the early and follow up assessments of patients with traumatic brain injury. It encompasses six domains of cognition; including orientation, registration of new information, attention and calculation, recall of information, language as well as visuospatial construction (Elhan et al., 2005). There are a different number of items per category that an interviewer asks the patient. The study by Elhan et al. (2005) proved the Mini Mental State Examination to be both a reliable as well as a valid tool for the screening of traumatic brain injury patients. The reliability of the tool was shown by an internal consistency of 0.75 on admission and 0.70 on discharge. However, some of the items are affected by illiteracy. The Spearman correlation between the FIM cognitive scale and the Mini Mental State Examination was 0.60 at admission and 0.53 at discharge, thus confirming convergent validity (Elhan et al., 2005).

It has been found that the Modified Mini Mental State Examination is able to retain the brevity and ease of administration, but broadens the scores from zero to 30, to zero to 100 (Teng et al., 1987). Teng et al. (1987) found that the Modified Mini Mental State Examination allows for the ceiling and floor of the test to be extended. Furthermore, it allows for the sampling of a wider range of cognitive abilities as well as enhancing the reliability and validity of the scores (Teng et al., 1987). This is a screening tool used to determine cognitive ability of a person (more specifically post-TBI); therefore, it was decided that the Mini Mental State Examination be used to determine the cognitive ability of the patient post-TBI.

The Mini Mental State Examination was shown to quantitatively estimate the degree of cognitive impairment (Folstein et al., 1975). Folstein et al. (1975) found the mean score in normal subjects to be 27. 6 out of a total score of 30, while scores ranged between 24 and 30. The mean score for people with cognitive impairments and depression was found to be 19. 0, while scores for people with depression was 24. 5. The range of scores of people with cognitive impairments was found to be between nine and 27 (Folstein et al., 1975). Thus, it is thought that scores of below 24 would denote some cognitive impairment.

2.8 Conclusion:

There are many long term consequences of traumatic brain injury. It is believed that the predictors of recovery assist both the patient as well as family members in determining the duration of rehabilitation as well as potential outcomes for the patient. A vital factor predicting recovery is the severity of injury and this is particularly important in predicting return to work as well as the psychosocial status of patients post injury.

Patients with moderate/severe injuries have a higher rate of return to work if they had a higher level of education, while older adults have a better quality of life. In addition to the severity of injury being an important variable, the length of hospital stay is also predictive of outcome. However, it is important to consider other variables that may influence outcome apart from the aforementioned variables and these include pre-injury personality factors like the patient’s coping style, attitude towards life and personality.

The prognosis of traumatic brain injury varies widely and it can be described by the Hippocratic aphorism: “no head injury is too severe to despair of, nor too trivial to ignore.” (Mushkudiani et al., 2008).

Chapter 3

3. Methodology

3.1. Study Design:

A cross sectional study was used for the data collection process.

3.2. Subjects:

3.2.1. Source of Subjects

Participants for the study were recruited from Chris Hani Baragwanath Academic Hospital (CHBH), Charlotte Maxeke Johannesburg Academic Hospital and Helen Joseph Hospital.

3.2.2. Sample size:

The outcomes of this study were binary variables, i.e. satisfactory or non- satisfactory. The effect of the exposure factors were assessed using a linear regression analysis (Nunally, 1978). By convention, ten to fifteen subjects were included in the study for every factor that entered the linear regression analysis (Nunally, 1978). From the literature, not more than six factors were established to have a solid impact on functional outcomes and hence a sample size of a minimum of 60 subjects was required.

3.2.3.1. Inclusion criteria:

<u>Participants meeting the following criteria were included in the study:</u>

- Between the ages of 18 and 70.
- Sustained traumatic brain injury as evidenced by a loss of consciousness (LOC) or by post-traumatic amnesia (PTA).
- Medically stable at the time of assessment.

- Able to sign informed consent forms or whose relatives could sign informed consent on their behalf.
- Have neurological fallout.

3.2.3.2. Exclusion criteria:

Participants were excluded from the study if:

- They had no neurological or cognitive deficits due to the injury.
- They had premorbid neurological conditions or pre-existing chronic disabling pathologies.
- They were unknown and unable to communicate.

3.3. Instrumentation and Outcome Measures:

3.3.1. Self designed questionnaire

A self designed questionnaire was used to determine factors that influence functional outcome. This questionnaire comprised of six sections.

Section A captured information related to the patient's demographic details such as the patient's date of birth, age, race, gender, address, contact numbers, hospital classification as well as the date of injury, date of admission and date of assessment.

Section B captured information on the patient's mechanism of injury, types of lesions, length of hospital stay as well the medical/ surgical intervention carried out.

Section C aimed to determine the patient's level of education, marital status, and availability of a caregiver, employment status as well as the number of dependants.

Section D captured information that identified the patient's premorbid health status, lifestyle as well as their functional abilities.

Section E gathered information on the patient's continence, ability to speak as well as any complications experienced by the patient post-injury.

Section F determined whether the patient received physiotherapy, occupational therapy and speech therapy as an in patient. This section also collected information on the number of rehabilitation sessions the patient received. For in patient rehabilitation this was determined from the patient's file.

Literature and opinions of experts in the field of adult neurological rehabilitation was used to establish content and construct validity for the questionnaire.

3.3.2. Other factors that influence functional outcome were established using the following tools:

3.3.2.1. Glasgow Coma Scale (GCS) (at time of admission)

The Glasgow Coma Scale was used to evaluate the severity of a traumatic brain injury.

3.3.2.2. Modified Mini Mental State (3MS) Examination

The Mini Mental State Examination was used as a brief screening tool that evaluated the patient's cognitive abilities.

3.3.3. The Rivermead Mobility Index (RMI)

The Rivermead Mobility Index was used to measure the patient's functional outcome.

3.4. Procedure

3.4.1. Pilot Study

Aim of the Pilot Study

The pilot study was conducted in order to familiarise the researcher with the outcome measures to be used, to determine inter-rater and intra-rater reliability of the outcome measures as well as to determine any shortfalls in the methodology.

Methodology of the pilot study

Five participants presenting with TBI and meeting the inclusion criteria were assessed in the pilot study. The participants' Glasgow Coma Scale on admission was noted and a functional as well as cognitive assessment was conducted before the patients were discharged. Outcome measures used were The Rivermead Mobility Index (to measure the physical functional ability of the patient) and The Modified Mini Mental State Examination (to measure the patient’s cognitive ability). Inter-rater reliability for the self designed demographic questionnaire was established by performing the tests simultaneously with another physiotherapist, while intra-rater reliability was established by conducting the same tests on the same individuals between four and five days later. Thereafter an analysis of the data was performed.

Results of the pilot study

It was found that all the questions had between 80 and 100 percent agreement when assessing inter-rater reliability. However, two questions had less than 80% agreement. The question that looked at the number of financial dependants had 70% inter- rater reliability. This was due to the one patient giving two different answers to the different therapists. However, it is thought that it was due to the different manner in which the question was phrased as both these therapists had agreement between their first and second assessments for this patient.

The second question that had less than 80% agreement was the question on the presence of a caregiver. The patient was asked whether or not a caregiver was present all the time, only at night or only during the day or whether the patient had no caregiver. Here the researcher found with one patient that the patient was alone, while the research assistant found that the patient had a caregiver present all the time. In the subsequent assessments, the same was found for the first patient, while for patient two the researcher found that the patient had a caregiver present all the time and the research assistant found that the patient had a caregiver only present at night. However, it is thought that the research assistant phrased this question differently as he only attained 40% agreement between the first and second assessments, while the researcher attained 80% agreement.

When looking at intra-rater reliability, it was found that the researcher attained between 80% and100% agreement on all the questions in the demographic questionnaire. When analysing the intra-rater reliability of the research assistant, it was found that he had between 80% and 100% agreement between the first and second interviews for all the questions except two: the question that looked at the type of the lesion, the research assistant only had 60% agreement as he had two lesions (sub arachnoid haemorrhage and subdural haematoma) in the first assessment (from the patient's hospital file) and only one lesion in the subsequent assessment (sub arachnoid haemorrhage). In addition, he found one lesion for patient 5 in the first assessment and two lesions in the subsequent assessment. The second question where the research assistant had less than 80% agreement was the question on the presence of a caregiver. Here the research assistant only scored 40% as he had differences between the first and second assessments for three of the patients. It is thought that it was the manner in which the question was phrased.

There was no need to establish inter-rater and intra-rater reliability of the Rivermead Mobility Index and the Modified Mini Mental State Examination as these tools have already been proven to be valid and reliable.

Implications of the results of the pilot study on the data collection process

It is important to ensure that the questions posed to the patients are phrased in the same manner and if the patient does not understand the question, then it should be explained to them. Therefore, prior to the main study, both the researcher and the research assistant discussed the manner of phrasing each question (especially the questions that had low reliability) and how to explain it if the patient did not understand. It was also emphasised and more training was given to the research assistant in order to ensure that he looked for all the lesions in each patient's hospital file (given that he had poor intra- rater reliability for this section during the pilot study).

The pilot study proceeded smoothly and the only problem experienced was that some patients were discharged prior to being assessed. In order to manage this problem, a presentation was delivered to the doctors so as to create awareness of this research project. Furthermore, a suggestion was made by one of the doctors to put a brightly coloured sticker on the hospital files of all potential patients so that the doctors could easily identify the patients. This was also taken into consideration for each patient.

The time taken for the assessment to be carried out was also noted, it took between 30 and 45 minutes (depending on the patient's understanding and whether a translator was used or not). It was determined that this time was deemed acceptable for the number of outcome measures used and the information gathered.

3.4.2. Main study:

Ethical clearance was granted by the University of the Witwatersrand Ethics Committee for Research on Human Subjects (See Appendix H). Permission was also sought from the authorities at Chris Hani Baragwanath Academic Hospital (CHBH), Charlotte Maxeke Johannesburg Academic Hospital and Helen Joseph Hospital. Once these two things were accomplished, participants for the study were then recruited (See Appendices I-K).

Participants for the study were recruited from CHBH, Charlotte Maxeke Johannesburg Academic Hospital as well as Helen Joseph Hospital. Physiotherapists that covered the aforementioned wards were recruited as research assistants. Participants were identified through screening of the wards by the physiotherapist that covered that ward. These participants were then invited to take part in the study if all the inclusion criteria were met. Informed consent was obtained, whereby participants were required to sign a form stating that they consented to participating in the study. Consent was only sought after the aim and method of the study were explained to them. If a participant was unable to give informed consent, a family member of the participant was then asked to sign informed consent on behalf of the patient.

Thereafter, participants were assessed pre-discharge, once they were stable. The Glasgow Coma Scale on admission was noted, the self designed questionnaire was administered by the interviewer and the cognitive assessment conducted using the Modified Mini Mental State questionnaire. A functional assessment, using the Rivermead Mobility Index was conducted.

3.5. Ethical Considerations

The following ethical considerations were taken for this study:

- Ethical clearance was obtained from the University of the Witwatersrand Ethics Committee for Research on Human Subjects.
- Permission was sought from the authorities at Chris Hani Baragwanath Academic Hospital (CHBH), Charlotte Maxeke Johannesburg Academic Hospital and Helen Jospeh Hospital.
- Patients were asked to sign informed consent forms.
- If patients were unable to sign informed consent, a family member was asked to sign informed consent on their behalf.
- Collected information was kept confidential at all times.
- Participants were free to leave the study or refuse to participate without any negative effects on their rehabilitation needs.

3.6. Data analysis

Data were analysed using descriptive statistics for age, length of stay, GCS score, RMI score and Mini Mental State Examination score. The principle analysis was to determine the factors that impact on functional outcome. A univariate analysis was first conducted in order to determine significant factors, using the programme Statistica statistical programme. This was followed by a linear regression analysis, which is a multivariate procedure. However, in order to prevent the multivariate analysis from being limited, all the variables were included in the multivariate analysis and this ensured that all variables were analysed against each other and the most significant variables were determined. However, the data was not distributed normally, thus in order to meet the assumptions, the data was transformed and then analysed using the programme STATA statistical programme (as Statistica could not perform this function accurately including all the data). This was then tested for residuals to ensure that all significant variables were identified.

Chapter 4

4. Results

4.1. Introduction

The objectives of this study were to establish the functional outcome of patients with traumatic brain injury at discharge and to identify the factors that influence the functional outcome of patients who have sustained traumatic brain injury. Presentation of these results will be as follows: demographic results, present injury and intervention history, rehabilitation services received, scores related to the severity of injury as well as functional outcome and the influence of factors on functional outcome.

4.2. Demographics

The sample consisted of 56 males (93.3%) and four females (6.7%).

Table 4.1 below shows the average age as well as the length of hospital stay of patients that participated in the study.

Table 4.1 The average age and length of hospital stay of the patients that participated in the study (n=60)

Factor	Mean (SD)	Minimum	Maximum
Age	27.8 years (± 8.5)	17 years	52 years
Average length of hospital stay	16.9 days (±15.9)	3 days	72 days

The minimum age of the patients was 17 years, with a minimum of three days of hospital stay. The age range of the study sample is shown in Figure 4.1 below.

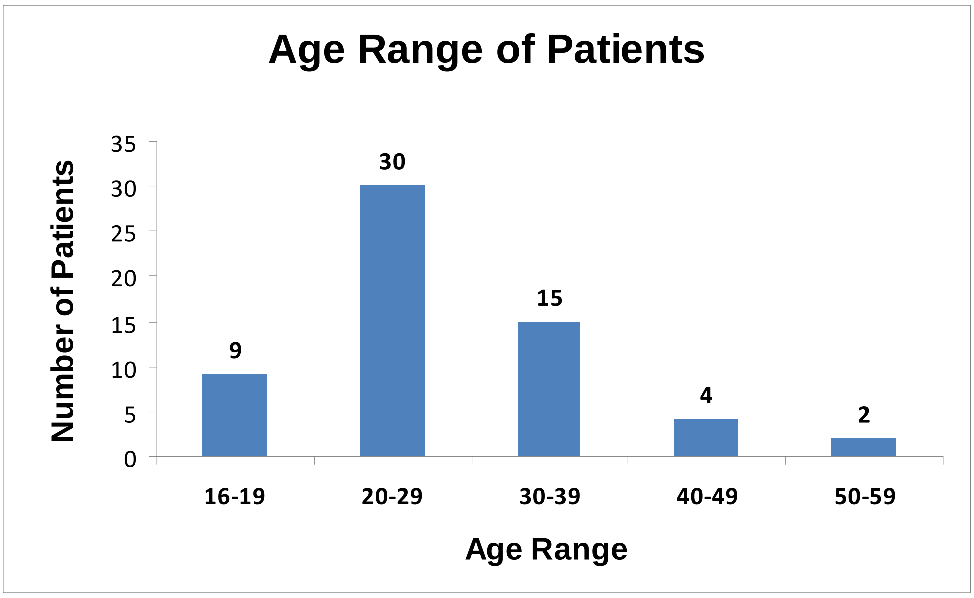

Figure 4.1. The age range of all the patients (n=60).

Half of the patients (50%) were within the age range of 20 to 29 years of age.

Details pertaining to the patients in the study sample are shown below in Table 4.2.

Table 4.2 Details of the patients in the study sample (n=60)

Patient Detail	Factor	n (%)
Level of Education	Never	2 (3.3%)
	Up to Grade 7	23 (38.3%)
	Up to Grade 11	13 (21.7%)
	Grade 12	19 (31.7%)
	Grade 12 + 3 years	3 (5%)
Marital status	Single	38 (63.3%)
	Married	5 (8.3%)
	Cohabitating	17 (28.3%)
Employment status	Employed	25 (41.7%)
	Self employed	14 (23.3%)
	Unemployed	9 (15%)
	Other	12 (20%)
Income	R0 – R800	26 (43.3%)
	R801 – R2000	21(35%)
	R2001 – R5000	8 (13.3%)
	Above R5000	4 (6.7%)
Lifestyle	Smoking	2 (3.3%)
	Drinking	14 (23.3%)
	Smoking & Drinking	36 (60%)
Availability of caregiver	Lives alone	4 (6.7%)
	Caregiver during day	1 (1.7%)
	Caregiver at night	15 (25%)
	Caregiver all the time	40 (66.7%)

The majority of patients (60%) were smoking and drinking, while 41.7% were employed.

4.3. Present Injury and Intervention

The mechanism of injury of the study sample is shown below in Figure 4.2.

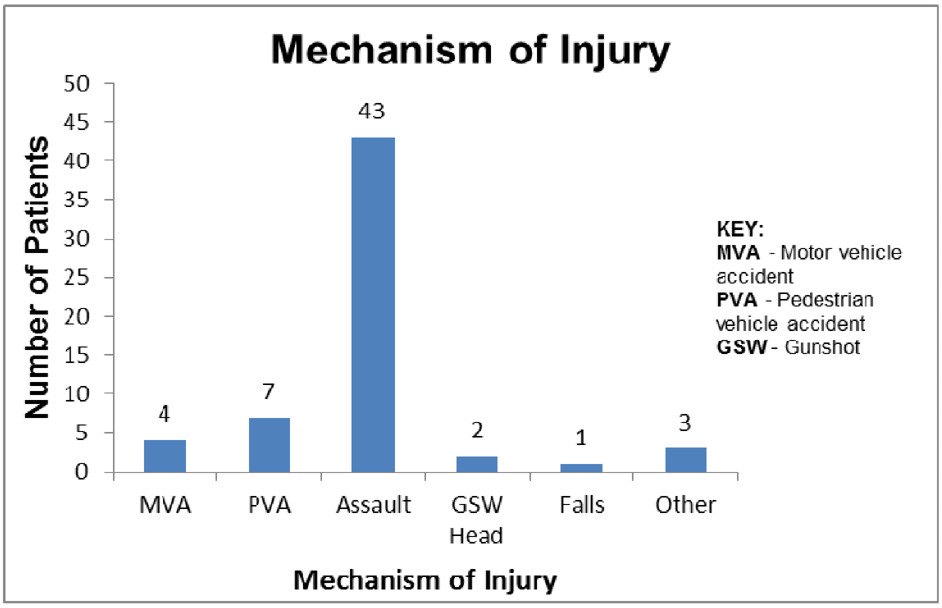

Figure 4.2: The mechanism of Injury of the study sample (n=60)

The most common mechanism of injury in this population was assault with 71.7% thereof being assaulted.

The type of intervention that the patients received is shown in Figure 4.3 below.

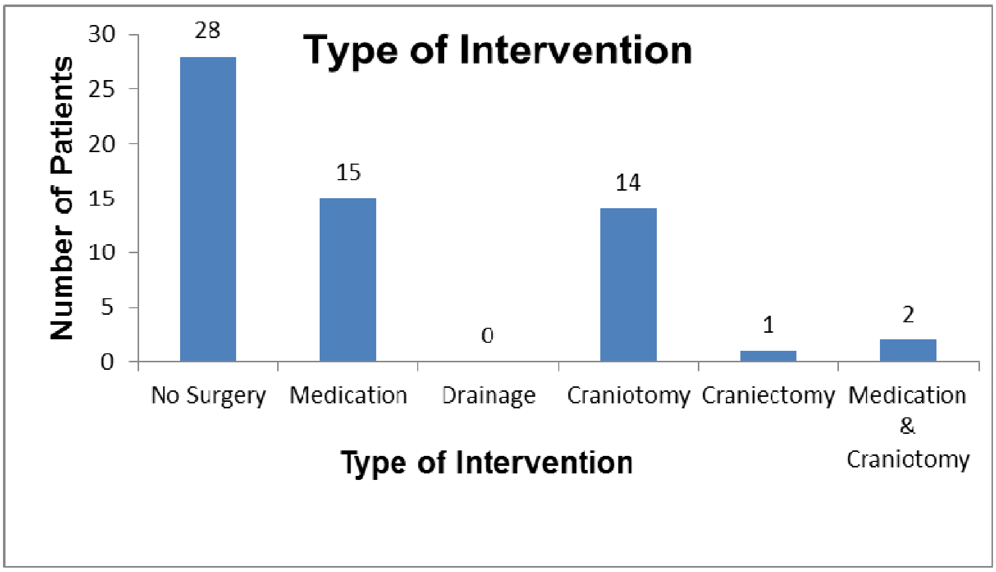

Figure 4.3: The Intervention that each patient received post-injury (n=60).

Twenty eight patients did not undergo surgery and/or receive medication (conservative management), while fifteen patients received medication in the form of Mannitol (a diuretic used to decrease the intracranial pressure as well as cerebral oedema) and fourteen patients underwent a craniotomy.

The Figure 4.4 below shows the type of lesions that patients in this study sample had. More than 50% of the patients that participated in this study had more than one type of lesion.

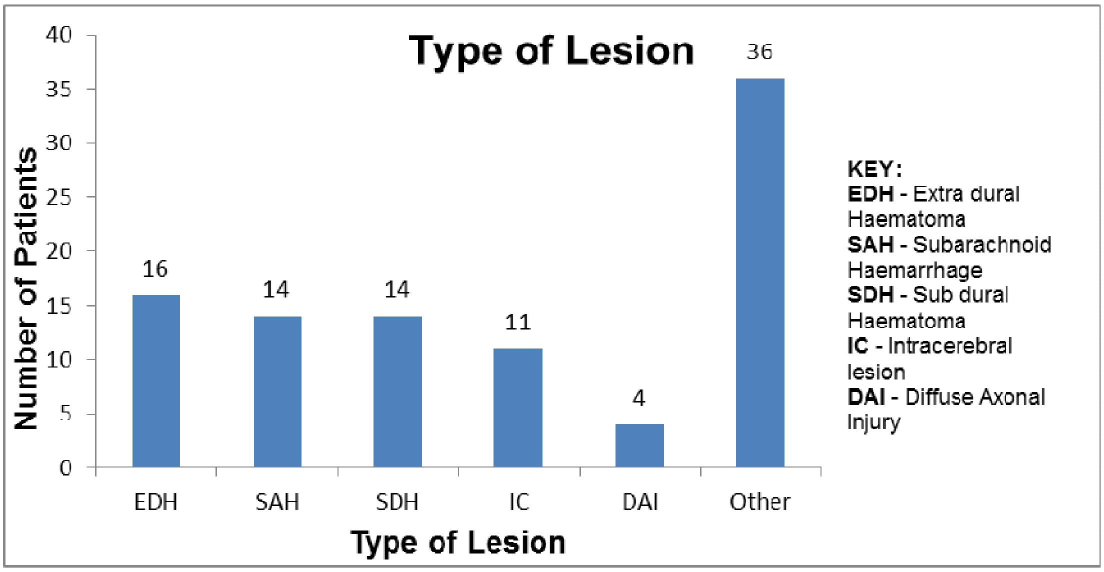

Figure 4.4: The type of lesion (n=60)

Sixteen patients had an extradural haematoma (EDH) and four had diffuse axonal injuries (DAI).

Table 4.3 below further elaborates on the 'other lesions' shown in Figure 4.4.

Table 4.3 Other lesions that patients in the study sample presented with (n=36)

Lesion	Number of patients (%)
Contusion	23 (63.9%)
Skull fracture	9 (25%)
Interventricular Haemorrhage	3 (8.3%)
Pneumocephalus	2 (5.6%)
Cerebral Oedema	2 (5.6%)
Rhabdomyolysis	1 (2.8%)
Infarct	1 (2.8%)
Hypodensity	1 (2.8%)

The most common lesion incurred by patients was a contusion (63.9%), while skull fractures were the second most common (9%).

4.4 Rehabilitation Services Received

Table 4.4 below shows the distribution of rehabilitation services received by the patients.

Table 4.4 The rehabilitation services received by the patients (n=60)

Rehabilitation received	Average number of therapy sessions Mean (SD)
Physiotherapy	5.1 (± 5.6)
Occupational therapy	1.5 (± 3.5)
Speech therapy	2 (± 2.7)

Patients received more physiotherapy sessions as compared to occupational therapy as well as speech therapy.

4.5. Severity of Injury of the Patients

Table 4.5 below displays the scores indicating severity of injury. The GCS scores were separated in the table below as some patients were scored out of 15 on admission, while those patients that were intubated on admission were scored out of 10. A score out of 10 eliminates the verbal component of the GCS. In addition, due to problems with filing at the respective hospitals, the GCS on admission was not noted in three patients hospital files, therefore, n=57.

Table 4.5 Summary of scores indicating severity of injury (n=60)

Score	Mean (SD)
GCS (/15) (n=50)	10.5(± 4.1)
GCS (/10) (n=7)	6.3 (±2)
RMI	7.6 (± 5.3)
3MSE	12.8(± 7.1)

Patients scored an average of 7.6 on the Rivermead Mobility Index indicating that they were able to walk indoors with assistance.

4.6 Functional Mobility Outcome of the Patients

Table 4.6 below shows the functional mobility outcomes for the patients post TBI

Table 4.6 The functional mobility outcomes for the patients from the Rivermead Mobility Index (n=60)

Activity	**n (%)**
Rolling	55 (91.7%)
Lying – to –Sitting	49 (81.7%)
Sitting Balance	50 (83.3%)
Sit – to – stand	44 (73.3%)
Standing Balance	38 (63.3%)
Transfer	37 (61.7%)
Walking inside with assistive device	30 (50%)
Stairs	22 (36.7%)
Walking outside	22 (36.7%)
Walking inside with no aid	24 (40%)
Picking up object from floor	22 (36.7%)
Walking on uneven ground	19 (31.7%)
Bathing	17 (28.3%)
Climbing four steps	19 (31.7%)
Running	9 (15%)

Half of the patients were able to walk indoors with an assistive device at the time of assessment, with only 36.7 percent of the patients having a higher functional level than walking indoors (i.e. climbing stairs).

4.7. The influence of demographic factors on functional mobility outcome

Table 4.7 below shows factors which had a statistically significant association with functional mobility outcome of the patients that participated in this study.

Table 4.7 Factors which had a statistically significant association with functional mobility outcome.

Factor	r value	p value
Physiotherapy	0.47	0.000
Length of hospital stay	0.48	0.000
GCS (/15)	0.36	0.004
Mini Mental State Examination	0.26	0.044
Continence	0.52	0.000

The highest association was between continence and functional mobility (0.52).

Factors that had an influence on functional mobility outcome of the patients are shown in Table 4.8 below.

Table 4.8 Factors that had an influence on functional mobility outcome

Factor	Sqrt (beta)	Std Error	t	p> ItI	[95% Confidence Interval	
Age	0.94	0.01	-4.84	0.000	0.92	0.97
Reference: Female Male	2.95	0.88	3.62	0.001	1.61	5.41
Reference: Never attended school Education - Grade 12	2.04	0.41	3.56	0.001	1.36	3.07
Reference: Employed Unemployed Self employed	3.93 4.03	1.03 0.9	5.23 6.26	0.000 0.000	2.31 2.57	6.7 6.34
Reference: R0-R800 Income (R801 – R2000) Income (> R5000)	2.05 6.35	0.39 1.99	3.79 5.87	0.001 0.000	1.39 3.35	3.01 12.04
Reference: No smoking & drinking Premorbid Smoking & Drinking	0.52	0.87	-3.90	0.000	0.37	0.73
Reference: Incontinence Bowel & Bladder Continence	3.80	0.73	6.98	0.000	2.58	5.61
Occupational Therapy Sessions	1.11	0.04	3.43	0.002	1.04	0.19
Physiotherapy Sessions	0.84	0.02	-8.08	0.000	0.80	0.88
Reference: No Medication & no surgery Medication Craniotomy	0.53 0.29	0.98 0.61	-3.41 -5.85	0.002 0.000	0.37 0.19	0.78 0.44

Patients that earned more than R5000 a month had on average 6.35 more mobility on discharge ($p=0.000$) as compared to those that earned less than R800. Patients that had craniotomy were on average 0.29 less likely to have functional mobility on discharge as compared to those patients who had no surgery and received no medication.

Chapter 5

5. Discussion

5.1 Introduction

The aim of this study was to determine the factors that influence the functional mobility outcome of patients with traumatic brain injury. The objectives of this study were to establish the functional mobility outcome of patients with traumatic brain injury at discharge from hospital, as well as to determine the factors that influence functional mobility outcome. The functional mobility outcome of patients and the factors influencing that outcome were shown in chapter four. This section will discuss the factors influencing mobility outcome as well as determine similarities and differences between the findings in this study to those found in the literature.

5.2 Functional Mobility Outcome of Patients with Traumatic Brain Injury

Only half of the patients were able to walk indoors with an assistive device implying that only half of the patients would be ambulant within their homes on discharge. This is a matter of concern to therapists as it is not always possible for therapists to meet with family members of patients (due to high work load and family members not always visiting during the week). It therefore means that many patients are not mobile within the home and later present to the hospital with many complications including pressure sores, contractures and chest infections.

Patients are showing poor mobility due to many reasons. The first reason is that the highest number of lesions suffered by patients in this study was cerebral contusions showing more severe lesions. According to Lehtonen et al. (2005) the location of the lesion may be a vital factor in determining the outcome following traumatic brain injury. Englander et al. (2003) found that subarachnoid haemorrhages, intracerebral contusions and haematomas were associated with disability. This means that patients have a poorer prognosis due to their injuries, thereby hindering their ability to be mobile.

The minimum time spent by a patient in hospital in this study was three days, with the average length of hospital stay being 16.9 days (±15.9 SD). Due to high patient turnover, many patients are discharged home before they are ambulant or before the family can be trained as to the patient's home exercise programme, thus disadvantaging the patient. In addition, 50% of patients were discharged from hospital before they were able to walk indoors with an assistive device, thus highlighting that patients were not ambulant on discharge.

Rolling was independently achieved by 91.7% of patients implying that these patients had good bed mobility and would be able to do pressure relief if left in bed for prolonged periods of time. However, these patients still have problems with mobility and accessibility both within the home as well as in the community if only able to roll. Eighty three percent of patients had good static sitting balance meaning that if discharged home these patients would at least be able to sit up. The number of patients that were able to perform sit-to-stand was 44 (73.3%), indicating that these patients with further exercise and assistance could become ambulant. Only 36.6% of patients were able to climb stairs independently, thus implying that patients that were unable to do this would be unable to access any building, shopping mall or hospital that only had stairs. Only 19 patients (31.7%) were able to walk outside on uneven ground, meaning that only 31.7% of patients would be ambulant within the community on discharge from the hospital. According to Katz et al. (2004) 82% of patients in their study achieved independent ambulation after two months and 95% achieved independent ambulation at three months post injury. The average length of hospital stay in this study was 16.9 days and this explains the relatively lower percentage of patients who achieved independent ambulation compared to those of Katz et al. (2004)'s study who were assessed between two and three months after stroke. This shows that most patients in this study would not be expected to have independent ambulation on discharge.

5.3 Factors that had an influence on functional mobility outcome of patients

For every increase in the unit of physiotherapy sessions that patients had, their functional mobility on discharge decreased by 0.84 (p=0.000). For every increase in the unit of occupational therapy sessions that patients had, their functional mobility increased by 1.11 (p=0.002). Patients who received physiotherapy were less likely to be functionally mobile despite the fact that they received more sessions of physiotherapy (5.1 ± 5.6). On the other hand patients who received more sessions of occupational therapy were more likely to be functionally mobile on discharge despite the fact that they received less sessions of occupational therapy (1.5 ± 3.5) as compared to physiotherapy.

Patients that required physiotherapy were likely to have far more severe injuries, thus requiring more sessions of physiotherapy before independent mobility could be noted. In addition, these patients only started occupational therapy once they had achieved certain mobility milestones (eg. Static sitting balance in order to be able to learn how to dress). This would, therefore, have a positive effect on mobility as compared to physiotherapy. As one of the main roles of an occupational therapist is to teach the patient activities of daily living, the Rivermead Mobility Index failed to capture this area as the Rivermead Mobility Index only assesses functional mobility. Furthermore, the focus of physiotherapy is functional mobility, therefore, patients that received more sessions of physiotherapy had more problems with mobility. Moreover, as the patient's functional mobility improved, some patients tended to reach a plateau, thus indicating that as the number of sessions increased, the improvement seen in these patients may not have increased as much. Lastly, this shows that the patients were not ready for discharge as the number of physiotherapy sessions did not have a positive impact on the patients' functional mobility on discharge. This indicates that the patients were not physically ready to be discharged.

The findings from this study found that physiotherapy and occupational therapy are significantly related to mobility. This is contradicted by Heinemann et al. (1995) who found that the intensity of physical, occupational and speech therapy was not related to motor or cognitive outcomes. However, the prediction of motor function at discharge was more accurate in patients with traumatic brain injury as compared to those with spinal cord injury. Not much information was provided as to the functional abilities of the patients, the severity of injury and the number of rehabilitation sessions. However, Heinemann et al. (1995) stated that patients with greater functional mobility were given less physiotherapy and occupational therapy.

Patients who were continent with both bowel and bladder were found on average to be 3.8 more likely to be functionally mobile than patients that were incontinent (in both bowel and bladder) ($p=0.000$). Not many studies look at the frequency of urinary and faecal incontinence in patients with traumatic brain injury (Safaz et al., 2008). Safaz et al. (2008) reported that patients with urinary and faecal incontinence were found to have poorer cognitive outcomes as compared to those patients who were continent. However, Safaz et al. (2008) did not compare incontinence to physical outcome. Patel et al. (2001) found that urinary incontinence was associated with muscle weakness and in a multivariate analysis found it to be a strong predictor of death or disability at two years. This thus highlights that the presence of incontinence indicates worse outcomes and a decrease in physical functional ability.

The older the patient got by one year, they were on average 0.94 times less likely to be functionally mobile on discharge. Thus, younger patients were more likely to have greater mobility on discharge as compared to patients that were older. This is similar to Brown et al. (1992)'s study who found that younger age has been associated with better recovery. This finding is also similar to that of Englander et al. (2003) who also established that age assists in determining functional outcome. Older people tend to have a higher incidence of traumatic intracranial and subarachnoid haemorrhage, both of which are associated with a poorer outcome, thus resulting in a higher mortality rate and thus a poorer prognosis (Chua et al., 2007). Another reason for a poorer prognosis is due to poor neuronal reserve and quality found in the elderly, usually due to cerebrovascular disease and dementia (Chua et al., 2007).

Mushkudiani et al. (2007) found a continuous relationship exists between age and outcome in patients with traumatic brain injury, indicating that the younger a person was, the better their recovery and vice versa.

This study found that males had on average 2.94 more functional mobility on discharge as compared to females (p=0.001). Not much research has been conducted looking at the physiological differences in recovery between males and females. However, Bruns et al. (2003) found that males are at higher risk of TBI as compared to females largely due to the incidence of interpersonal violence and motor vehicle accidents. This was further augmented by Chua et al. (2007) who found that the mortality rate was higher in males compared to females due to lifestyle differences as well as the differences in exposure to risk taking behaviour, which contradicts the findings of this study. However, Mushkudiani et al. (2007) found no gender differences in outcome post traumatic brain injury, thus contradicting the results of this study. In this study a comparison was made between only four female patients and fifty six male patients, and thus the results may not be reliable due to the big difference in the number of patients within each category

Patients that underwent surgery (craniotomy) were 0.29 less likely to be mobile on discharge (p=0.000) as compared to those patients that had no surgery and no medication. The interventions carried out on patients that were included in this study were specific to the type and severity of the lesion as well as the availability of investigation procedures (CT scan) and theatres for surgery at the hospitals included in this study. In addition, surgical procedures are carried out after a decision taken by the doctor together with the senior consultant at the respective hospitals included in this study. The reason for this intervention having a negative influence on functional mobility outcome can be explained by the fact that patients requiring this intervention are likely to have had more severe injuries as compared to patients requiring no surgery and no medication. Timofeev et al. (2006) stated that decompressive surgery is opted for when other measures of controlling intracranial pressure (ICP) have been exhausted. It is used as an alternative and/or an addition to medication (Timofeev et al., 2006).

Patients who had a Grade twelve education were on average 2.04 times more likely to be mobile on discharge (p=0.001) as compared to those patients that never attended school. This finding is similar to that of Mushkudiani et al. (2007) who found that highly educated patients (with more than 12 years of education) have a more favourable outcome compared to those with a lower education level. This was further re-iterated by Ik-Chan et al. (2008) who found that higher educational level and intelligence may preserve the cognitive function of a patient regardless of the severity of the injury. This will assist therapists during rehabilitation as it allows patients the understanding of instructions and tasks.

Patients that were self employed were 4.03 more likely to have better functional mobility (p=0.000) as compared to those patients that were employed, while those that were unemployed were 3.93 more likely to be mobile at discharge (p-0.000) as compared to those patients that were employed. Thus, the fact that patients were employed did not have an effect on the functional mobility outcome of the patient, as patients that were both self employed and unemployed were found to have a better functional mobility outcome. A reason for this could be that patients who were self employed did not have sick leave and were thus forced to regain function as soon as possible in order to generate an income. Those patients that were employed on the other hand would still receive an income while on sick leave as per the Basic Conditions of Employment Act: No. 75 of 1997.This states the employee may take the number of days they would normally work in a six week period for sick leave with full pay over a three year period.

The literature looks at factors that determine post-injury employment status and not at the effect of employment on functional outcome. As post-injury employment status was not an objective of this study, this will not be discussed in this section. In addition, not much research has been found that looks at the effects of employment on the functional outcome of the patient post traumatic brain injury. However, the likelihood of achieving functional independence was found to be lower in patients who were unemployed before having a stroke (Stineman et al., 1997). It is not clear why there is a difference between their findings and this study's findings besides the fact that theirs was done on patients with stroke and in a different country.

Patients that earned between R801 and R2000 a month were on average found to have 2.05 more mobility at discharge ($p=0.001$) as compared to those patients that earn between R0 and R800, while those that earned more than R5000 a month had 6.35 more mobility on discharge ($p=0.000$) as compared to those that earned less than R800. However, more than forty percent of the participants earned less than R800, while thirty five percent earned between R801 and R2000 and only six percent earned more than R5000. This indicates that most people are earning less than R800 a month and have meagre incomes to support themselves as well as their families. Not much has been found in the literature with regards to the effect of income on the functional outcome of patients post-injury. According to Sander et al. (2009) patients with a lower income were found to have poorer community integration as well as home integration skills. No mention was made of physical function. However, this can be deduced as the patient is not as active both in the home as well as in the community. People with higher levels of education usually have a higher income, thus linking income and education. As aforementioned, patients that were more highly educated were found to have better functional mobility on discharge. This implies that patients with higher income would also have better functional mobility on discharge.

Sixty percent of the patients that participated in this study were both smokers and drank alcohol. This means that only thirteen percent neither smoke nor drank alcohol. Patients that smoked and drank alcohol had on average 0.52 less functional mobility on discharge as compared to those patients that did not smoke and drink alcohol ($p=0.000$). However, not much research has been conducted to determine the effects of smoking and alcohol on recovery after traumatic brain injury.

5.4 Demographic details of the study sample

The average age of the participants in this study was 27.8 (±8.5) with 50% of the participants being between the ages of 20 and 29. This indicates that half of the participants in this study were young adults. According to Nell et al. (1991) the highest age group at risk of traumatic brain injury was twenty five to forty four years. This is different from this study's finding that the highest number of people who sustained a traumatic brain injury was between the ages of 20 and 29. A possible explanation for this is that assault is becoming one of the leading causes of TBI, especially in the lower socio-economic groups and in war-torn countries (Chua et al., 2007) and it is the opinion of the author that this results in younger people being in the higher risk group. Adolescents and young adults have a higher risk of sustaining traumatic brain injury due to violence and motor vehicle accidents (Bruns et al., 2003).

When looking at the gender of the participants it was found that only four participants (6.7%) were females. Males are at a higher risk of sustaining TBI than females, with the male to female ratio in Johannesburg being greater than 4:1 (Bruns et al., 2003). This study showed that the male to female ratio is greater than 4:1. This has been explained to be due to the testosterone ages as described by Bruns et al. (2003). This has largely been attributed to interpersonal violence and motor vehicle accidents occurring in adolescence and young adulthood (Bruns et al. 2003).

Most of the patients in this study (63.3%) were single, while only five patients (8.3%) were married. The reason for such a high number of patients in this study being single is the age of these patients. Thirty patients in the study sample were between the ages of 20 and 29, while nine were between the ages of 16 and 20. This indicates that more than 50% of the patients with TBI are young adults and at this age most of them are not yet married.

Patients were hospitalised for varying periods of time depending on severity of injury and medical stability post-injury. The length of hospital stay varied from a minimum of three days to a maximum of 72 days. However, some patients were transferred from other hospitals for specialist neurosurgical care and once they were stabilised these patients were transferred back. The longer the patient was in hospital, the more daily therapy sessions the patient received. Most research looks at the rehabilitation length of hospital stay and not much research has been found that focuses on the actual length of hospital stay post TBI.

The most common mechanism of injury was assault with more than 70% of patients sustaining their injury due to violence. This was followed by pedestrian vehicle accidents (11.67%) and motor vehicle accidents (6.67%). Nell et al. (1991) found that interpersonal violence accounted for 50.95% of all non fatal traumatic brain injuries in the African population in South Africa, 39.53% among coloured people, 25% in the Asian community and 10% in the white community. Motor vehicle accidents on the other hand accounted for more traumatic brain injuries in white people as compared to the other race groups (Nell et al., 1991). This was contradicted by Hyder et al. (2007) who stated that 60% of all traumatic brain injuries are due to road traffic accidents and only 10% of injuries being due to violence. However, these statistics are reflective of all parts of the world. This shows that the rate of interpersonal violence in South Africa is the highest cause of traumatic brain injuries.

Of the study sample two patients had never attended school, 23 (38.3%) attended school up to Grade seven (primary school), with only three (5%) studying at either a college or a tertiary institution. It was expected that not many of the participants would have a tertiary education due to the population demographics of the patients involved in this study (the participants in this study all came from a low socioeconomic background and therefore, were only able to access healthcare services at a public institute). This implies that most of the patients in this study sample did not have professional jobs and were either manual labourers or artisans. Sander et al. (2009) found that Hispanic people (forming part of the lower income bracket) had informal jobs which included painting as well as construction and yard work. This can be translated into this sample that did not have professional jobs.

However, 41.7% (25 patients) of the study sample were employed, with only nine patients being unemployed. This is interesting as only nine patients were unemployed. Due to the high rate of unemployment in South Africa, it was expected that most patients would be unemployed. Of these patients, 14 (23.3%) stated that they were self employed, by selling items to the general public and doing odd jobs. These patients therefore, attempted to make a living by finding sources of income through self employment. Perlesz et al. (2000) reported that 61.5% of patients that participated in their study were employed on a full time basis and 12.3% of participants were unemployed prior to the injury. Self employment was not considered a category by Perlesz et al. (2000) and can thus not be commented on.

Sixty percent of patients stated that they were both smokers and drinkers. Another reason for the high rate of smoking and drinking is the age group wherein more than 50% of patients fall. According to Walbeek (2001), the prevalence of smoking is 28% in people between the ages of 16 and 24 and 25.7% in people between 25 and 34 years. Hansen et al., (1991) also reported that peer pressure is a major cause of the onset for abusing commonly used substances. It is for this reason that the author hypothesised that the pressure from peers to smoke and drink is higher. The prevalence of smoking has declined from 32% in 1993 to 28% in 1999, with the number of adult smokers in South Africa being constant at approximately eight million people (Walbeek, 2001). However, in this study sample the rate of smoking is higher as compared to the 28% reported by Walbeek (2001).

According to Walbeek (2001), the prevalence of smoking among black people decreased from 28.1% in 1993 to 22.7% in 2000. A reason for this decline as given by Walbeek (2001) was that the tobacco industry has been unable to penetrate this community as much as it has in the other racial communities. As this study did not look at the race of its participants, this will not be discussed further. Walbeek (2001) also found a prevalence of 31.9 in the 25 to 34 year old age group which is similar to the highest age group in this study. The prevalence of smoking was also found to be higher in urban/metropolitan areas with people with a primary or secondary school education having a higher prevalence of smoking (Walbeek, 2001). It has been further re-iterated by Madu et al. (2003) that the prevalence of smoking has a positive correlation to both the age and standard in which the person begins to smoke. Walbeek (2001) stated that the prevalence of smoking was increasing among the lower socioeconomic class in the United Kingdom. When Walbeek (2001) compared the monthly income to prevalence of smoking, it was found that people earning less than R499 had a prevalence rate of 23.5%, while those earning between R500 and R899 had a prevalence of 23.1%, thus forming the bulk of the participants from this study. However, in this study, more than 40% of patients had a monthly income of less than R800, while more than 60% of patients smoked. This is far higher than what was found by Walbeek (2001).

According to Madu et al. (2003), the prevalence of alcohol is two times higher than that of drug usage with 11% of people reporting that it is easier to socialise when they are drunk. A possible reason for the high number of assaults (71.7%) in this study is thought to be due to the use of alcohol, whereby people have less inhibition and are more prone to violence when drunk. This has been augmented by Nell et al. (1991) who stated that alcohol use was more frequently associated to assault than it was to motor vehicle accidents. In addition, it is not culturally acceptable for black females to drink alcohol, while it is more acceptable for males to drink alcohol (Madu et al., 2003). A reason for the very high numbers of patients who drink alcohol could thus be due to the study group having a larger number of males (93.3%) as compared to females.

Another factor that was looked at during the study was the presence of a caregiver. Forty patients (66.7%) stated that they had a person who was at home on a full time basis, thus implying that the patient would have a caregiver present all the time once the patient was discharged. Twenty five percent of patients only had someone present at night, implying that the person they lived with, worked or studied during the day, while four patients (6.7%) lived alone. This means that the person would either need to find a caregiver on discharge from hospital or live with a family member who could act as a caregiver till the patient was able to live independently again. Smith et al., (2004) reported that 80% of stroke survivors are living one year post-stroke in the United Kingdom and almost a third of these people are dependant on an informal caregiver. This is different to the results of this study, which found that only 66.7% of patients had caregivers. This could be due to the different countries wherein the studies were conducted. Mamabolo et al. (2008) found that 59% of patients post stroke in the Gauteng region of South Africa had caregivers. This is similar to the results of this study that found that 66.7% of patients post traumatic brain injury in the Gauteng region of South Africa had caregivers. The reason for the similarity between this study and that of Mamabolo et al. (2008) is that both studies were conducted in the Gauteng region of South Africa.

Limitations of the study:

The study was conducted at big hospitals within the Johannesburg region (Chris Hani Barargwanath Academic Hospital, Charlotte Maxeke Johannesburg Academic Hospital and Helen Joseph Hospital). Due to the logistics of these hospitals, patients records were not always filed correctly, thus a few of the patients files were not found at discharge and certain information from the files could not be obtained when the patient was discharged. Some details were not noted in the patient's file (eg. The GCS of the patient on admission), resulting in the researcher being unable to determine these details.

A problem experienced by the researcher, during the course of the study, was that doctors discharged patients without informing the therapists concerned. Initially a lot of patients were being lost as they were not assessed due to early discharge. Thereafter, the researcher assessed the patient a few days prior to discharge to ensure that these patients were not missed. However, due to the inconsistencies of the doctors, patients were not assessed at a specific period before discharge.

The last limitation was being unable to transform the data obtained from the GCS scores. This was due to the fact that some of the patients' were scored out of 15, while those patients that were intubated on admission were scored out of 10. For this reason the data could not be transformed. Thus, the researcher together with the statistician was unable to include the GCS scores in the final multivariate analysis.

Chapter 6

6. Conclusion and Recommendations

6.1 Conclusion

The first main objective of this study was to identify the functional outcome of patients with traumatic brain injury post discharge from hospital. Only 50% of patients were able to walk indoors with an assistive device or an aid. Less than 40% of patients in this study sample were ambulant within the community, thus implying that most patients were not independent within the community on discharge. The cognitive status, as well as the degree of continence and the communicative ability of the patient was imperative in ensuring that the patient was independent both within the home as well as within the community on discharge from hospital.

The second objective of this study was to identify the factors that influence the functional mobility of patients who have sustained a traumatic brain injury. Previous studies have identified a multitude of factors and this study has served to confirm that some of the aforementioned factors are significant to functional outcome post traumatic brain injury. The gender of the patient, Grade 12 education, being either self employed or unemployed, an income of between R800 and R2000 as well as more than R5000, having both bowel and bladder continence and Occupational therapy sessions have a positive impact on the physical function of the patient on discharge. On the other hand, age, premorbid smoking and drinking, having a craniotomy and physiotherapy sessions have a negative impact on the physical function of the patient on discharge.

6.2 Recommendations

6.2.1 Clinical Recommendations

Traumatic brain injury still remains a major cause of morbidity, mortality and disability. The impact on the family as well as the society is colossal, especially in the South African context where one man is the sole provider for families consisting of a large number of people. It is for this reason that awareness campaigns should focus on decreasing the number of motor vehicle and pedestrian vehicle accidents as well as the number of assaults. Assault was a major cause of traumatic brain injury in this study. For this reason the main focus on preventive campaigns should focus on preventing assaults and decreasing interpersonal violence. Awareness campaigns must also focus on preventing motor and pedestrian vehicle accidents as these were the second most common cause of injury in this study.

As aforementioned, less than 40% of patients were not ambulant outdoors, thus implying that they were not mobile within the community. An extended period of rehabilitation would be ideal for many of these patients, thus it would be ideal to have more post discharge rehabilitation facilities in order to continue with rehabilitation post discharge.

6.2.2 Recommendations for Further Research

Different countries and populations have different characteristics and this research report identified those factors that influence functional mobility outcome of patients within the Gauteng province of South Africa. Future research could identify factors that influence functional outcome post traumatic brain injury in different populations. In addition, common factors can then be identified from the different populations.

The influence of functional mobility post-traumatic brain injury in community integration as well as many other life roles including employment, family functioning and the impact on the caregiver are other areas that can be investigated.

Chapter 7

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Appendices

Appendix A: Information Sheet for Patients

INFORMATION SHEET FOR PATIENTS

Dear Patient

My name is Sameera Haffejee and I am currently doing a Masters degree in physiotherapy. In addition, I work as a physiotherapist at Chris Hani Baragwanath Hospital. From clinical experience I have found that there are a lot of patients who have had a head injury (traumatic brain injury). It is for this reason that I am doing a research project that will aim to find out things that influence the patient's ability to function after they have had a head injury.

Patients who agree to participate in this study will be tested, at discharge, in their ability to walk or move around and their ability to understand. In addition, patients will be assessed three months after discharge for the above as well as the level of functioning in the community. Patient's who participate in this study will be required to come to the hospital three months after they have been discharged for the follow up assessment. However, these patients will be given money (R50) to assist them with transport costs on the day of their follow-up assessment. Participating in this study should not lead to any injury or discomfort.

This study will thus assist health professionals in their treatment of people with traumatic brain injuries. It will assist therapists to identify which patients need to attend a rehabilitation center (patients who require intensive therapy). In addition, it will assist the patient's family to identify whether the patient will need extra help at home and if there will be increased costs to the household in order to care for the patient.

Therefore, I would like you to participate in this study. Your participation would be completely voluntary. If at any point during the course of the study, you decide not to participate in this study you will not be treated any differently than what you were before the study. The information gathered in this study is confidential and will not be shared with anyone without your permission.

For further information please feel free to contact me at any time.

Sameera Haffejee (Miss)
(011) 933-8309
0828484364

Appendix B: Consent Form for Participants

CONSENT FORM FOR PARTICIPANTS

I ____ have read the information sheet and agree to take part in the study that is being conducted by Miss S. Haffejee. By signing this form I am agreeing to be assessed at discharge as well as 3 months after discharge on my ability to walk or move around and my ability to understand, as well as how well I am coping in the community.

I understand that there are no monetary rewards to participate in this study and that I am not forced to participate and can withdraw from the study at any time. In addition, I understand that this will not affect the rehabilitation that I will receive.

Signed _______________________________________

Witness ______________________________________

Date ____

Appendix C: Consent Form: Use of Clinical Information

CONSENT FORM: USE OF CLINICAL INFORMATION

THIS DOCUMENT MUST BE EXPLAINED TO THE PATIENT BY A MEMBER OF THE CLINICAL STAFF

PATIENT NAME	HOSPITAL NUMBER

YES	I hereby give consent for my patient records or the patient records of my family member to be used as per the abovementioned conditions for the purposes of research.

FULL NAME OF THE PERSON GIVING CONSENT (PLEASE PRINT)	WRITE "SELF" OR GIVE RELATIONSHIP TO THE PATIENT
SIGNATURE	DATE

NO	I do not give consent for such patient records to be used.

FULL NAME OF THE PERSON DECLINING CONSENT (PLEASE PRINT)	WRITE "SELF" OR GIVE RELATIONSHIP TO THE PATIENT
SIGNATURE	DATE

FULL NAME OF THE WITNESS (PLEASE PRINT)	
SIGNATURE	DATE

Appendix D: Patient Demographic Questionnaire

PATIENT DEMOGRAPHIC QUESTIONNAIRE

SECTION A: DEMOGRAPHIC DETAILS

Name: ________________________________ Date of birth: ____________________

Age: _________________________________ Hospital Classification: __________

Address: ____

Patient's Contact number: ____

____

Primary caregiver: _______________________ Contact Number: ______________

Date of Assessment: _____________________ Date of Injury: ________________

Date of Admission: ______________________ Date of Discharge: ____________

Gender: ________________________________

SECTION B:

1. Mechanism of injury:
   - ☐ MVA
   - ☐ PVA
   - ☐ Assault
   - ☐ GSW Head
   - ☐ Falls
   - ☐ Other: Specify ____

2. Type of lesion:

- ☐ Extra dural haematoma
- ☐ Sub arachnoid haemorrhage
- ☐ Sub dural haematoma
- ☐ Intracerebral
- ☐ Diffuse axonal injury
- ☐ Other: Specify: ____

3. Medical/surgical intervention

- ☐ No surgery
- ☐ Medication
- ☐ Drainage (burrholes)
- ☐ Craniotomy
- ☐ Craniectomy
- ☐ Other: Specify: ____

4. Length of hospital stay as an in patient

   ____ Days

SECTION C:

1. Level of education:

- ☐ Never attended school
- ☐ Upto grade 7
- ☐ Upto grade 11
- ☐ Grade 12 or equivalent
- ☐ Grade 12 + 3years or more
- ☐ University degree

2. Marital status:

- ☐ Single
- ☐ Married
- ☐ Divorced
- ☐ Separated
- ☐ Cohabitating
- ☐ Other: Specify: ____

3. Employment status:

- ☐ Employed
- ☐ Self employed
- ☐ Unemployed
- ☐ Retired
- ☐ Receiving grant/benefit
- ☐ Other: Specify: ____

4. Number of people Financially dependant on patient: __________________

5. Gross Monthly Income:

- ☐ R0 – R800
- ☐ R801 – R2000
- ☐ R2001 – R5000
- ☐ More than R5000

6. Source of income: ____

7. Caregiver assistance:

- ☐ Lives alone
- ☐ Caregiver present only during the day
- ☐ Caregiver present only at night
- ☐ Caregiver present all the time

SECTION D:

1. Premorbid conditions:
   - ☐ Diabetes
   - ☐ Epilepsy
   - ☐ Asthma
   - ☐ Arthritis
   - ☐ Tuberculosis
   - ☐ Heart disease
   - ☐ Hypertension
   - ☐ Thyroid
   - ☐ Brain tumour
   - ☐ Other conditions: Specify: ___________________________________
2. Premorbid lifestyle:
   - ☐ Smoking
   - ☐ Drinking alcohol
   - ☐ Obesity
3. Premorbid functional status:
   - ☐ Was Independent in all ADL'S
   - ☐ Required assistance with some ADL'S
   - ☐ Required assistance with all ADL'S
   - ☐ Other: Specify: ____

6. Clinical manifestations of HIV:
   - ☐ Generalised wasting
   - ☐ Generalised weakness
   - ☐ Poor Exercise tolerance
   - ☐ Poor response to rehabilitation

SECTION E:

Baseline assessment of patient:

1. Continence:
   - ☐ Bowel
   - ☐ Bladder
2. Aphasia
   - ☐ Global
   - ☐ Receptive
   - ☐ Expressive
3. Is the patient able to communicate fluently:
   - ☐ Yes
   - ☐ No

SECTION F:

1. Rehabilitation:

Did the patient receive the following therapy while in hospital:

Therapy:	Number of sessions (in patient):
Physiotherapy	
Occupational therapy	
Speech therapy	

Appendix E: Glasgow Coma Scale

Glasgow Coma Scale

The Glasgow Coma Scale provides a score in the range 3-15; patients with scores of 3-8 are usually said to be in a coma. The total score is the sum of the scores in three categories. For adults the scores are as follows:

Eye Opening Response	Spontaneous--open with blinking at baseline	4 points
	Opens to verbal command, speech, or shout	3 points
	Opens to pain, not applied to face	2 points
	None	1 point
Verbal Response	Oriented	5 points
	Confused conversation, but able to answer questions	4 points
	Inappropriate responses, words discernible	3 points
	Incomprehensible speech	2 points
	None	1 point
Motor Response	Obeys commands for movement	6 points
	Purposeful movement to painful stimulus	5 points
	Withdraws from pain	4 points
	Abnormal (spastic) flexion, decorticate posture	3 points
	Extensor (rigid) response, decerebrate posture	2 points
	None	1 point

Appendix F: Rivermead Mobility Index

RIVERMEAD MOBILITY INDEX

Instructions: The patient is asked the following 15 questions and observed (for item 5). A score of 1 is given for each yes answer. Note that most require independence from personal help, but method is otherwise unimportant.

Q	Question	Yes	No
1	*Turning over in bed* Do you turn over from your back to your side without help		
2	*Lying to Sitting* From lying in bed, do you get up to sit on the edge of the bed on your own without holding on for 10 seconds		
3	*Sitting balance* Do you sit on the edge of the bed without holding on for 10 seconds		
4	*Sitting to standing* Do you stand (from any chair) in less than 15 seconds, and stand there for 15 seconds (using hands, and with an aid if necessary)?		
5	*Standing unsupported* Observe standing for 10 seconds without any aid or support		
6	*Transfer* Do you manage to move e.g. from bed to chair and back without help?		
7	*Walking inside, with an aid if needed* Do you walk 10m, with an aid or furniture if necessary, but no standby help?		
8	*Stairs* Do you manage a flight of stairs without help?		
9	*Walking outside (even ground)* Do you walk around outside, on pavements without help?		
10	*Walking inside, with no aid* Do you walk 10m inside with no calliper, splint, aid or use furniture, and no stand-by help?		
11	Picking off floor If you drop something on the floor, do you manage to walk 5m, pick it then walk back?		
12	*Walking outside (uneven ground)* Do you walk over uneven ground)grass, gravel, dirt etc) without help?		
13	*Bathing* Do you get in/out of bath or shower unsupervised and wash self?		
14	*Up and down four steps* Do you manage to go up and down four steps with no rail and without help, but using an aid if necessary?		
15	*Running* Do you run 10m without limping in 4 seconds (fast walk is acceptable)?		

Total……/15

7

Appendix G: Modified Mini Mental State Examination

GSH/UCT GERIATRIC CLINIC
MODIFIED FOLSTEIN'S MINIMENTAL STATE EXAMINATION (MMSE)

INSTRUCTIONS, SEE OVERLEAF

		POSSIBLE POINTS	SCORE
a	What is this year?	1	...
b	What is this season?	1	...
c	What is this month?	1	...
d	What is the date?	1	...
e	What day of the week is this?	1	...
a	In which country are we?	1	...
b	In which province are we?	1	...
c	In which town/city are we?	1	...
d	In which hospital are we?	1	...
e	In which ward/clinic/floor are we?	1	...

Tell the patient "I am going to say three words which I want you to remember". Then say (only once) "apple, pen, table," taking one second for each (Afrikaans: "appel, pen, tafel"). Score one point for each correct answer. Then ask patient to repeat all three. Then say "Later I am going to ask you to repeat these three words". — 3 ...

a Say "If you had 100 cents and spent seven cents what would you have left? Then say "Now take away seven cents again". Stop after five answers (eg 93, 86, 81, 64, 59 scores 2). Do not correct wrong answers. Enter score (maximum 5) in box.

b Ask patient "Spell "WORLD". Correct any errors and rehearse until patient spells correctly. Then ask patient "Now spell WORLD backwards". (Afrikaans: Spell HERFS agteratevoorom"). Score one point for each letter correctly placed and enter score (maximum 5) in box. (eg DLORW = 3; DWR = 1; LROW = 0)

c For illiterate patients ask patient "Will you please say this sentence after me: 'Every dog has its day'" and then "Now say it backwards, please". (Afrikaans: "Elke hond kry sy dag" agteratevoorom). Score one point for each word correctly placed as in 4b and enter score (maximum 5) in box

(Der 4a, c) ...

		POSSIBLE POINTS	SCORE
5.	Ask patient "Please repeat the three words that I asked you to remember" (as in question 3). Score one point for each correct answer.	3	...
6.	Point to a pen and a watch. Ask patient to name them as you point.	2	...
7.	Tell patient "I am going to say something once and then I want you to repeat it". Then say "No ifs, ands or buts". (Take care to pronounce the final s's clearly and penalise if the patient omits them.) (Afrikaans: "Nog vis, nog vlees, nog voëls").	1	...
8.	Ask patient to follow this three-stage command: "Take this paper in your right hand. Fold the paper in half. Put the paper on the floor". Then hand patient the paper. (Afrikaans: "Neem die papier in u regter hand, vou dit dubbel, en plaas dit op die vloer"). (Penalise if the patient folds the paper more than once and note "perseveration" on the final page).	3	...
9.	Ask patient to read and obey the instruction printed overleaf ("Close your eyes" or "Maak u oë toe").	1	...
10.	Ask patient to write a sentence of own choice. (The sentence should contain a subject and a verb and be sensible. Ignore spelling errors when scoring).	1	...
11.	Ask patient to copy the design printed overleaf. (Score one point if all sides and angles are preserved and if the intersecting sides form a diamond shape).	1	...

TOTAL SCORE (MAXIMUM 30)

Age:	
Years of schooling:	
Able to read:	Yes / No
Able to hear:	Yes / No
Date:	

PREAMBLE AND INSTRUCTIONS FOR ADMINISTERING THE MMSE:

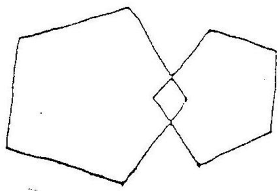
Tell patient that you are going to ask some questions and that you will be glad if he/she will help you by answering them. In the case of highly intelligent patients say that you realise that the questions may seem very easy but that for research purposes we do need to include all patients. Note that this test should only be administered to patients who are alert. For questions 6, 7, 8, 9, 10 and 11 patients with significantly impaired eyesight or deafness should be scored "E" or "D". (Please note that we are currently testing a Xhosa version for validity; 9c is a GSH additional item).

SCORING:

For a person with 7 years' schooling, good eyesight and hearing, a score of less than 23/30 is highly suggestive of dementia or delirium. Where illiteracy or eyesight is relevant the score is expressed as x/30-y (where y is the no. of disqualified questions).

MAAK JOU OË TOE

CLOSE YOUR EYES



Appendix H: Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Haffejee

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M080958**
PROJECT	Factors that Influence Functional Outcomes of Patients with Traumatic Brain Injury
INVESTIGATORS	Miss S Haffejee
DEPARTMENT	Physiotherapy Department
DATE CONSIDERED	08.09.26
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09.01.15 **CHAIRPERSON** ....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : MV Mamabolo

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix I: Letter of Permission from Chris Hani Baragwanath Academic Hospital

Gauteng Department of Health

CHRIS HANI BARAGWANATH HOSPITAL

PERMISSION FOR RESEARCH

DATE: 24-02-2009

NAME OF RESEARCH WORKER: GANEEZA HAFFEJEE (Senior physiotherapist at Chris Hani Bara)

TITLE OF RESEARCH PROJECT: FACTORS THAT INFLUENCE FUNCTIONAL OUTCOMES OF PATIENTS WITH TRAUMATIC BRAIN INJURY

OBJECTIVES OF STUDY (Briefly or include a protocol): SEE PROTOCOL

METHODOLOGY (Briefly or include a protocol): SEE PROTOCOL

CONFIDENTIALITY OF PATIENTS MAINTAINED: YES

COSTS TO THE HOSPITAL: NIL

APPROVAL OF HEAD OF DEPARTMENT: [signature] (HOD physio)

APPROVAL OF CRHS OF WITS UNIVERSITY: See attached

SUPERINTENDENT PERMISSION:

Signature: R Naik Date: 2009/03/03.

Subject to any restrictions: Please remember that functional Assessments are the core function of Occupational Therapists not Physiotherapists. I would also caution the interpretations made from the Mini Mental Tests.

No funding from CHBH.

Appendix J: Letter of Permission from Charlotte Maxeke Johannesburg Academic Hospital

Private bag X39, Johannesburg 2000, South Africa
Tel: +27 (0) 11 488 4911, Fax: +27 (0) 11 643 1612
www.johannesburghospital.org

JOHANNESBURG HOSPITAL
SIPHILISA ISIZWE | WE CARE
Gauteng Department of Health

Office of the CEO
Enquiries: M. Motjelele
(011): 488-3785
(011) 488-3753

14 April 2010

Sameera Haffeejee
Physiotherapy Department

Dear. Sameera

RE: Permission to conduct research on "Factors that influence functional outcomes of patients with Traumatic Brain Injury."

Permission is granted for you to conduct the above research as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Yours sincerely

Dr. Barney Selebano
Chief Executive Officer

Appendix K: Letter of Permission from Helen Joseph Hospital

P.O. Box 10305
Extension 8
Lenasia
1821
19 April 2010

Helen Joseph Hospital
Auckland Park
2109

Dear Sir/Madam

RE: REQUEST OF PERMISSION TO CONDUCT STUDY AT HELEN JOSEPH HOSPITAL

My name is Sameera Haffejee and I am a physiotherapist currently employed at Chris Hani Baragwanath Hospital. Currently I am studying for masters in physiotherapy at the University of Witwatersrand. As a requirement of the degree I have to conduct research specific to my field of study.

My proposed research will aim to determine the factors that influence the functional outcome of patients who have sustained a traumatic brain injury. I require approximately 100 patients in order to fulfill the sample size for the study. I have already received ethical clearance and have started my data collection at Chris Hani Baragwanath Hospital. However, due to a lot of the patients being transferred from other hospitals in outlying areas, these patients can not be included in the study (as follow up will be affected). This has, thus decreased the number of patients eligible for this study from Chris Hani Baragwanath hospital.

It is for this reason that I have decided to expand my study to include patients from Charlotte Maxeke hospital as well as Helen Joseph hospital. Furthermore, it is hoped that the data collection and analysis will be completed by the end of 2010. The study entails a functional as well as cognitive assessment of patients that meet the inclusion criteria performed prior to discharge, as well as a re-assessment at 3 months post-discharge.

I hereby request permission to conduct this study at Charlotte Maxeke hospital.

Hoping that this request will be granted.

Thanking You
Miss S. Haffejee
0828484364
haffejee@vodamail.co.za

Approved / Not Approved

Janine Webber (HOD Physio)

Date: 20/4/2010

Approved / Not Approved

Naomi Sithole (Clinical Executive)

Date: 21/04/2010