

COMMUNITY REINTEGRATION AFTER TRAUMATIC BRAIN INJURY

Heidi Gouws

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the Degree of Masters of Physiotherapy.

Johannesburg, 2019

DECLARATION

I, Heidi Gouws, declare that this research report is my own, unaided work. It is being submitted for the Degree of Masters of Physiotherapy at the University of the Witwatersrand, Johannesburg. It has not been submitted for any other degree or examination at this or any other University.



(Signature of the candidate)

25th day of September 2019

To my loving family for all the support, encouragement and motivation they have given me to complete this research report.

ABSTRACT

Background: Traumatic brain injury (TBI) affects cognitive, behavioural and physical function to varying degrees. Although the burden is spread throughout the world, developing countries such as South Africa (SA) are especially affected. The level of community reintegration post-TBI and the factors that influence it are largely unknown in SA.

Aim and objectives: The aim of the study was to describe the level of community reintegration and the associated influencing factors post TBI.

The primary objective of the study was to describe the level of community reintegration in patients with TBI six to eighteen months subsequent to discharge from hospital.

The secondary objectives include the following:

- to describe the level of functioning and disability based on the International Classification of Functioning, Disability and Health (ICF);
- to describe the health-related quality of life (HRQoL);
- to establish the respective associations between level of functioning and disability and HRQoL and community reintegration; and
- to establish the factors that influence community reintegration.

Methods: The study used a quantitative, cross-sectional analytical design. The participants were all patients who had sustained a TBI and were discharged home in the past six to eighteen months from Steve Biko Academic Hospital (SBAH) who met the inclusion criteria. Given that the study considered eight factors identified from the literature that have an influence on community reintegration post-TBI in the South African context, it was decided that eighty participants would be required for the study. They were required to complete a demographic questionnaire, the Community Integration Questionnaire (CIQ), the World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0), and the Quality of Life after Brain Injury Overall Score (QOLIBRI-OS).

Results: The male to female ratio was found to be nine to one and the median age of the sample was 32 years with an interquartile range of 14 years. A total of 53.8% of the participants presented with mild TBI, with assault (42.5%) being the most common mechanism of injury. The highest level of education was up to Grade 11 (30%) with 65% of the participants being employed pre-morbidly and 37.5% employed subsequent to the injury. Most of the participants (55%) did not receive any rehabilitative treatment.

The median total CIQ score was 22 with an interquartile range of 7.5, a minimum score of eight and a maximum score of 29, this result being interpreted as a fairly good level of community reintegration. The median WHODAS 2.0 percentage was 31% with an interquartile range of 18%, this result being interpreted as a high level of functioning with a low level of disability. The median QOLIBRI-OS percentage was 73%, with an interquartile range of 45.5%, this result being interpreted as a fairly high HRQoL. The WHODAS 2.0 percentage proved to be a significant negative predictor of the CIQ score. For every Beta = -0.4 decrease in the WHODAS 2.0 percentage, the CIQ score would increase by one unit.

No associations or relationships were found between community reintegration and gender, education levels, pre-morbid occupation, type of lesion, severity of injury or age, thus indicating that these factors do not influence community reintegration in this sample of patients with TBI. Participants with TBI who were in paid employment post-TBI attained significantly higher CIQ scores compared to those participants who, on account of poor health, were unemployed (MD = 7.73, $p < 0.001$), retired (MD = 8.13, $p = 0.02$), and, for any other reasons, unemployed (MD = 3.26, $p = 0.02$). Self-employed individuals attained significantly higher CIQ scores than both unemployed (on account of poor health) (MD = 8.8, $p < 0.001$) and retired individuals (MD = 9.2, $p = 0.02$). Individuals who were grouped as unemployed on account of poor health attained significantly lower CIQ scores compared to both students (MD = -6.03, $p < 0.001$) and those who were unemployed for any other reason (MD = -4.48, $p < 0.001$). Participants who had suffered a TBI on account of a gunshot wound to the head attained significantly lower CIQ scores compared to those participants who had suffered a TBI on account of a motor vehicle accident (MVA) (MD = -10.19;

$p = 0.001$), a pedestrian vehicle accident (PVA) ($MD = -10.97$; $p = 0.002$), a fall ($MD = -12.67$; $p = 0.001$) or assault ($MD = -12.05$; $p < 0.001$).

In this sample of participants with TBI, those who received acute in-patient and out-patient rehabilitative treatment attained significantly lower CIQ scores than individuals who received acute in-patient rehabilitation only ($MD = -6.06$; < 0.001), out-patient rehabilitation only ($MD = -7.2$; $p = 0.02$); and no rehabilitation at all ($MD = -8.06$; $p < 0.001$).

Conclusion: As indicated by the high CIQ scores, the participants in the study had good community reintegration. They presented with high levels of functioning and low levels of disability, both of which were found to be in tandem with high CIQ scores. In line with the high CIQ scores and low levels of disability, the quality of life experienced by the participants with TBI was generally good.

ACKNOWLEDGEMENTS

I wish to acknowledge with gratitude the guidance and assistance that I was granted by the following people who contributed to the research leading up this final dissertation and the writing of this report:

1. Prof. W. Mudzi and Mrs N. Comley-White (my supervisors) - for making this research report possible;
2. The staff of Steve Biko Academic Hospital Neurosurgery Ward - for their support during the data collection phase of this study;
3. The staff of the Physiotherapy Department at the Steve Biko Academic Hospital - for their endless support;
4. Mr N. Pautz - for his time and patience in advising on the data analysis for this study;
5. Mrs V. de Boer – for her time in advising on the language editing for this study.

TABLE OF CONTENTS	Page number
DECLARATION	ii
DEDICATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENTS	vii
TABLE OF CONTENTS	viii
LIST OF APPENDICES	xiii
LIST OF FIGURES	xiv
LIST OF TABLES	xv
ACRONYMS	xvii
DEFINITIONS	xix
CHAPTER 1	1
1. INTRODUCTION	
1.1 INTRODUCTION	1
1.2 BACKGROUND TO AND MOTIVATION FOR THIS STUDY	1
1.3 PROBLEM STATEMENT	2
1.4 OVERALL AIM OF THE STUDY	3
1.5 OBJECTIVES	3
1.6 SIGNIFICANCE OF THE STUDY	4
CHAPTER 2	5
2. LITERATURE REVIEW	5
2.1 INTRODUCTION	5
2.2 TRAUMATIC BRAIN INJURY	6
2.2.1 Primary injury	6
2.2.2 Secondary injury	7
2.3 EPIDEMIOLOGY OF TRAUMATIC BRAIN INJURY	8
2.3.1 Incidence of traumatic brain injury	8

2.4 CAUSES OF TRAUMATIC BRAIN INJURY	10
2.5 MORBIDITY AND MORTALITY	11
2.6 COMMUNITY REINTEGRATION POST-TRAUMATIC BRAIN INJURY	12
2.6.1 Introduction to community reintegration post-traumatic brain injury	12
2.6.2 Defining community reintegration	13
2.6.3 Predicting community reintegration	14
2.6.4 Community reintegration in the South African context	27
2.7 COMMUNITY REINTEGRATION OUTCOME MEASURES	28
2.7.1 Community Integration Questionnaire	31
2.7.2 The Craig Handicap Assessment Reporting Technique	33
2.7.3 Community Integration Measure	34
2.7.4 Reintegration to Normal Living Index	36
2.7.5 London Handicap Scale	36
2.8 INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH	38
2.8.1 International Classification of Functioning, Disability and Health based Outcome Measures	42
2.9 HEALTH-RELATED QUALITY OF LIFE	49
2.9.1 Health-related quality of life outcome measures	50
2.10 CONCLUSION	52
CHAPTER 3	54
3. METHODOLOGY	54
3.1 INTRODUCTION	54
3.2 STUDY DESIGN	55
3.3 STUDY POPULATION	55
3.4 LOCATION FROM WHICH PARTICIPANTS WERE RECRUITED	55
3.5 SAMPLE SIZE AND SELECTION	55
3.6 INSTRUMENTATION AND OUTCOME MEASURES	57
3.6.1 Demographic questionnaire	57
3.6.2 Community Integration Questionnaire	57
3.6.3 The World Health Organisation Disability Assessment Schedule 2.0	59

3.6.4 Quality of Life After Brain Injury Overall Scale	60
3.7 RESEARCH PROCEDURE	61
3.7.1 Pilot study	61
3.7.2 Main study	61
3.8 VARIABLES	64
3.9 DATA ANALYSIS	64
3.10 ETHICAL CONSIDERATIONS	67
CHAPTER 4	68
4. RESULTS	68
4.1 DEMOGRAPHIC AND CLINICAL DATA PERTAINING TO THE STUDY SAMPLE	68
4.1.1 Gender	68
4.1.2 Age	68
4.1.3 Mechanism of injury	70
4.1.4 Type of lesion	71
4.1.5 Level of education	72
4.1.6 Severity	72
4.1.7 Pre-morbid occupation	73
4.1.8 Current occupation	74
4.1.9 Rehabilitative treatment	75
4.1.10 Time in days from discharge to assessment	76
4.1.11 Duration in days of hospitalisation	76
4.2 COMMUNITY REINTEGRATION	77
4.3 LEVEL OF FUNCTIONING AND DISABILITY	78
4.4 HEALTH-RELATED QUALITY OF LIFE	79
4.5 RESPECTIVE ASSOCIATIONS BETWEEN LEVEL OF FUNCTIONING AND DISABILITY, AND HEALTH-RELATED QUALITY OF LIFE AND COMMUNITY REINTEGRATION	80
4.6. FACTORS INFLUENCING COMMUNITY REINTEGRATION	83
4.6.1 Gender	83
4.6.2 Level of education	84

4.6.3 Pre-morbid occupation	85
4.6.4 Current occupation	86
4.6.5 Mechanism of injury	89
4.6.6 Type of lesion	91
4.6.7 Severity	93
4.6.8 Rehabilitative treatment	94
4.6.9 Age	96
4.7 SUMMARY OF FINDINGS	97
CHAPTER 5	100
5. DISCUSSION OF RESULTS	100
5.1 DEMOGRAPHIC AND CLINICAL DATA PERTAINING TO THE STUDY SAMPLE	100
5.1.1 Gender	100
5.1.2 Age	102
5.1.3 Mechanism of injury	103
5.1.4 Type of lesion	105
5.1.5 Level of education	105
5.1.6 Severity	107
5.1.7 Occupation	108
5.1.8 Rehabilitative treatment	109
5.1.9 Duration of hospitalisation	111
5.2 COMMUNITY REINTEGRATION	112
5.3 LEVEL OF FUNCTIONING AND DISABILITY	115
5.4 HEALTH-RELATED QUALITY OF LIFE	116
5.5 RESPECTIVE ASSOCIATIONS BETWEEN LEVEL OF FUNCTIONING AND DISABILITY AND HEALTH-RELATED QUALITY OF LIFE AND COMMUNITY REINTEGRATION	118
5.6 FACTORS EVALUATED IN COMMUNITY REINTEGRATION	119
5.6.1 Factors influencing community reintegration	120
5.6.2 Factors not influencing community reintegration	123

CHAPTER 6	127
6. CONCLUSION AND RECOMMENDATIONS	127
6.1 CONCLUSION	127
6.2 STUDY LIMITATIONS	129
6.2.1 Limitations linked to outcome measures chosen	130
6.2.2 General limitations to the study	130
6.3 FUTURE DIRECTIONS	131
6.3.1 Information for clinicians	131
6.3.2 Future research	132
REFERENCES	133

LIST OF APPENDICES

Appendix 1: Ethics Clearance Certificate	144
Appendix 2: Permission letter	145
Appendix 3: Information letter for patient	146
Appendix 4: Information letter for caregivers	149
Appendix 5: Informed consent for patient	152
Appendix 6: Informed consent for caregiver	153
Appendix 7: Demographic questionnaire	154
Appendix 8: The Community Integration Questionnaire (CIQ)	155
Appendix 9: World Health Organisation Disability Assessment Schedule (WHODAS 2.0)	158
12-item version, proxy-administered	158
12-item version, self-administered	161
12-item version, interviewer administered	163
Appendix 10: Quality of Life after Brain Injury – Overall Scale (QOLIBI-OS)	164
Appendix 11: Turn-it-in report	165
Appendix 12: Plagiarism declaration	167

LIST OF FIGURES

Figure 2.1: The ICF Model: Interaction between ICF components (World Health Organisation, 2013)	39
Figure 3.1: Study design flow diagram	54

LIST OF TABLES

Table 2.1: WHO's ICF 'activity and participation' chapters	40
Table 2.2: Frequency in the use of instruments in the "activity and participation" domain of the ICF	43
Table 3.1: Independent and dependent variables	64
Table 3.2: Data analysis	65
Table 4.1: Age distribution for the study sample (n = 80)	68
Table 4.2: Categorised age distribution for the study sample (n=80)	69
Table 4.3: Mechanism of injury for the study sample (n=80)	70
Table 4.4: Distribution of type of lesion for the study sample (n=80)	71
Table 4.5: Distribution of the highest level of education for the study sample (n=80)	72
Table 4.6: Distribution of severity by initial Glasgow Coma Scale score for the study sample (n=80)	72
Table 4.7: Distribution of pre-morbid status by occupation for the study sample (n=80)	73
Table 4.8: Distribution of current occupational status for the study sample (n=80)	74
Table 4.9: Distribution of type of rehabilitative treatment received for the study sample (n=80)	75
Table 4.10: Time in days from discharge to assessment for the study sample (n=80)	76
Table 4.11: Duration in days of hospitalisation for the study sample (n=80)	76
Table 4.12: CIQ scores for the study sample (n=80)	77
Table 4.13: CIQ scores per gender (n=80)	78
Table 4.14: WHODAS 2.0 percentage for the study sample (n=80)	79
Table 4.15: QOLIBRI-OS percentage for the study sample (n=80)	80
Table 4.16: Descriptives of the total CIQ score, WHODAS 2.0 percentage and QOLIBRI-OS percentage (n=80)	81
Table 4.17: Pearson's Correlation Analysis to determine the respective associations between level of functioning and disability and health-related quality of life and community reintegration (n=80)	81

Table 4.18: Regression Coefficients to determine the respective associations between the level of functioning and disability and community reintegration (n=80)	82
Table 4.19: The relationship between total CIQ scores for males and females respectively (n=80)	83
Table 4.20: The relationship between level of education and total CIQ score (n=80)	84
Table 4.21: The relationship between pre-morbid employment status (pre-morbid occupation) and total CIQ score for the study population (n=80)	85
Table 4.22: Relationship between employment status (current occupation) and total CIQ score and for sample population (n=80)	86
Table 4.23: Least significant difference post-hoc tests with current occupation as the independent variable and total CIQ score as the dependent variable	87
Table 4.24: Relationship between mechanism of injury and the total CIQ score for the study population (n=79)	89
Table 4.25: Least significant difference post-hoc tests with mechanism of injury as the independent variable and total CIQ score as the dependent variable	90
Table 4.26: Relationship between type of lesion and total CIQ score for the study population (n=80)	92
Table 4.27: Relationship between severity of injury and the total CIQ score for the study population (n=80)	93
Table 4.28: Relationship between type of rehabilitative treatment received and the total CIQ score (n=80)	94
Table 4.29: Least significant difference post-hoc tests with type of rehabilitative treatment received as the independent variable and total CIQ score as the dependent variable	95
Table 4.30: Two-way Pearson's Correlation with age and CIQ as the variables (n=80)	97

ACRONYMS

ADL – activity of daily living

CHART - Craig Handicap Assessment Reporting Technique

CHART-SF - Craig Handicap Assessment Reporting Technique - Short Form

CIM – Community Independence Measure

CIQ – Community Integration Questionnaire

CVI – cerebrovascular incident

DAI – diffuse axonal injury

FAM – Functional Assessment Measure

FIM – Functional Independence Measure

GCS – Glasgow Coma Scale

HREC – Human Research Ethics Committee

HRQoL – Health-Related Quality of Life

ICP – intracranial pressure

ICU – Intensive Care Unit

ICC – intra-class coefficient

ICF – International Classification of Functioning, Disability and Health

ICIDH - International Classification of Impairment, Disability and Health

IMPACT - ICF Measure of Participation and ACTivities

IMPACT-S - ICF Measure of Participation and ACTivities Screener

IQ – intelligence quotient

LHS – London Handicap Scale

LSD – least significant difference

MVA – motor vehicle accident

PTA – post-trauma amnesia

PVA – pedestrian vehicle accident

QoL – quality of life

QOLIBRI - Quality of Life after Brain Injury

QOLIBRI-OS - Quality of Life after Brain Injury: Overall Scale

RNLI - Reintegration to Normal Living Index

RTW – return to work

SA – South Africa

SAH – subarachnoid haemorrhage

SBAH - Steve Biko Academic Hospital

SF-36 – Short Form 36

TBI – traumatic brain injury

US - United States

VAS - Visual Analogue Scale

WHO – World Health Organisation

WHODAS 2.0 - The World Health Organisation Disability Assessment Schedule 2.0

DEFINITIONS

Activities: the execution of actions and tasks (World Health Organisation 2013).

Bio-psycho-social model: a model suggesting that to understand a person's medical condition one must not only consider the biological factors, but also the psychological and social factors (Mc Inerney 2002).

Brainstem: a structure deep in the brain, which connects the two cerebral hemispheres with the medulla and the cerebellum, and is responsible for some of one's basic vital life functions, which include breathing, regulation of blood pressure, control of consciousness and circadian or sleep rhythms (Angeles Fernandez-Gil *et al.* 2010).

Community reintegration: a multidimensional concept with many definitions, but three common themes amongst these definitions are that the patient's time must be occupied with activities, he must have somewhere to live, and be able to build and maintain relationships with other people (Hardaker 2011).

Diffuse axonal injury: a type of brain damage that occurs as a result of tearing of axons during acceleration, deceleration and rotation of the brain (Lee *et al.* 2012).

Health-related quality of life: relates to the different aspects of one's life which are affected by health (Truelle *et al.* 2010). It is the subjective evaluation of well-being, satisfaction, functioning and disability (Koskinen *et al.* 2011)

Ischemia: A lack of blood; an inadequate supply of blood to a part of the body, in this case the brain, which caused by a partial or total blockage of an artery (Abbott *et al.* 2017).

Likert scale: a type of rating scale used to measure attitudes or opinions. Items are rated on a level of agreement (Statistics How To 2019)

Multidisciplinary: a treatment approach combining or involving several academic disciplines, each drawing on their own disciplinary knowledge (Jensenius 2012).

Participation: involvement in life situations (World Health Organisation 2013)

Quality of life: an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (Truelle *et al.* 2010).

Sequelae: A disease or disorder that is caused by a preceding disease or injury in the same individual (Shiel 2018).

Traumatic brain injury (TBI): a change in brain function, or other signs of brain pathology, which is caused by an externally generated force (Menon *et al.* 2010).

Visual Analogue Scale: a psychometric measuring instrument designed to document the characteristics of disease-related symptom severity (Klimek *et al.* 2017).

CHAPTER 1

1. INTRODUCTION

1.1 INTRODUCTION

This chapter presents an overview of the study, including the background, problem statement, the overall aim, the objectives and the significance of the study.

1.2 BACKGROUND TO AND MOTIVATION FOR THIS STUDY

According to the World Health Organisation (WHO), an estimated 10 million people are affected by traumatic brain injury (TBI) annually (Alexander *et al.* 2009). Although the burden is spread throughout the world, developing countries such as South Africa (SA) are especially affected (Alexander *et al.* 2009). There are few published epidemiological studies on TBI in SA, which is a significant pointer suggesting unknown morbidity and mortality rates, and hence undefined impacts on the health system (Kalyan, Radasam & Puckree 2007).

Depending on its severity and nature, TBI affects cognitive, behavioural and physical functions to varying degrees (Hardaker 2011) (Parvaneh & Cooks 2012). Impairments are often only picked up after discharge from hospital, and can be especially challenging for patients and their families. Common impairments resulting from a TBI include memory difficulties, cognitive problems, increased fatigue, reduced abilities in terms of decision making, and personality changes (Hardaker 2011).

TBI occurs most commonly in young people, which is often the age where vocational goals are set and skills are acquired (Soeker, van Rensburg & Travill 2012a). One's ability to live independently, to form relationships, to participate in leisure-time activities, to study and to pursue a career can all be affected by a TBI (Ponsford, Draper & Schonberger 2008).

Community reintegration is a multidimensional concept, with many definitions, but three common themes that stand out amongst these definitions are that the patient's time must be occupied with activities, and that he/she must have somewhere to live, and be able to build and maintain relationships with other people (Hardaker 2011). Studies have shown that despite rehabilitation services, 26 to 45% of people who have suffered a severe TBI are poorly reintegrated into their communities (Sloan, Winkler & Callaway 2004).

Owing to the rising costs of acute care, as well as rehabilitation costs, and the increasing burden placed on acute care post-TBI, it is important to predict the outcomes arising from TBI (Fleming *et al.* 1999). This information will benefit health care providers, researchers, policy makers, patients and their caregivers/family (Sherer *et al.* 2014). Factors that are likely to hamper community reintegration should thus be addressed wherever possible, and a successful community reintegration programme should, if at all possible, be implemented (Reistetter & Abreu 2005) (Hardaker 2011).

1.3 PROBLEM STATEMENT

A limited number of studies focusing on community reintegration subsequent to cerebrovascular incidents (CVI) and spinal cord injuries have been conducted in SA. The researcher is unaware of any studies in SA that focus on community reintegration post-TBI. Observations made by the researcher while working in the Neurosurgery Ward in Steve Biko Academic Hospital, showed that patients with TBI seem to have superior community reintegration outcomes compared to those who had experienced a CVI. As such, she set out to determine the actual level of community reintegration post-TBI.

Many studies done abroad have established various factors that influence community reintegration after TBI, but these do not necessarily take SA's unique population and home environment into account. The level of community reintegration post-TBI and the factors that influence it are thus largely unknown in SA.

1.4 OVERALL AIM OF THE STUDY

The aim of the study was to describe the level of community reintegration and the factors that influence it post-TBI.

1.5 OBJECTIVES

Primary Objective

- To describe the level of community reintegration in patients with TBI six to eighteen months after their discharge from hospital.

Secondary Objectives

- To describe the level of functioning and disability based on the International Classification of Functioning, Disability and Health (ICF) for patients with TBI six to eighteen months after their discharge from hospital.
- To describe the health-related quality of life (HRQoL) of patients with TBI six to eighteen months after their discharge from hospital.
- To establish the association between level of functioning and disability and HRQoL and community reintegration in patients with TBI six to eighteen months after their discharge from hospital.
- To establish factors that influence community reintegration in patients with TBI six to eighteen months after their discharge from hospital.

1.6 SIGNIFICANCE OF THE STUDY

It is envisaged that this study will provide valuable information on community reintegration in a sample of South African patients with TBI. It will contribute to the very limited body of knowledge in SA on community reintegration of patients with TBI.

Knowledge of the level of community reintegration and factors that influence it can be used to guide therapy so that it becomes tailored to address the identified problematic areas. The information gathered will be useful in identifying the community services needed by patients with TBI, and in providing motivations for them.

CHAPTER 2

2. LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents an overview and discussion of the relevant literature on which this research report is largely based. Initially, a broad overview of TBI and the epidemiology of TBI is offered. It includes an overview of community reintegration, factors that influence community reintegration, and the outcome measures that determine the level of community reintegration. The ICF as a framework for describing the level of functioning and disability and HRQoL is also discussed.

The key words and phrases used in the search were traumatic brain injury/ brain injury, pathophysiology of TBI, epidemiology of TBI, causes of TBI, community reintegration/community integration, community reintegration/integration outcome measures¹, the International Classification of Functioning, Disability and Health (ICF), ICF outcome measures², health-related quality of life (HRQoL), and HRQoL outcome measures³.

Owing to the paucity of the literature concerning community reintegration after TBI, especially in SA, the search was not limited to the last 10 years. The Witwatersrand Health Sciences Library, and the Physiotherapy, Biokinetics, and Sports Medicine LibGuide were used to search the following electronic data bases: Google Scholar, Academic Search Complete (EBSCO), CINAHL Plus with Full Text (EBSCO), Cochrane Library, PEDro, PubMed, Medline and Science Direct.

¹ searches were undertaken for the specific factors mentioned in the review

² searches were undertaken for the specific factors mentioned in the review

³ searches were undertaken for the specific factors mentioned in the review

2.2 TRAUMATIC BRAIN INJURY

Traumatic brain injury (TBI) is defined as a change in brain function, or other signs of brain pathology, caused by an externally-generated force (Menon *et al.* 2010). “Change in brain function” could refer to any loss or altered level of consciousness, any memory deficits pre- or post-injury, any neurological fallouts and/or any change in the psychological state of the patient as a result of the injury (Menon *et al.* 2010). “Other signs of brain pathology” could include confirmations of brain damage through visual, neuro-radiological or laboratory determinations. “Externally-generated force” could refer to an object hitting the head, the head hitting an object, an acceleration/deceleration movement, penetration of the brain by a foreign object, or forces generated from external events (Menon *et al.* 2010).

Pathophysiologically, TBI can be differentiated into primary and secondary injuries. Understanding this is vital, in order to ensure optimal TBI outcomes.

2.2.1 Primary injury

Primary injury is believed to be irreversible, and occurs at the time of impact (Stiver & Manley 2008). Direct damage then occurs, which involves the transfer of contact and inert energy and damage the cerebral vasculature itself (Stiver & Manley 2008).

The greatest cause of TBI in SA is interpersonal violence. The trajectory of force typically inflicted by right-handed individuals results in frontal lobe and/or left temporal lobe injuries (Webster, Taylor & Balchin 2015). A frontal lobe injury may result in poor judgement, limited problem-solving abilities, an inability to think abstractly, diminished organisational skills, less control over one’s inhibitions, impulsive behaviour, aggression, personality changes, anxiety, depression and impaired social skills (Webster *et al.* 2015). In addition to these problems, left temporal lobe injuries can lead to communication difficulties. Despite often having limited evidence of physical sequelae⁴, reduced inhibition and impairment in social

⁴ A disease or disorder that is caused by a preceding disease or injury in the same individual

skills may result in the need for patients to be under supervision to avoid dangerous situations (Webster *et al.* 2015).

Post-TBI brain damage may be due to focal or diffuse injury (Kaylan *et al.* 2007). Depending on the severity and the location of the TBI, the cognitive, behavioural and physical functions are then affected to varying degrees (Hardaker 2011) (Parvaneh & Cocks 2012). Impairments are often only picked up only after discharge from hospital, and can be especially challenging for patients and their families. Common impairments in post-TBI cases include memory difficulties, cognitive problems, increased fatigue, reduced ability in decision making, and personality changes (Hardaker 2011).

2.2.2. Secondary injury

Secondary injury ensues as a result of the primary injury, and causes a cascade of cellular events, that cause raised intracranial pressure (ICP) and include inflammation, oxidative stress, mitochondrial, metabolic and vascular complications (Stiver & Manley 2008). The major causes of secondary brain injury are hypotension, hypoxia, metabolic imbalances and electrolyte imbalances (Stiver & Manley 2008).

KwaZulu-Natal is an example of a province in SA where secondary TBI is rife. According to a 2007 audit in Kwazulu-Natal, this could be attributed to the fact that the prevention of secondary brain injury was apparently not well understood or prioritised in the medical field, and protocols and guidelines were not being adhered to (Alexander *et al.* 2009). As such, means for amongst others, organised trauma-response systems to improve patient outcomes should be sought and implemented to prevent secondary brain injuries (Naidoo 2013). Furthermore, protocols based on current TBI epidemiological data appropriate to SA's unique set of conditions also need to be developed (Naidoo 2013). This applies to South Africa as a whole and to Africa as well.

Patients with TBI often lack insight into their residual neurocognitive and behavioural fallouts. They report a need for a social life and a life filled with meaningful activity,

and often list noise sensitivity, sleep-related problems, depression, anxiety and headaches as some of their symptoms (Webster *et al.* 2015).

In general, TBI in its primary and secondary forms, is a serious public health and socio-economic problem globally, and a significant cause of death and lifelong disability among young adults (Roozenbeek, Maas & Menon 2013). Society is largely uninformed about the extent of the problem. As such, TBI is considered to be a 'silent epidemic' (Roozenbeek *et al.* 2013).

2.3 EPIDEMIOLOGY OF TRAUMATIC BRAIN INJURY

2.3.1 Incidence of traumatic brain injury

As a result of the increased use of motor vehicles, the worldwide incidence of TBI is rising (Roozenbeek *et al.* 2013). To determine the incidence of TBI is difficult, as study methods differ significantly (Bruns & Allen Hauser 2003). Furthermore, high-quality epidemiology studies on TBI are lacking (Roozenbeek *et al.* 2013). TBI incidence studies depend on information from and relating to patients who have been admitted or who have visited a hospital, which is often not the case with mild TBIs. As such, the overall incidence of TBI is possibly much higher than what is actually reported (Naidoo 2013). Milder TBIs managed in emergency departments often go uncounted, which results in a higher proportion of more severe TBI cases (Bruns & Allen Hauser 2003).

Another reason why milder TBIs may be under-reported and untreated is the limited access that many have to good health care facilities, as in the case of SA. On the contrary, more severe cases may die before reaching the hospital (Hyder *et al.* 2007).

South African studies produce data mostly from urban-based secondary and tertiary hospitals, which results in a loss of information at both the mild and severe extremities of the severity spectrum (Hyder *et al.* 2007). Furthermore, most epidemiology studies use data sets that were not originally intended for research

purposes, and therefore may have a large amount of missing data (Bruns & Allen Hauser 2003).

Estimates of TBI incidence show large variations between countries (Roozenbeek *et al.* 2013). The general TBI incidence is reported to be between 56 per 100 000 in China and 836 per 100 000 in the Netherlands (Bruns & Allen Hauser 2003). On the other hand, in developed countries, the general TBI incidence is 200 per 100 000 (Bruns & Allen Hauser 2003). A more recent study found the incidence of TBI in the United States (US) to be as high as 506.4 per 100 000 (Naidoo 2013). Differences in study designs may result in such large discrepancies.

In Western countries such as the United States (US), the annual incidence of TBIs is 1.7 million per year (Roozenbeek *et al.* 2013). TBI is the main cause of mortality in the Western Hemisphere in individuals younger than 45 years (Okonkwo 2008). Furthermore, in Western countries such as the US, the male to female ratio ranges from 1.5 to 1 to 2.8 to 1 (Bruns & Allen Hauser 2003). This is the age group where vocational goals are set and skills are acquired (Soeker *et al.* 2012a).

The WHO estimates that 10 million people are affected by TBIs annually (Alexander *et al.* 2009). Although the burden is spread throughout the world, developing countries such as SA are especially affected (Alexander *et al.* 2009). This can be attributed mainly to the high rate of interpersonal violence and the large number of road accidents (Norman *et al.* 2007).

There are, however, few published epidemiological studies on TBI in SA, which suggests that the resultant morbidity and mortality rates are largely unknown, and hence cannot be defined in terms of their impact on the health system (Kalyan *et al.* 2007). According to the literature, SA lacks a TBI databank, and TBI prevalence studies are very limited (Naidoo 2013).

The general incidence of TBI in SA in 1991 was found to be 316 per 100 000. In the same prospective sampling survey of TBI, an incidence of 360 per 100 000 in the 15 to 24-year-old age group and 409 per 100 000 in the 25 to 44-year-old age group was found (Nel & Brown 1991). There was a significant decline above the age of 64

years, with a reported incidence of 63 per 100 000. The incidence of TBI tends to peak during early childhood, late adolescence/early adulthood, and in the elderly (Nel & Brown 1991). This study was conducted during the apartheid era, where hospitals were segregated. Although these conditions no longer apply, other methodological difficulties they faced previously still apply (e.g. incomplete and unreliable hospital records, limited funding for research, the overcrowding in public hospitals, and the lack of adequate resources) (Nel & Brown 1991) (Naidoo 2013).

2.4 CAUSES OF TRAUMATIC BRAIN INJURY

An audit in 2009 at Groote Schuur Hospital in the Western Cape found that 24% of the trauma patients admitted were classified as 'head-injury' patients (Webster *et al.* 2015). In SA, a very high male-to-female ratio was found in comparison to the global ratio, namely four to one (Nel & Brown 1991). The extremely high male-to-female ratio was at a peak in young adults, and was attributable mainly to interpersonal violence (Nel & Brown 1991). At the extremities of the age categories, gender ratios were found to be similar, and could even be inverted in some studies (Nel & Brown 1991). Regardless of gender, the most common cause of TBI in children and the elderly were falls (Nel & Brown 1991). However, in the general population, intentional trauma was found to be the most frequently reported form of trauma in SA (Alexander *et al.* 2009).

In a 2007 audit of the emergency department at Edendale Hospital in Pietermaritzburg, of the 150 patients with head injuries who were admitted, only 11 were admitted to the surgical Intensive Care Unit (ICU). Forty-one percent (41%) of the TBIs were due to assault, while motor vehicle accidents (MVAs) accounted for 28%, falls for 3%, and gunshot wounds to the head, for 3%. The mechanism of injury was not recorded in the remaining 25% (Alexander *et al.* 2009).

The most common risk factors for TBI in SA are the male gender, a lower socioeconomic status (which is linked to high levels of interpersonal violence and assault), and the extremes of age (i.e. in the very old or the very young).

The leading causes of TBI in the US in descending order are falls, MVAs, objects striking the head, and assaults (Norman *et al.* 2007). Interpersonal violence, on the other hand, is far more common in SA, with the second most common cause of TBI being road accidents (Norman *et al.* 2007). Road accidents produced the highest rate of TBIs in females (Kaylan *et al.* 2007).

Epidemiological data on TBI in SA are lacking in terms of quantity and quality. Further and greater efforts should be made towards the prevention of TBI. To address the high rate of interpersonal violence in SA, more focus should be placed on violence prevention campaigns. On account of the large number of road vehicle accidents, improvements should be made in road design and road safety initiatives.

Although falls only account for a small percent of TBIs, they are the leading cause of TBI in children. Therefore, improvements in the construction of buildings and the safety of play areas should be addressed.

The quality of trauma care and access to rehabilitative services also needs to be improved. There is a need for collaboration between the developed countries with their established research programmes, and the developing countries, and clear leadership from international organisations such as the WHO (Hyder *et al.* 2007).

2.5 MORBIDITY AND MORTALITY

A study in Johannesburg by Nel & Brown (1991) found that one fifth of all TBIs resulted in death, with a male mortality rate of 138 per 100 000 and a female mortality rate of 24 per 100 000. Alarming, injury-related mortality rates in SA in 2007 were found to be six times those of the global rate, and the incidence of road accident injuries amounted to twice the global rate (Naidoo 2013). Countries with low to middle incomes, such as SA, account for over 90% of the deaths from injuries globally (Norman *et al.* 2007).

In 2000, 46% of the deaths due to injury were caused by homicide. Road accidents accounted for 26.7% and self-inflicted injuries for 9.1% of the total injury mortality (Norman *et al.* 2007). In Cape Town in 2006, homicide accounted for 25% of the

deaths in males older than 15 years. In 2000, SA's homicide rate was nine times higher than the global rate, at 184 per 100 000 for males aged 15 to 29 years, and at 31.7 per 100 000 for women aged 30 to 44 years (Norman *et al.* 2007).

The fatality rate from road accidents was 39.7 per 100 000, which is almost double the global average (Norman *et al.* 2007). SA also has a significantly large number of pedestrian vehicle accidents (PVA). In 2000, 52% of all road traffic fatalities involved pedestrians (Norman *et al.* 2007). The high incidence of road accidents can be attributed to unsafe roads, poor traffic law enforcement, reckless and/or aggressive driving, and the misuse of alcohol. PVAs can be attributed to insufficient crossing points, poor lighting and the lack of adult supervision in the case of minors (Norman *et al.* 2007).

The study conducted by Nel and Brown (1991) is the one most frequently cited in South African epidemiological literature. It was conducted in 1991 during the apartheid era, which caused wide variations in the results for the respective races. More recent epidemiological studies on such a large scale are non-existent.

2.6 COMMUNITY REINTEGRATION POST-TRAUMATIC BRAIN INJURY

2.6.1 Introduction to community reintegration post-traumatic brain injury

Twenty-six (26%) to forty-five percent (45%) of people with severe TBI were found to be poorly integrated into their communities despite their access to rehabilitative services (Sloan *et al.* 2004). Community reintegration is a multidimensional concept, defined in many ways. However, three common themes have emerged, namely that the patient must be occupied with activities, he/she must have somewhere to live, and he/she must be able to build and maintain relationships with other people (Hardaker 2011). Rebuilding or developing new roles and relationships is the crux of community reintegration (Wood 2010).

Many consider optimal community reintegration to be the final goal in rehabilitating patients with TBIs, and for the patient to return to productive activity (Fleming *et al.* 1999). Statements such as “community integration has consistently been

considered by many researchers as the ultimate goal of rehabilitation after traumatic brain injury” (Kim *et al.* 2013) and “community participation has been regarded as a key indicator of successful rehabilitation for people with disabilities” (Chang, Coster & Helfrich 2013) show how important it is to reintegrate people with disabilities into the community.

Research has shown that people with TBIs may struggle in terms of the different aspects of community reintegration, including the return to productive activity, their participation in leisure-time activities, the maintenance of friendships and intimate relationships, mobility, transportation, and independence at home (Sander *et al.* 2009).

2.6.2 Defining community reintegration

Different authors have attempted to define community reintegration throughout the years, with limited agreement amongst themselves.

- Jacobs (1993) has defined it as having something to do, a place to live, and someone to love (Hardaker 2011) (Parvaneh & Cocks 2012).
- Willer *et al.* (1993) has defined three aspects necessary for community reintegration, namely integration into a home-like setting, integration into social activities, and integration into productive activities (Hardaker 2011) (Parvaneh & Cocks 2012).
- McColl *et al.* (1998) has described community reintegration as a four-dimensional model, which consists of general integration, being able to live independently, occupation and social support (Hardaker 2011) (Parvaneh & Cocks 2012).
- McColl *et al.* (2001) has described community reintegration as the ability to live as part of the community, without being unduly disadvantaged because of a disability. This source defines it as having activities to fill one’s time, independence within one’s home-like setting, and the forging of relationships with others (Hardaker 2011).

- Wong and Solomon (2002) has described community reintegration in terms of three dimensions, namely physical integration, social integration, and psychological integration (Parvaneh & Cocks 2012).
- McCabe (2007) and Reistettler & Abrea (2005) define it as a multi-dimensional concept, including independence in living, having somewhere to live, maintaining a social support network, and participating in productive activity (Hardaker 2011).

According to Parvaneh & Cocks (2012), these respective concepts or frameworks emanate from the respective views of discrete groupings of people (e.g. patients with TBI, their families, health-care workers, or their stakeholders), rather than from a combination of ideas from all of the groups simultaneously. According to these authors, the lack of a comprehensive definition leads to difficulties in addressing the complexities of community reintegration.

Parvaneh & Cocks (2012) therefore developed a comprehensive Community Integration Framework in 2012, with the goal envisaged being that it be used to inform the structure of the community reintegration programmes for the development of outcome measures, and furthermore that it be incorporated into an evaluation instrument. They identified seven dominant themes, namely relationships, access to the community, acceptance, occupation, being at home, resuming life and heightened risks and increased vulnerability.

Community reintegration and “participation” in the ICF can be considered to be equivalent or interchangeable concepts. The ICF defines “participation” as involvement in life situations (Gretshel 2016).

2.6.3 Predicting community reintegration

Owing to the rising costs of acute care, the increasing burden placed upon acute-care facilities arising from the large number of patients with TBI visiting and admitted to hospitals, and the cost of rehabilitation, it would be useful to predict outcomes emanating from TBI (Fleming *et al.* 1999).

Goranson and colleagues (2003) found the following to be predictors of community reintegration in the case of patients with TBI:

- participation in a rehabilitation programme,
- the age when the injury was obtained,
- the level of education,
- the length of post-traumatic amnesia (PTA), and
- gender.

Fleming and colleagues (1999) divided predictors of community reintegration in patients with TBI into:

- demographic variables (age, gender, education and pre-morbidity occupation),
- injury severity variables (initial Glasgow Coma Scale (GCS) score, length of PTA, whether the patient received surgery, and length of acute hospitalisation, and
- rehabilitation variables (cognition, memory, activities of daily living (ADL), functional disability and fine motor skills).

They found that the contributing predictors of community reintegration in patients with TBI were:

- age,
- duration of PTA,
- length of acute hospitalisation,
- cognition,
- ADLs, and
- functional disability.

According to Reistetter & Abreu (2005), the following have been consistently identified as prognostic factors, regardless of the study design:

- severity of the injury,
- demographic factors (e.g. age, gender and level of education),
- prior work and living arrangements,
- cognition,
- emotional status,
- functional performance, and
- disability (Reistetter & Abreu 2005).

It is important to understand the prognostic factors for community reintegration following a TBI, so that factors that are likely to hamper community reintegration can be addressed wherever possible, and a successful community reintegration programme can be implemented (Reistetter & Abreu 2005; Hardaker 2011). This information will benefit health care providers, researchers, policy makers, the patients with TBI and their caregivers or family (Sherer *et al.* 2014).

The eight factors that were chosen by the researcher to be included in the study will now be reviewed in detail. Owing to the vast number of factors mentioned in the relevant literature, and the scope of practice of the researcher as a physiotherapist, it was not possible to include all factors that could possibly influence community reintegration. Thus, the researcher chose the most frequently discussed factors in the literature, as well as those relevant to the scope of physiotherapy practice.

2.6.3.1 Age

TBI occurs most commonly in young people, which is often the age where vocational goals are set and skills are acquired (Soeker *et al.* 2012a). TBI therefore affects one's ability to live independently, to form relationships, to participate in leisure-time activities, to study and to pursue a career (Ponsford *et al.* 2008).

Some studies found younger age to be a significant predictor of improved prognoses, whereas other studies have demonstrated no significant association between age and outcome (Ponsford *et al.* 2008). Fleming *et al.* (1999) found age to be a statistically significant predictor of scores for the total Community Integration

Questionnaire (CIQ), and of scores for the social integration and productivity subscales of the CIQ. As opposed to older people, younger people achieved higher levels of community and social integration, and productivity. As an explanation for these findings, the researcher hypothesised that when accessing social activities, older people have fewer physical reserves and their functional ability is limited (Fleming *et al.* 1999).

A systematic review that included the results of 35 papers and 14 cohorts of good quality examined the prognostic value that different factors have on the long-term activity limitations and participation restrictions experienced post-TBI. Prognostic factors that were associated with disability and non-productivity at least one-year post-injury onset were analysed. It was found that the older the age, the stronger the association with more severe disability in the total number (7/7; 100%) of cohorts that were assessed. On studying older age and the association of this variable with non-productivity, the researchers found the evidence to be inconclusive, with four out of the seven (4/7) studies showing positive results, and three out of the seven (3/7) showing negative results (Willemse-van-Son *et al.* 2007).

Regardless of the cause of TBI, older people generally present with slower neurological recovery and functional recovery rates. As such, they require longer periods of rehabilitation. As opposed to their younger counterparts, older people also tend to present with a wider range of pre-existing medical conditions, which contributes to their lower physical and functional status (Cifu *et al.* 1996).

2.6.3.2 Gender

One of the most controversial factors in predicting outcomes after TBI is gender. In TBI research, gender interacts with many other outcome variables, which could lead to the misinterpretation of the findings. In general, it appears that subsequent to a TBI, females have worse outcomes than males (Farace & Alves 2000).

Some studies have found the male gender to be a significant predictor of improved prognoses, whereas other studies have demonstrated no significant association between gender and outcome (Ponsford *et al.* 2008). When assessed, the female

gender delivered inconclusive results in predicting more severe disabilities (positive in 2/3 cohorts, negative in 1/3 cohorts). Furthermore, the female gender was not found to be a predictor of non-productive behaviour, with four out of the four (4/4) studies showing negative results (Willemse-van-Son *et al.* 2007).

Controlled animal experiments have consistently shown improved survival and cognitive functions subsequent to TBI in females as opposed to males. This has led to the hypothesis that gonadal steroids such as oestrogen and progesterone may provide neuro-protection to patients with brain injury resulting from trauma. Several human observational studies have, however, reported poorer outcomes amongst females subsequent to both severe and milder TBIs. One hypothesis as to why females would appear to have poorer outcomes than their male counter-parts is that females are more likely to report on their post-TBI symptoms. Furthermore, they appear to have poorer coping abilities. On account of societal pressure on the male gender, males are also more likely to return to work than females, despite the fact that their activity levels are similar to those of the females (Bazarian *et al.* 2010).

Other hypotheses include the role of the endocrine system as hypothesised in animal studies, pre-morbid factors such as differences in pre-morbid intelligence quotient (IQ), gender-related injury factors such as cause and type of injury sustained, cognition and psychosocial factors, differences in brain function of males and females, effects of medical treatments and pharmacological interactions of medications (Farace & Alves 2000).

2.6.3.3 Severity

The severity of a TBI is determined by the extent of the primary brain damage caused by the injury (Maas, Stocchetti & Bullock 2008). On a macroscopic level, this includes damage to white-matter tracts, focal contusions, haematomas and diffuse swelling. Damage occurs on a microscopic level too, and is often caused by ischemia (Maas *et al.* 2008). In addition to the primary damage, secondary brain damage develops over hours or days (Maas *et al.* 2008). The more severe the primary and secondary brain damage, the worse the outcome (Maas *et al.* 2008).

Those variables predicting severity outcomes include the GCS score, the necessity of undergoing a neurosurgical procedure, length of hospitalisation in acute care, and length of PTA (Fleming *et al.* 1999). The most widely used outcome measure to measure TBI severity is the GCS. It is based on the response that patients give when requested to open their eyes, and on their verbal and motor functions, when subjected to various stimuli. A TBI with a score of 13 to 15 is classified as mild, one with a score of 9 to 12, as moderate, and one with a score of less than nine, as severe (Bruns & Allen Hauser 2003). Typically, TBI severity is mild in 80% of the cases, moderate in 10%, and severe in 10% of the cases (Bruns & Allen Hauser 2003). In the study conducted by Nel & Brown (1991) in South Africa, 78% of the cases were very mild, 10% were mild, 8% were moderate and 5 % were severe.

Owing to the methodological differences associated with studies, the GCS score is often inconclusive or contradictory as a predictor of community reintegration post-TBI. Some researchers use the initial GCS score as the outcome measure, while others use the lowest GCS score in the first 24 hours following injury, or the best GCS score in the first 24 hours following injury. The reasons for methodological differences such as these are unclear. In the acute setting, the GCS score is not a true reflection of the severity of the injury, as the level of consciousness may be influenced by other factors such as medically-induced sedation, paralysis or intoxication (Maas *et al.* 2008).

In a systematic review that included the results of 35 papers and 14 cohorts of good quality, a lower GCS score, indicative of a more severe injury, was inconclusive in predicting disability (two out of three (2/3) cohorts assessed presented with positive findings; and one out of three (1/3) presented with negative findings). A lower GCS score was also found to be inconclusive in predicting non-productivity, with two out of six (2/6) patients presenting with positive findings and four out of six (4/6) presenting with negative findings). A longer period of PTA was found to be a strong predictor of non-productivity, with three out of three (3/3) cohorts presenting with positive results) (Willemse-van-Son *et al.* 2007).

A 2008 study with the aim of describing the functional outcomes of individuals 10 years after sustaining a TBI found that most patients presented with good outcomes

- with a few of the patients presenting with minor residual disabilities in terms of the Extended Glasgow Outcome Scale. It was found that poor outcomes are significantly associated with a longer duration of PTA. The GCS score did not produce any significant associations. Previous studies also favour duration of PTA to GCS score in predicting outcome (Ponsford *et al.* 2008).

Fleming *et al.* (1999) found that the initial GCS score was not a statistically significant predictor for community reintegration on any of the subscales of the CIQ. This particular result may be attributed to the size of the sample, which comprised mainly of patients with severe TBI, and was not representative of patients suffering from different severity levels of TBI, ranging from mild to moderate to severe (Fleming *et al.* 1999).

A study by Wagner *et al.* (2002) found that less severe injuries are positively associated with the patient returning to productive activity. Patients discharged to a place other than their homes failed to return to productive activity. Those who had been discharged to inpatient rehabilitation or other facilities had possibly suffered more severe injuries and impairments at the time of discharge from the acute hospital (Wagner *et al.* 2002).

2.6.3.4 Education, income and employment

It is very difficult to separate education, income and employment when looking at the predictors of community reintegration following TBI, as these all contribute to a person's socio-economic status. For that reason, these three points are discussed together. One could infer that the higher the level of education, the greater the chance of employment, and the higher the income that could be earned. People of lower socio-economic standing are generally less likely to return to gainful employment following a TBI (Watt 2000). This trend is particularly important when it comes to the South African context (Watt 2000).

A higher pre-injury education is associated with improved long-term outcomes in employment, social functioning and community integration (Ponsford *et al.* 2008). A

study by Wagner *et al.* (2002) found that a level of education over and above the high school level is positively associated with a return to productive activity.

It was found that 56.1% of the people who were unemployed had an educational level lower than Grade 12. They were followed by those with a Matric qualification (35.1%), other tertiary qualifications (6.6%), graduates (1.7%) and others (0.6%). Close to two in every 100 people were graduates (Statistics South Africa 2018).

Income makes a significant contribution to the social reintegration subscale of the CIQ, the Craig Handicap Assessment Reporting Technique-Short Form (CHART-SF), and to the total score, as well as to the scores on the belonging and independent participation scales of the Community Integration Measure (CIM) (Sander *et al.* 2009). For each of these outcome measures, lower income was found to be associated with a lower level of community reintegration. The sample was controlled for age, severity of injury, education and race/ethnicity (Sander *et al.* 2009).

The level of social integration assessed by these questionnaires was determined by looking at the amount of time spent shopping, visiting friends and family and participating in leisure-time activities – all of which may not be affordable for people with lower incomes. Post-TBI, it is more than likely that the patient would want to change his/her social environment, if the pre-injury social setting attributed to the injury – as in the case of social settings where violence and substance abuse are rife. Patients with TBI who are from a low-income background may not have the opportunity to replace their old social contacts with new ones (Sander *et al.* 2009).

TBIs are mainly classified as mild on the GCS scale, but in spite of this, patients have substantial difficulty when it comes to return to work (RTW) (Wagner *et al.* 2002).

A cohort study involving people who had sustained mild TBIs from MVAs found that only 42% of the sample returned to work. More alarming, however, is the fact that only 12% returned to the same pre-morbid type of work, while 30% returned to an adapted type of work (Ruffolo *et al.* 1999). Another study by van der Naalt *et al.*

(1999) involving a cohort of people with mild to moderate TBI, found that 73% returned to work, but that most patients (84%) still reported notable symptoms related to the TBI. The complaints most frequently reported were headaches, irritability, forgetfulness, poor concentration and fatigue.

Following on severe TBI, only 26 to 46% of the people who were working prior to the TBI returned to work (Sloan *et al.* 2004). People with TBI may also struggle to retain their jobs. The study by Sloan *et al.* (2004) showed that following on their traumatic brain injury, 25% of those working at their initial place of employment were unemployed at the three-year mark subsequent to this incident (Sloan *et al.* 2004).

A systematic review by Willemse-van Son *et al.* (2007) found that being unemployed when the injury occurred was positively associated with more severe disability (4/4 cohorts assessed showed positive findings), and was positively associated with non-productivity (4/5 cohorts assessed showed positive findings) (Willemse-van-Son *et al.* 2007).

Pre-morbid employment status was found to be a significant predictor of RTW and the productivity sub-score on the CIQ (Fleming *et al.* 1999). However, this could possibly be attributed to a higher socioeconomic status that goes hand-in-hand with a higher pre-morbid employment status, which would result in improved access to resources such as transport, and financial support to access rehabilitation services (Fleming *et al.* 1999). A better outcome in skills required for living, relationships and employment was associated with a more skilled pre-injury form of employment (Ponsford *et al.* 2008).

The nature of pre-morbid work is important when assessing the variable RTW. There is a higher incidence of downgrading of individuals in their jobs in cases where they held higher level positions pre-morbidly. Individuals who were working as manual or clerical workers either returned to the same position, or were left unemployed (Watt 2000). This can be attributed to the greater range of skills that workers in higher positions possess pre-morbidly, allowing them to function effectively in other types of work. These employees also tend to have more established work contracts, which provide greater protection in the event of a

disability. Manual, clerical or technical workers are often forced to return to their same position, or lose their employment all together (Watt 2000).

Although RTW is often seen as a successful vocational outcome, one should also consider those who return to their roles as home-makers or students, or those who go from paid employment to the role of home-maker or student (Wagner *et al.* 2002). For this reason, *return to productive activity* is deemed a more suitable and acceptable term (Wagner *et al.* 2002).

2.6.3.5 Type of brain lesion

The types of brain lesions predictive of poor outcomes include the obliteration of the third ventricle or the basal cisterns, midline shift, subarachnoid haemorrhage (SAH), lesion burden and diffuse axonal injury (DAI) (Lee *et al.* 2012). The obliteration of the third ventricle or the basal cisterns and midline shift are indicative of raised ICP (Maas *et al.* 2008), which causes ischaemic damage to the brain, and if no intervention occurs, can ultimately lead to death (Alexander *et al.* 2009).

The most common cause of poor outcomes, namely DAI, is also the most common primary lesion in TBI (Weiss *et al.* 2007). DAI occurs as a result of the tearing of axons during acceleration, deceleration and rotation of the brain (Lee *et al.* 2012). It is unclear whether the poor outcomes linked to DAI are due to the enormity of the total lesion burden, or to the location of the DAI (Weiss *et al.* 2007). The functional outcome of 42 patients with TBI was evaluated after three months. DAI was found to be a prognostic factor for unfavourable outcomes in patients with TBI (Lee *et al.* 2012).

Poor prognosis is associated with lesions to the brain stem, and is supported by the Ommaya-Gennerelli model, which states that the depth of the brain injury in TBIs correlates with the resulting morbidity and mortality (Hilario *et al.* 2012). The brainstem is a structure deep in the brain, which connects the two cerebral hemispheres with the medulla and the cerebellum, and is responsible for some of the basic vital life functions, which include breathing, regulation of blood pressure, control of consciousness and the circadian or sleep rhythms. Voluntary motor

function is relayed along white-matter fibre tracts which pass from the cerebral cortex to the spinal cord and peripheral nerves, and somatosensory information travels up to the highest parts of the brain via the spinal cord and peripheral nerves (Angeles Fernandez-Gil *et al.* 2010).

A 2012 study by Hilario *et al.* found that patients with brain stem lesions experience worse outcomes compared to the outcomes emanating from injury to the cerebral hemispheres only. Furthermore, bilateral and symmetrical brain stem injuries predicted poor outcomes in 100% of the studies on poor outcomes. It was also found that the number of regions affected by a TBI was indicative of a good versus poor outcome.

2.6.3.6 Mechanism of injury

There is a paucity of literature on the relationship between mechanism of injury and functional outcome (Lee *et al.* 2012). Mechanism of injury in TBI can be divided into two distinct groups according to intentionality. Intentional injuries are caused by violence, and unintentional injuries result from causes such as MVAs and falls (Kim *et al.* 2013).

It was previously found that three to six months subsequent to rehabilitation, TBIs caused by intentional injury were significantly associated with poorer community reintegration, especially as measured on the productivity subscale of the CIQ, which evaluates employment, volunteer work and educational activities (Kim *et al.* 2013).

When measured on the Reintegration to Normal Living Index (RNLI), the intentional TBI group in this particular study achieved significantly lower levels of community reintegration, particularly in respect of participation in family roles and recreational activities.

This study supports the findings of previous community reintegration outcome studies that make use of outcome measures such as the CIQ, the Traumatic Brain Injury Model Systems Programme and the Rivermead Head Injury Follow-Up

Questionnaire, in that, as opposed to unintentional injuries, intentional injuries tend to show poorer community reintegration (Kim *et al.* 2013).

Intentional injuries may lead to more physical symptoms such as headaches and insomnia, more severe levels of disability, and shorter lengths of stay for the purpose of rehabilitation, which in turn result in greater strain being placed on caregivers (Kim *et al.* 2013). Patients with intentional TBIs were found to display poorer community reintegration results on the CIQ after one year, especially on the productivity and social integration subscales (Kim *et al.* 2013).

2.6.3.7 Rehabilitation and education

The goal of multidisciplinary programmes is to assist the patient to overcome his/her injury, and to maximise their functional capacity (Hardaker 2011). A comprehensive treatment plan is formulated, which provides appropriate treatments, education, compensatory strategies and sets therapeutic goals in place (Hardaker 2011).

A multidisciplinary approach to rehabilitation post-TBI has been shown to be most effective in improving community reintegration, when compared to the less-structured and less-intense programmes, home-based programmes or no intervention at all (Hardaker 2011). Patients should be referred to rehabilitation programmes within 90 days of having acquired their TBI for improved outcomes (Hardaker 2011).

The recommended volume/intensity of optimal treatment has not yet been studied, but typically varies from two to four days per week, two to six hours per day, for three to six months (Hardaker 2011). Each patient's individual needs and progress should dictate his/her community reintegration programme (Hardaker 2011).

On a societal level, the South African government has committed itself to developing rehabilitation programmes that are accessible, affordable and goal-orientated (Gretschel 2016). One of the foundations of rehabilitation principles is to “achieve the integration of persons with disabilities into society through full participation in community life” (Gretschel 2016). However, South African studies on community

reintegration for different disabilities show that these goals are not being met (Gretschel 2016).

The recovery period of a person with a TBI is slow and there may be a period of initial PTA. Rehabilitation centres expect patients to advance the most in their journey to recovery within a six to 12-week period. As such, the patient may not receive the necessary rehabilitative support required. Patients are typically discharged home to the care of their families, who are often unprepared. Outpatient rehabilitation is also very restricted (Webster *et al.* 2015). In addition, there are few in-patient rehabilitation facilities in the public setting and access to rehabilitation services remains a major problem in SA (Webster *et al.* 2015).

Over a period of five years, patients with TBIs constituted less than nine percent (9%) of the total number of patients admitted to the Western Cape Rehabilitation Centre (Webster *et al.* 2015). Furthermore, in a 2009 audit, only 16 of 654 patients with TBI were admitted to rehabilitation facilities (Webster *et al.* 2015).

In interviews with the family members of patients with TBI, it emerged that more information and education are required when it comes to handling personality changes and aggressive behaviour, memory fallouts, decreased motivation, sleep disturbances, language and communication difficulties, a lack of inhibition and/or interest in sex, depression and safety/security concerns (Webster *et al.* 2015).

Families report that they found the verbal information during the acute hospitalisation phase to be inadequate, as behavioural issues only presented over time and only once the patient had been discharged home (Webster *et al.* 2015). They suggested that written information should be provided and would be of greater benefit in that the hard copy could then be consulted at different stages of recovery and by different members of the family (Webster *et al.* 2015). Families better equipped with such knowledge would be better able to facilitate community reintegration for their brain-injured family member (Webster *et al.* 2015).

Family members were asked to describe their coping strategies. A balanced and structured day was found to be important to achieve a sense of well-being and

safety. Regular sleep, a healthy diet, stimulation and friendship were imperative to recovery (Webster *et al.* 2015).

Although families play a vital role in the rehabilitation of their brain-injured relatives, the latter are often denied professional medical treatment for their condition since they have limited access to acute specialist neurosurgical services. This is the case throughout the world, but in particular in SA (Alexander *et al.* 2009). Most patients with TBI in SA will never see a specialist neurosurgeon, and their care will remain in the hands of general practitioners (Alexander *et al.* 2009). Considering the number of patients with TBI in SA, this should be a matter for concern (Alexander *et al.* 2009).

In the case of mild TBI patients, community reintegration programmes have little impact on outcomes. However, outcomes of patients with moderate to severe TBIs improve with community reintegration programmes, and these should be considered for such patients (Hardaker 2011).

2.6.4 Community reintegration in the South African context

There is a paucity of available literature on community reintegration in the South African context. In 2000, Watt examined the predictors and indicators of RTW post-TBI in SA. It was found that the high rate of unemployment, the lack of intensive rehabilitation programmes available, and the younger age at which TBIs are acquired stood out strongly as negative factors in this context and in sharp contrast to the results gleaned from other studies in other countries that also focused on this topic. It was found that, the low pre-injury educational levels in people with a lower socio-economic standing, and the type of work that they do (manual, unskilled, clerical and technical work) were found to be factors unique to the South African conditions that influence the return-to-work issue (Watt 2000).

Gretschel (2016) aimed to determine the levels of community reintegration in adults with disabilities post-discharge from a rehabilitation unit in the Western Cape. Of the five studies included in the literature review, no South African studies on community

reintegration after TBI were included in the discussion. CVI and TBI were grouped into one medical diagnosis (brain injury) in order to produce larger sample sizes.

A US study found that race/ethnicity is associated with overall community reintegration, after factors such as age, education, severity of injury and income were controlled. Compared to White and Hispanic people, Black people showed worse outcomes on the CIQ total score and the CIQ home integration score. The researchers explained this finding by acknowledging the potential differences in traditional family roles across the racial groups. They found that in Black people households, women are often responsible for the household activities. They also found that in Hispanic people households, groups of friends live together and the household responsibilities are usually shared. Such a situation would automatically record a lower score on the CIQ. The researchers also attributed the poorer community integration of Black people to possible prejudice in terms of employment opportunities (Sander *et al.* 2009).

Although the practice of generalising the US study findings to explain the South African situation is not possible, the reasons given as explanations for the US findings are in fact applicable to SA. They should, therefore, be kept in mind when discussing community reintegration in this country, especially when outcome measures not designed for this setting (e.g. the CIQ, as mentioned above) are used. Furthermore, according to the researcher's knowledge, no study focusing on community reintegration of people with TBI has ever been conducted in SA, and as such, there is no such outcome measure that has been specifically and appropriately designed for researching SA's TBI population.

2.7 COMMUNITY REINTEGRATION OUTCOME MEASURES

The use of outcome measures provides for one common language that can be used when information about a patient's status is shared between rehabilitation professionals throughout the care of the patient (Salbach, Guilcher & Jaglal 2011). The purpose of an outcome measure is to measure a patient's actual or perceived ability to execute activities, often before and after an intervention.

Benefits of using standardised outcome measures include the early identification of at-risk patients, improved continuity of care when transitioning between institutions, the enhancement of cost effectiveness, the assessment of practitioner and institutional performance, and the determination of the most effective treatment for different conditions (Jette *et al.* 2009).

Over the last two decades, the use of standardised outcome measures has been recommended by many rehabilitation professionals. Many barriers to and facilitators for their application have been identified, as well as the potential advantages of using standardised outcome measures (Jette *et al.* 2009). Selecting the appropriate outcome measure can be challenging owing to the vast range of available outcome measures. Properties such as appropriateness, reliability, validity and responsiveness to change should be kept in mind when selecting outcome measures (Mudge & Stott 2007)

The ICF provides a framework for developing outcome measures (WHO 2001). It defines three levels of functioning: body structure and function, activity limitation and participation restriction (WHO, 2001). A comprehensive assessment of participation is often the least measured variable, despite the fact that it is regarded as the ultimate goal of rehabilitation (WHO 2001).

There are many outcome measures for measuring community reintegration. No tool has been shown to be the most valuable; they all differ slightly, and all have their own strengths and weaknesses. When selecting the most appropriate outcome measure, one should first determine the particular outcomes of interest (Hardaker 2011). Unfortunately, these measures were not developed in ethnically diverse populations, or with low-income populations in mind (Sander *et al.* 2009). As such, they may limit the degree to which these measures can effectively measure community reintegration, especially in our South African context (Sander *et al.* 2009). It is no wonder that, given the wide range of disabilities and the different communities to which the people with disabilities belong, such measures do not exist (Gretschel 2016).

Community reintegration outcome measures assess and record indicators such as:

- the frequency of participation in activities,
- the time spent on these activities,
- the support received during these activities, and
- the variety of activities carried out (Gretschel 2006).

Because most of the community reintegration outcome measures are self-administered, they may be problematical to patients with TBI. Often, they make use of a Visual Analogue Scale (VAS), which people with lower levels of education and literacy find to be an abstract concept. Alternatively, they could use a Likert scale, which cannot be easily translated and which is, therefore, difficult to respond to (Yazbek, Stewart & Becker 2009; Grebe 2009).

There is a great need for the development of culturally-competent outcome measures for community reintegration post-TBI which in themselves include subjective and objective components (Sander *et al.* 2009). A questionnaire that has been altered in any shape or form must undergo validity and reliability tests before it can be used in a study. This is costly and time-consuming, and on account of illiteracy, does not necessarily yield better results (Grebe 2009).

A study by Maleka (2010) evaluated the community reintegration of stroke survivors in certain impoverished urban and rural areas of SA where dire socio-economic conditions prevailed. It was found that no available community reintegration outcome measure was appropriate for use in a black South African context. The reasons given include the following:

- Many black South Africans are from a poor background;
- many have high illiteracy levels;
- many different languages are spoken;
- many different cultural beliefs and practices prevail;
- Different housing circumstances prevail;
- there is limited access to tarred roads;
- there is limited access to a main road for using public transport;

- the available scales used would have to be translated.

These reasons prompted Maleka (2010) to develop an outcome measure, the Maleka Stroke Community Reintegration Measure, which is specific to stroke patients living in both urban and rural areas in poor socio-economic areas in SA. As this study evaluates community reintegration in patients with TBI, and this outcome measure was specifically designed for use in patients having suffered a CVI, it could not be used. However, it shows that there is a great need for culturally-sensitive community reintegration outcome measures for patients with different disabilities.

The section below briefly discusses the most commonly used community reintegration outcome measures. The most suitable outcome measure which was chosen for use during this study, the CIQ, is discussed in more detail than the other commonly used outcome measures.

2.7.1 The Community Integration Questionnaire

The Community Integration Questionnaire (CIQ) (Appendix 8) is an objective tool that yields both valid and reliable results. It is used frequently and is often quoted in the literature. It is a brief assessment of a person's reintegration into the community after having sustained a TBI (Hardaker 2011).

It consists of 15 questions in the format of a self-reporting questionnaire. It is divided into three performance areas, namely the following:

- home integration (five items, with a maximum sub-category score of 10),
- social integration (six items, with a maximum sub-category score of 12), and
- productivity (four items, with a maximum sub-category score of 7).

The items are mostly rated on a scale of zero to two (on the three-point Likert scale), either according to the frequency of performing the activity, or according to the manner in which the activity is performed (Salter *et al.* 2008).

Total scores could range from zero to 29 points. Higher scores are indicative of greater independence and community reintegration levels (Salter *et al.* 2008). No norms or effect change scores are available for this outcome measure.

The CIQ does not measure or take into account the person's pre-injury activity level, and therefore the level of reintegration achieved by an individual may be a reflection of his/her own personal choice or of the environment (Doig, Fleming & Tooth 2000). A possible explanation for low community reintegration scores could be attributed to the normal distribution of household tasks between partners, which would prevail irrespective of an injury (Fleming *et al.* 1999).

Although race was not considered a factor in this study, it is noteworthy that in certain cultures, and irrespective of an injury, women are often responsible for household activities such as the cooking and housework. Since there is a four to one ratio of male-to-female patients with TBI, it is important to consider this when looking at the home integration subscale on the CIQ (Sander *et al.* 2009). Males will typically score lower on this subscale, as often, irrespective of an injury, the household tasks are the responsibility of the females. It is also not uncommon for young males to live with groups of friends, which would also lead to the sharing of household responsibilities (Sander *et al.* 2009). Sharing responsibilities with another person leads to a lower score on the CIQ. Regardless of whether this is for reasons related to the injury or not, the responsibilities are usually shared (Sander *et al.* 2009). It is evident from the South African context that there is a need for a control group without a TBI in order to draw conclusions on the level of community reintegration.

Another potential problem of the CIQ is that it is a subjective self-reporting measure, which may lead to an over-estimation of actual performance arising from reduced self-awareness as a result of the TBI (Doig *et al.* 2000). It was mentioned by Saeki, Okazaki & Hachisuka (2006), in a validity study of patients with TBI in Japan, that the scores of the productive activity subscale may have been underestimated, as volunteer activities are not common in the general population of Japan. This too is the case in SA, and should be considered when interpreting the results.

In its current format, the CIQ can be administered in the form of an in-person interview or in a telephonic interview with the patient. Alternatively, it could be administered via a proxy if the patient is unable to complete the questionnaire him/herself (Dijkers, Whiteneck & El Jaroudi 2000). The questionnaire is available free of charge, takes 15 minutes to administer, requires no additional training, and is specific to patients with TBI (Salter *et al.* 2008). These reasons all led the researcher to decide on the CIQ as the most suitable outcome measure for this study.

The major advantage of the CIQ, and the reason it was chosen as the outcome measure to measure community reintegration in this study, is that it is a standardised outcome measure developed specifically for TBIs, and is one of the most commonly used and thoroughly evaluated outcome measures available (Salter *et al.* 2008). It was chosen so that the results of this study could be comparable with those of other studies that use this outcome measure. The researcher found it easy to administer as the language/questions were easy to understand. This made it appropriate for use in the TBI population, as well as in this sample population with potentially lower educational and literacy levels. As it was used during the data collection phase, the CIQ is discussed again in section 3.7.

2.7.2 The Craig Handicap Assessment Reporting Technique

The Craig Handicap Assessment Reporting Technique (CHART) is an outcome measure developed to assess the level of handicap, or change in participation as a result of neurological impairments and disabilities (the nomenclature of the ICF at the time). Initially, it was designed for individuals with spinal cord injuries, but it was later found to be valid in cases involving a wide range of physical and cognitive impairments, including TBI (Mellick 2000).

It provides information on six scales, namely the following:

- Physical independence: the ability to independently sustain one's existence;
- mobility: the ability to mobilise successfully in one's environment;

- cognitive independence: the ability to independently sustain one's existence from a cognitive standpoint without the need for supervision;
- occupation: the ability to occupy one's time in such a manner that it is appropriate to one's sex, age and culture;
- social integration: the ability to participate in and maintain appropriate social relationships; and
- economic self-sufficiency: the ability to sustain appropriate socio-economic activity and independence.

A short form (CHART-SF) which includes the same six domains has been developed. The CHART is a 32-item scale (CHART-SF = 19 questions) with the questions weighted and given a particular score. Each subscale is then scored from 0 to 100 (Mellick 2000). A higher score indicates greater role fulfilment. The CHART takes up to 30 minutes to administer, and the CHART-SF up to 15 minutes. It can be administered by means of an interview, either face-to-face, or via the telephone (Mellick 2000).

Reasons for not using the CHART include the fact that compared to the CIQ, it takes longer to administer (Hardaker 2011), and that it is based on the old nomenclature of the ICF, namely the International Classification of Impairment, Disability and Handicap (ICIDH) (Mellick 2000). It has not been validated for use via a proxy, as in the case of the CIQ, which is very important, given the diagnosis of TBI in this particular study population.

2.7.3 Community Integration Measure

The Community Integration Measure (CIM) is a subjective outcome measure centred on the client, and developed for use as a questionnaire directed at people with a TBI (Hardaker 2011).

Community reintegration includes the following four factors:

- Assimilation, which refers to conformity, orientation and acceptance;

- social support, which refers to both close and diffuse relationships;
- occupation, which refers to leisure and productivity; and
- independent living, which refers to personal independence (McColl *et al.* 2001),

It consists of 10 questions, focusing on people's viewpoints of community reintegration (McColl *et al.* 2001). Each item is scored on a five-point Likert scale (ranging from "Always agree to always disagree") and the scores for the items are then added together to produce a total score of 10 to 50, with a higher score indicating greater community reintegration (Sander *et al.* 2009). This measure can be administered face-to-face, telephonically, or by the subject him/herself. It does not require a high literacy level, and is quick to administer - usually in three to five minutes (McColl *et al.* 2001).

The CIM shows a correlation of 0.34 with the more objective CIQ (Sander *et al.* 2009). The CIM is a valid and reliable outcome measure (with $r=0.88$ and internal consistency= 0.70) (McColl *et al.* 2001). It demonstrates good content validity. Discriminant validity is supported as the CIM is able to distinguish between groups that are expected to perform differently when assessed ($p<0.006$). Criterion validity is evaluated by correlating the CIM and the CIQ (0.34). A common variance of 12% was found (McColl *et al.* 2001).

Although it is quick to administer and was developed specifically for patients with TBI, it is more subjective than the CIQ. Furthermore, it excludes "productivity", which is a vital part of community reintegration. It also focuses on assessing impairments and activity limitations as opposed to participation. The five-point Likert scale is also difficult to translate and understand (Maleka 2010).

2.7.4 Reintegration to Normal Living Index

The Reintegration to Normal Living Index (RNLI) is a subjective outcome measure, which is centred on the client, and which reflects client satisfaction with increased functional performance (Hardaker 2011). It was developed as a global assessment of the quality of life (QoL) of people with disabilities (Stark *et al.* 2005).

The RNLI looks at mobility, self-care, daily activity, recreational activity and family roles. It is made up of 11 items that are scored on a ten-centimetre VAS, where patients mark the degree of integration on the scale. Scores are then adjusted to a minimum score of zero, and a maximum score of 100. A higher score indicates a better perceived integration. It is short, subsequently easy to administer and widely used in research and practical settings (McColl *et al.* 2001).

It has a high internal consistency (0.904), but its construct validity has not been confirmed with an independent sample (Stark *et al.* 2005). It has adequate inter-rater reliability ($r=0.62$; $p=0.00$). The scale was developed from participants with stroke perceptions, and later validated on adults with mobility limitations in the community. The authors of the RNLI consider it to be a valid and reliable tool (Stark *et al.* 2005).

A limitation for using this tool in this particular study and for use in the South African context is that it is not a TBI-specific measure, and makes use of a VAS scoring system. Patients with lower literacy levels find this scoring system difficult to understand as it makes use of very abstract concepts, and requires the ability to think abstractly – something that patients with TBI and patients with lower literacy levels tend to struggle with (Maleka 2010; Yazbek *et al.* 2009).

2.7.5 London Handicap Scale

The London Handicap Scale (LHS) was developed to measure the disadvantage experienced by people on account of ill health (Harwood *et al.* 1994). It measures participation in its entirety in adults with physical and neurological impairments, although it still uses the old nomenclature of the ICIDH (Maleka 2010).

The LHS consists of six components, and is based on the ICIDH. The domains are similar to those of the CHART, except that the “cognitive independence” domain is called “orientation” in the LHS.

The domains are:

- physical independence,
- orientation,
- mobility,
- occupation,
- social integration, and
- economic self-sufficiency (Harwood *et al.* 1994).

It is scored on a six-point Likert scale, ranging from none to extreme, to derive a single handicap measure which ranges from zero (extreme disadvantage) to 100 (no disadvantage) (Harwood *et al.* 1994; Maleka 2010). It appears to be a valid, reliable and acceptable measure, with a Pearson’s Correlation Coefficient of 0.98 (Harwood *et al.* 1994). It correlates strongly with other measures ($r=0.90$; $p=0.009$).

One disadvantage is that it uses a complicated Likert scale, which is difficult to understand and accurately translate into the South African languages. Patients with TBI and those with lower levels of literacy may find it difficult to understand and will not be able to respond to it appropriately (Yazbek *et al.* 2009; Grebe 2009). It is for this reason, together with the fact that it is based on the ICIDH (the old nomenclature), that the LHS was not used in this study.

2.8 INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

The International Classification of Functioning, Disability and Health (ICF) was developed by the World Health Organisation (WHO) as a framework for organising and documenting information on functioning and disability. It provides a comprehensive understanding of the different components of health, and is presented in a language that health professionals can all understand, irrespective of their backgrounds (Laxe *et al.* 2011).

The ICF has been developed to provide a standardised language that describes and classifies aspects of health and disability (Stucki 2005). The main difference between the ICF and its predecessor, the ICIDH, is that it has moved away from focusing on the “consequence of a disease” to become a “components of health” classification (Perenboom & Chorus 2003).

The basis of the ICF is a bio-psycho-social model, and defines three levels of health which are negatively impacted upon by health conditions, namely body functions and structures, activities and participation (Sloan *et al.* 2004).

The term “activities” refers to actions and tasks, and “participation” refers to involvement in life situations (World Health Organisation 2013). Community reintegration is not only influenced by body function and structures, but also by contextual factors, which can be divided into environmental factors and personal factors (Gretshel, 2016). The ICF model is depicted below in Figure 2.1.

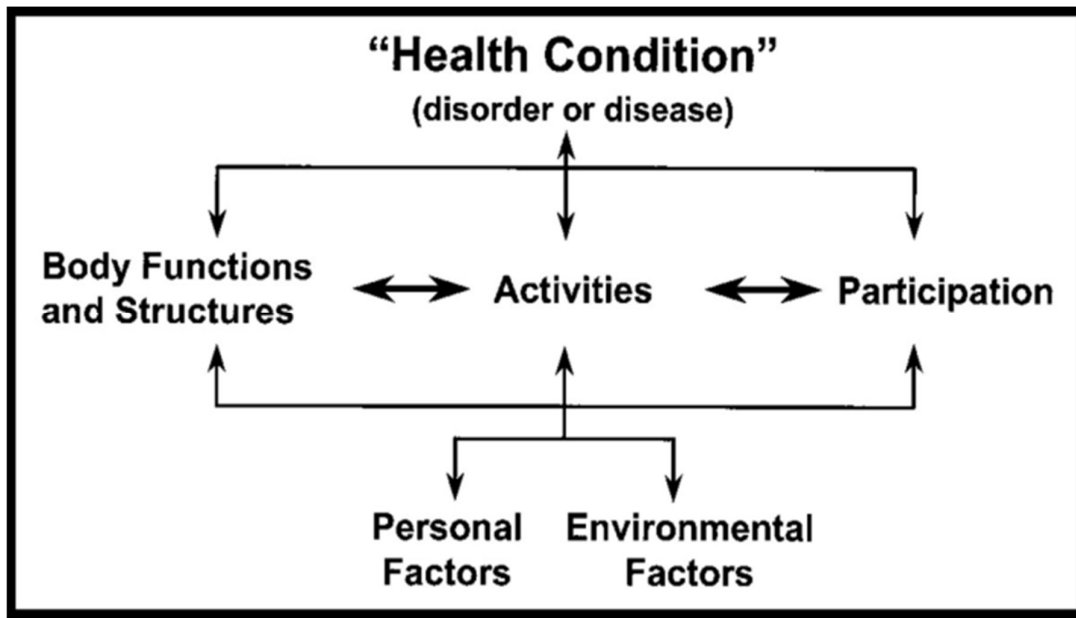


Figure 2.1: The ICF Model: Interaction between ICF components (World Health Organisation 2013)

It is not possible to separate “activities” from “participation” on the ICF. As shown in Table 2.1 below, “Activities and participation” are combined to be presented as a single list of nine chapters in the ICF. According to the WHO, every action executed in a social environment is seen as participation, and participation always involves the execution of an action (World Health Organisation 2013).

Table 2.1: WHO's ICF “activity and participation” chapters (Resnik & Allen 2007)

‘Activity and participation’ chapters	Description
Learning and applying knowledge	Cognitive functions such as thinking, memory, problem-solving and decision-making
General tasks and demands	Carrying out tasks, organising routines, handling stress
Communication	Expressive and receptive language
Mobility	Moving around, transferring, using transportation
Self-care	Caring for oneself
Domestic life	Carrying out domestic and everyday actions and tasks
Interpersonal interactions	Basic and complex interactions with people in appropriate ways
Major life areas	Education, work, employment
Community, social and civic life	Organised social life outside family

Because some of the activities mentioned in Table 2.1 take place beyond the immediate household, the individual with TBI cannot be seen in isolation and must engage with the community and society at large to make use of the services offered and the service providers beyond the household that perform these functions. Therefore, certain personal factors, environmental factors and environmental facilitators are extremely important to the traumatic brain-injured person.

Age, gender, education, coping style, pre-morbid profession, experiences – both past and present, overall behaviour pattern, character and socio-economic status are examples of personal factors that impact on community reintegration. Environmental factors include access to products and technology that can assist to improve function, factors within the natural environment and changes that can be made to it to improve function, family structures, social support and attitudes, belief systems held by cultural groups, government policies, having access to community environments and services (Gretschel 2016; WHO 2001).

The definition of environmental facilitators is “...factors in a person’s environment that, through their absence or presence, improve functioning and reduce disability”. The barriers that limit functioning and lead to greater disability must be overcome through amongst others environmental facilitators (Sherer *et al.* 2014).

Less resourced countries such as SA have unique barriers against (negative factors) and/or facilitators (positive factors) fostering community reintegration, and include:

- the availability of assistive devices,
- accessibility to health care services and interventions,
- accessibility to home-based care,
- family support,
- accessibility to the home environment and amenities,
- accessibility to the community, public buildings and the public transport system,
- negative attitudes held by people in the community and/or employers,
- lack of knowledge and awareness about disability,
- social, cultural and religious beliefs, and
- accessibility to social security services and support (Gretschel 2016).

Although environmental factors such as social support and access to care have been identified by the ICF to impact on disabilities, functioning and participation of people with TBI in community activities, little research has been done on their effect (Sherer *et al.* 2014). As of now, only a limited number of TBI studies based on the ICF have been carried out (Laxe *et al.* 2011).

A study by Sherer *et al.* in 2014 looked at a range of environmental barriers/facilitators predictive of the participation of TBI patients in community. Owing to vast differences in study design in the 23 studies that they included in their survey, no definite predictive or non-predictive variables could be identified. Access to transport facilities, services and opportunities for social interaction could possibly be classified as predictive of participation. On the other hand, living arrangements and social support could possibly be considered to be non-predictive of employment.

Marital status, support in the workplace and the type of community were found to be either conflicting or weak predictors of participation (Sherer *et al.* 2014). Self-reported traits that could be linked to probably predictive of employment include a number of post-concussive symptoms, fatigue and physical ability. The quality of self-efficacy in a patient with TBI is probably not predictive of employment. Possibly predictive of employment are subjective well-being, no pain and social interaction, while on the other hand, coping abilities would possibly not be predictive. The literature focusing on the role of social support, cognitive ability, psychological distress, depression, anxiety, personality type, self-concept, social competence, and dizziness in influencing the brain-injured person to participate in activities was found to be either conflicting or inadequate (Sherer *et al.* 2014).

Drawing conclusions regarding the predictive value of environmental barriers/facilitators and patient self-reported traits for participation outcomes is difficult, and may suggest a reason for the paucity of literature in this respect. The findings of the respective studies were often conflicting; furthermore, a wide range of assessment measures were used. As such, the conclusions that one would be able to draw are limited (Sherer *et al.* 2014).

An improved understanding of these modifiable environmental and personal factors could lead to new interventions or increased support delivered to patients, since the demographic and severity-of-injury factors are often non-modifiable (Sherer *et al.* 2014).

2.8.1 International Classification of Functioning, Disability and Health based Outcome measures

The ICF provides a uniform process of collecting data across different conditions, ages, settings, and disciplines. It holds many benefits, including the fact that it is a detailed and wide-ranging assessment leading to a more comprehensive method of managing patients and for enhancing clinical reasoning (World Health Organisation 2013).

There are different ways in which the ICF can be implemented, and these include the use of ICF-based assessment instruments (e.g. The World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0), the entire classification, a limited pre-set level and a pre-set short list. This section describes some of the most commonly-used ICF-based assessment instruments.

Since the ICF was published in 2001, researchers have been studying the use of the ICF in the field of TBI. Most of the research has been conceptual, or aimed at the content validity of the relevant measurement instruments (Laxe, Cieza & Castano-Monsalve 2015). The ICF is not an assessment tool, but rather a classification system covering 1 424 categories. ICF-based instruments have been developed to address this practical challenge in respect of its application (Koskinen *et al.* 2011).

A systematic review of the assessment tools used in TBI research was conducted in 2013. One-hundred-and-nine (109) instruments covered the domains of activity/participation, and are depicted below in Table 2.2.

Table 2.2: Frequency in the use of instruments in the “activity and participation” domain of the ICF (Tate *et al.* 2013)

ICF domain	Number of instruments
Learning and applying knowledge	2
General tasks and demands	2
Communication	9
Mobility	27
Self-care	2
Domestic life	0
Interpersonal interactions and relationships	11
Major life areas	4
Community, social and civic life	4
Multi-domain activities & participation	48

Rating scales predominate, while the number of performance-based instruments was found to be limited (Tate, Godbee & Sigmundsdottir 2013). The vast number of tools available presents a barrier to their effective assessment (Tate *et al.* 2013). Within the multi-domain category, the Functional Independence Measure (FIM), followed by the CIQ, was used most often (Tate *et al.* 2013).

Frequency of use is not necessarily the best way to select an instrument. Administration time, ease of scoring, cost, ease of access, and comparability with measures in other settings should also be taken into account when selecting an outcome measure (Tate *et al.* 2013).

A number of measures have been developed as a result of the more recent use of the ICF, which explains why these tools were not referred to more frequently in the literature reports. The most popular measures developed include the World Health WHODAS 2.0, the ICF Checklist, the ICF Measure of Participation and ACTivities (IMPACT), and the Participation Assessment with Recombined Tools – Objective (Tate *et al.* 2013). These types of outcome measures are important in that they mitigate instrument redundancy, which is a major problem in the TBI research field (Tate *et al.* 2013).

Owing to the vast number of ICF-based outcome measures, the WHODAS 2.0 is now discussed in detail, as it was chosen by the researcher to be used during the data collection phase of research. Thus, the ICF Checklist, ICF Core Sets and the IMPACT are mentioned only briefly.

2.8.1.1 The World Health Organisation Disability Assessment Schedule 2.0

The World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0) (Appendix 9) is an outcome measure developed by the WHO, through international collaboration, as a standardised, cross-cultural measurement of health, based on the ICF (Üstün *et al.* 2010). It is a single generic outcome measure that can be used across different health status levels, and a wide range of disabilities, cultures and settings (World Health Organisation Disability Organisation Schedule 2.0 (WHODAS 2.0), 2017). The WHODAS 2.0 can be used for many purposes, as in population

surveys and registers, and in monitoring patient outcomes in clinical settings and in clinical trials where the effects of treatments are being evaluated (Üstün *et al.* 2010).

The WHODAS 2.0 is an overall measure of functioning and disability which extends across six of the major life domains, which correspond directly with the “activities and participation” dimension of the ICF, and can be used for any health condition (Üstün *et al.* 2010). These domains include the following:

- cognition (being able to understand and effectively communicate),
- mobility (moving and getting around),
- self-care (ADLs that involve personal hygiene, dressing, eating and being able to live independently),
- getting along (interaction with others),
- life activities (responsibilities at home, leisure-time activities, attending work or school), and
- participation in society (participating in community activities)

(World Health Organisation Disability Organisation Schedule 2.0 (WHODAS 2.0), 2017).

The WHODAS 2.0 has been found to be sensitive to change when tested in different cultural settings and health populations (World Health Organisation Disability Organisation Schedule 2.0 (WHODAS 2.0), 2017). A study by Garin *et al.* (2010) validated the WHODAS 2.0 in patients with 13 different chronic diseases or ailments/injuries, including TBI. It presented with a very high reliability level, and an impressive ability to discriminate between and detect changes over time (Garin *et al.* 2010).

There are two versions – a 12-item version and a 36-item version requiring an estimated five and twenty minutes respectively to complete - that is, if conducted via an interview. Three different formats are available, namely interviewer-administered, self-administered and proxy-administered (World Health Organisation Disability Organisation Schedule 2.0 (WHODAS 2.0) 2017).

The 12-item version includes two items from each domain, and was found to have good screening properties for problematic domains of functioning, identifying over 90% of all people that had even mild disabilities on the 36-item version (Üstün *et al.* 2010). The 12-item version explains 81% variance of the 36-item version (Üstün *et al.* 2010). For this reason, the shorter 12-item version was deemed more appropriate for use in this study. It is available free of charge in more than 30 different languages. However, English is the only South African language into which it is translated (Üstün *et al.* 2010).

There are two ways in which summary scores can be computed. With the simple scoring method (the method used in this study), items are scored from one to five, with one being associated with “no difficulty”, and five being associated with “extreme difficulty” or “cannot do”. Higher scores indicate higher levels of disability. The scores are added and converted to a percentage, which is regarded as an adequate indication or measure to describe the degree of functional limitation (Üstün 2010).

“Item-response theory” is the second scoring method, and is more complex than the first, as multiple levels of difficulty are taken into account for each item. This method of scoring involves three steps, and the algorithm is available from the WHO (World Health Organisation Disability Organisation Schedule 2.0 (WHODAS 2.0) 2017). No norms or effect change scores are available for this outcome measure.

2.8.1.2 The International Classification of Functioning Checklist

Two generic tools have been developed by the WHO, namely the WHODAS 2.0, as mentioned above, and the International Classification of Functioning Checklist (ICF Checklist), which is a 12-page, shortened version of the ICF, with 125 second-level categories. It is designed for any patient, regardless of the diagnosis. Information from various sources can be used, including that from patient files and records, primary respondents, other informants and through direct observation (Stucki 2005). This checklist takes approximately one hour to complete, but may take even longer in patients with many impairments, activity limitations and participation restrictions.

This literature review has mentioned it only briefly as it is one of only two tools developed by the WHO which speaks in detail to the ICF. However, on account of its length, it is not very practical for research into rehabilitation or in practice (Stucki 2005). For this reason, the ICF Checklist was not chosen for this particular study.

2.8.1.3 The International Classification of Functioning Core Sets

Although both tools mentioned above have their applications, they are both generic in nature, and may not address the needs associated with specific conditions (Stucki 2005). As a result, ICF Core sets have been developed for over 15 diseases (Laxe *et al.* 2013). Laxe *et al.* (2013) have developed a TBI core set, based on the Extended ICF Checklist for TBI, which identifies the most common problems patients with TBI face. The functioning and rehabilitation goals of patients can be described on the basis of the ICF Core sets.

Both a Comprehensive ICF Core Set and a Brief ICF Core Set have been developed. The Comprehensive ICF Core Set is intended to guide comprehensive multidisciplinary assessments in patients with TBI, and includes 39 categories. The Brief ICF Core Set was designed for use in the clinical documentation or epidemiological studies when a brief description and assessment of the functioning of a person with TBI is sufficient (Laxe *et al.* 2013). It includes as few categories as possible to still be practical and comprehensive, and includes 23 categories derived from the Comprehensive Core set.

The developers of this tool expect it to improve the quality of treatment by allowing interested parties to fully understand the burden of TBI. Furthermore, the common language it provides promotes care planning in rehabilitation programmes (Laxe *et al.* 2015).

The ICF Core Sets for TBI are not measures of health status, but instead provide a comprehensive list of all the domains of functioning relevant to a patient with a TBI. This list is intended as a guide as to *what* to measure, and not *how* to measure. It assists in determining the most appropriate instrument that will assess the problems experienced by people with TBI (Laxe *et al.* 2013). The researcher decided not to

use the TBI ICF Core Set, as it was not well suited to the quantitative study design of this study.

2.8.1.4 The International Classification of Functioning Measure of Participation and ACTivities

Based on the ICF, the International Classification of Functioning Measure of Participation and ACTivities (IMPACT) is a generic measure to describe functioning and disability independent of one's health condition. The developers of this tool were of the opinion that no tool could completely and accurately reflect all of the ICF chapters and domains, and noted that many available tools were still based on the ICIDH (Post *et al.* 2008).

It is brief enough to form part of a battery of questionnaires, but detailed enough to provide a thorough assessment of functioning and disability. It is a self-report measure, and consists of two levels. Level one, the Measure of Participation and ACTivities Screener (IMPACT-S), is the screener part of the IMPACT questionnaire. IMPACT-S consists of 33 items on nine subscales, and reflects the nine "activity and participation" chapters of the ICF, and can be used independently of the IMPACT. It results in a one-scale score for each ICF chapter, summed scores for "activity and participation", and a total IMPACT-S score. It was found to be a reliable and valid measure of activity limitations and participation restrictions in people with various disabilities issuing from road accidents. Level two is still in the developmental phase, and consists of a series of modules administered only when applicable (Post *et al.* 2008).

The IMPACT-S showed good reliability and validity in persons with various disabilities arising from road accidents. The developers concluded that it is a useful outcome measure when used together with other ICF instruments, such as the ICF Checklist and the ICF Core Sets, and that it accurately reflects all of the ICF chapters (Post *et al.* 2008). Even though an English version of the IMPACT-S is available, it has not yet been validated in English (van der Zee *et al.* 2014), and for this reason, this scale was not used during the data collection phase of this research.

2.9 HEALTH-RELATED QUALITY OF LIFE

Quality of life (QoL) is defined by the WHO as “an individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (Truelle *et al.* 2010). Health-related quality of life (HRQoL) relates specifically to the different aspects of one’s life which are affected by health (Truelle *et al.* 2010). The concept of HRQOL relates to the subjective evaluation of well-being, satisfaction, functioning and disability (Koskinen *et al.* 2011).

The long-term implications of TBI include cognitive, emotional and physical impairments, which affect one’s self-esteem, coping strategies, and ultimately one’s HRQoL (Truelle *et al.* 2010). HRQoL post-TBI is affected by a variety of factors, such as changes in emotional status, neuro-behavioural fallouts, cognitive fallouts, sleep disturbances, fatigue, pain, communication difficulties, loss of autonomy in advanced ADLs, co-morbid health conditions, changes in the level of participation and changes in vocational status (Koskinen *et al.* 2011).

The HRQoL scores may be lower in individuals with fewer resources, as patients with TBI who live in developed countries may have increased access to services such as support groups, individual psychological treatment, financial assistance, health-care facilities, nursing homes and adult day-care facilities (Arango-Lasprilla *et al.* 2012).

According to a cohort of people who had reached the two-year post-hospitalisation mark for TBI, employment was found to be the most important contributor to improved QOL (Wagner *et al.* 2002). Patients with TBI who are employed subsequent to injury present with a lower level of disability, greater community participation, increased satisfaction with their social support systems, use task-oriented coping strategies, and have a more optimistic life orientation stance, and consequently report higher HRQoL.

Patients with TBI who report higher levels of fatigue, who report to suffer from headaches and who have a history of psychiatric illness prior to the TBI report, achieve poorer HRQoL (Arango-Lasprilla *et al.* 2012).

Research shows that patients with TBI often report poorer HRQoL in comparison to the respondents without a TBI and who have not experienced any other types of trauma (Arango-Lasprilla *et al.* 2012).

2.9.1 Health-related quality of life outcome measures

In recent years, HRQoL has been introduced as an outcome criterion post-TBI (Koskinen *et al.* 2011). Only one outcome measure, the Quality of Life after Brain Injury (QOLIBRI) assessment has been developed specifically for people with TBI. Other HRQoL outcome measures are not specific to one condition.

For this reason, the QOLIBRI is discussed in detail as the Quality of Life after Brain Injury Overall Scale (QOLIBRI-OS) was the outcome measure used during the data collection phase of this study. The Short-Form 36 (SF-36) is the most widely-used generic HRQoL outcome measure, and is discussed very briefly below.

2.9.1.1 The Quality of Life after Brain Injury assessment

The Quality of Life after Brain Injury (QOLIBRI) assessment is a relatively new outcome measure. It was created to be a complex, disease-specific measure of HRQoL for TBI (von Steinbuechel *et al.* 2012). Before the QOLIBRI was developed, no widely used and validated TBI-specific HRQoL outcome measure existed (Truelle *et al.* 2010).

The tool is based on the patient's subjective evaluation of his/her satisfaction with the different life domains commonly affected by his/her TBI condition (Koskinen *et al.* 2011).

It is a 37-item scale, divided into six subscales that measure areas of well-being and functioning. The six subscales are cognition, self, daily life and autonomy, social relationships, emotions and physical problems (Koskinen *et al.* 2011).

The Quality of Life after Brain Injury Overall Scale (QOLIBRI-OS), presented in Appendix 10, was developed from the QOLIBRI to be a brief TBI-specific HRQoL scale. It is a six-item scale, with satisfactory psychometric properties, and is available free of charge. Items are scored on a five-point Likert scale, from one (not at all) to five (very much), after which the sum of all the items is converted to a percentage scale, with zero representing the lowest possible HRQoL, and 100 representing the best possible HRQoL (Truelle *et al.* 2010). There are no norms or effect change scores available for this outcome measure.

The QOLIBRI offers a very detailed explanation of HRQoL post-TBI, but is very time consuming, and may cause patient fatigue, especially in the TBI demographic (von Steinbuechel *et al.* 2012). For this reason, the shorter QOLIBRI-OS assessment was deemed more appropriate for the purposes of this study.

2.9.1.2 Short-Form 36

The Short-Form 36 (SF-36) is the most widely used generic HRQoL assessment (von Steinbuechel *et al.* 2016). It is a reliable and valid measure of the severity of HRQoL and is useful in both clinical and research settings (Arango-Lasprilla *et al.* 2011).

The SF-36 is a self-rating questionnaire, which consists of 36 items that focus on eight subscales of health assessing the following domains: physical functioning, physical role functioning, bodily pain, general health perceptions, vitality, social role functioning, emotional role functioning and mental health. Each domain produces a score from zero to 100, with higher scores indicating higher HRQoL. A physical component summary and a mental component summary are also reported. In comparison with control groups, patients with TBI have lower mean scores on the scales and on the mental and physical component summaries, which reflect poorer health (von Steinbuechel *et al.* 2016).

As the QOLIBRI and QOLIBRI-OS are specific to brain injury, they capture additional information not captured by the generic HRQOL measures such as the SF-36, which is why the QOLIBRI-OS was chosen for this study (von Steinbuechel *et al.* 2016).

2.10 CONCLUSION

Globally, TBI is a serious public health and socio-economic problem (Roozenbeek *et al.* 2013). Although the burden is spread throughout the world, developing countries such as SA are especially affected (Alexander *et al.* 2009). TBI in SA can be largely attributed to the high rate of interpersonal violence and the large number of road accidents (Norman *et al.* 2007).

Depending on the nature and severity of the TBI, such an injury affects the cognitive, behavioural and physical functions to varying degrees, making it one of the most debilitating diseases (Hardaker 2011) (Parvaneh & Cocks 2012). Impairments are often only picked up after discharge from hospital, and can be especially challenging for patients and their families. Common impairments post-TBI includes memory loss, cognitive problems, increased fatigue, reduced decision making and personality changes (Hardaker 2011).

Many consider optimal reintegration back into the community as the final goal for rehabilitating patients with TBI, and for the patient to return to productive activity (Fleming *et al.* 1999). It is well documented that people with a TBI may struggle with different aspects of community reintegration, as in the case of returning to productive activity, participating in leisure-time activities, maintaining friendships and intimate relationships, and in assuring their mobility, transportation and independence at home (Sander *et al.* 2009).

There is very little research specific to community reintegration in the traumatic brain injury population of SA. Owing to differences in socioeconomic status, culture and other related factors, the particular needs of people with TBI in terms of community reintegration into South African communities differ from those of traumatic brain-injured people in other regions.

Understanding the prognostic factors for community reintegration following a TBI is important, so that factors that are likely to hamper community reintegration can be addressed wherever possible, and a successful community reintegration programme can be implemented (Reistetter & Abreu 2005; Hardaker 2011). The eight factors selected by the researcher to be included in the study have been discussed in detail. They were chosen on the basis of the literature and the researcher's scope of practice as a physiotherapist, and included age, gender, level of education, occupation at the time of the injury, cause of injury, type of injury suffered, severity of the injury, and type of rehabilitative treatment received. The different outcome measures that establish community reintegration was discussed.

Community reintegration and "participation" in the ICF can be considered to be interchangeable concepts (Gretshel 2016). The ICF was developed by the WHO as a framework for organising and documenting information on functioning and disability. It provides a comprehensive understanding of the different components of health, and provides a common language for health professionals, irrespective of their backgrounds (Laxe *et al.* 2011). There are different ways in which the ICF can be implemented, and these include using ICF-based assessment instruments, using the entire classification, using a limited pre-set level and using a pre-set short list. The most commonly used ICF assessment tools were reviewed in this chapter.

The long-term implications of TBI include cognitive, emotional and physical impairments, which affects one's self-esteem, coping strategies, and ultimately their HRQoL (Truelle *et al.* 2010). HRQoL relates specifically to the different aspects of one's life which are affected by health (Truelle *et al.* 2010). The concept of HRQOL relates to the subjective evaluation of well-being, satisfaction, functioning and disability (Koskinen *et al.* 2011). Only one outcome measure, the QOLIBRI assessment has been developed specifically for TBI. The QOLIBRI-OS was discussed in detail, as this outcome measure was used during the data collection phase of the study.

The next chapter describes the methodology of the study, and how the researcher went about finding the level of community reintegration post-TBI and the factors that influence it.

CHAPTER 3

3. METHODOLOGY

3.1 INTRODUCTION

The research procedure that was followed for the study and the data analysis method are explained in this chapter.

The study design is summarised in the flow diagram below.

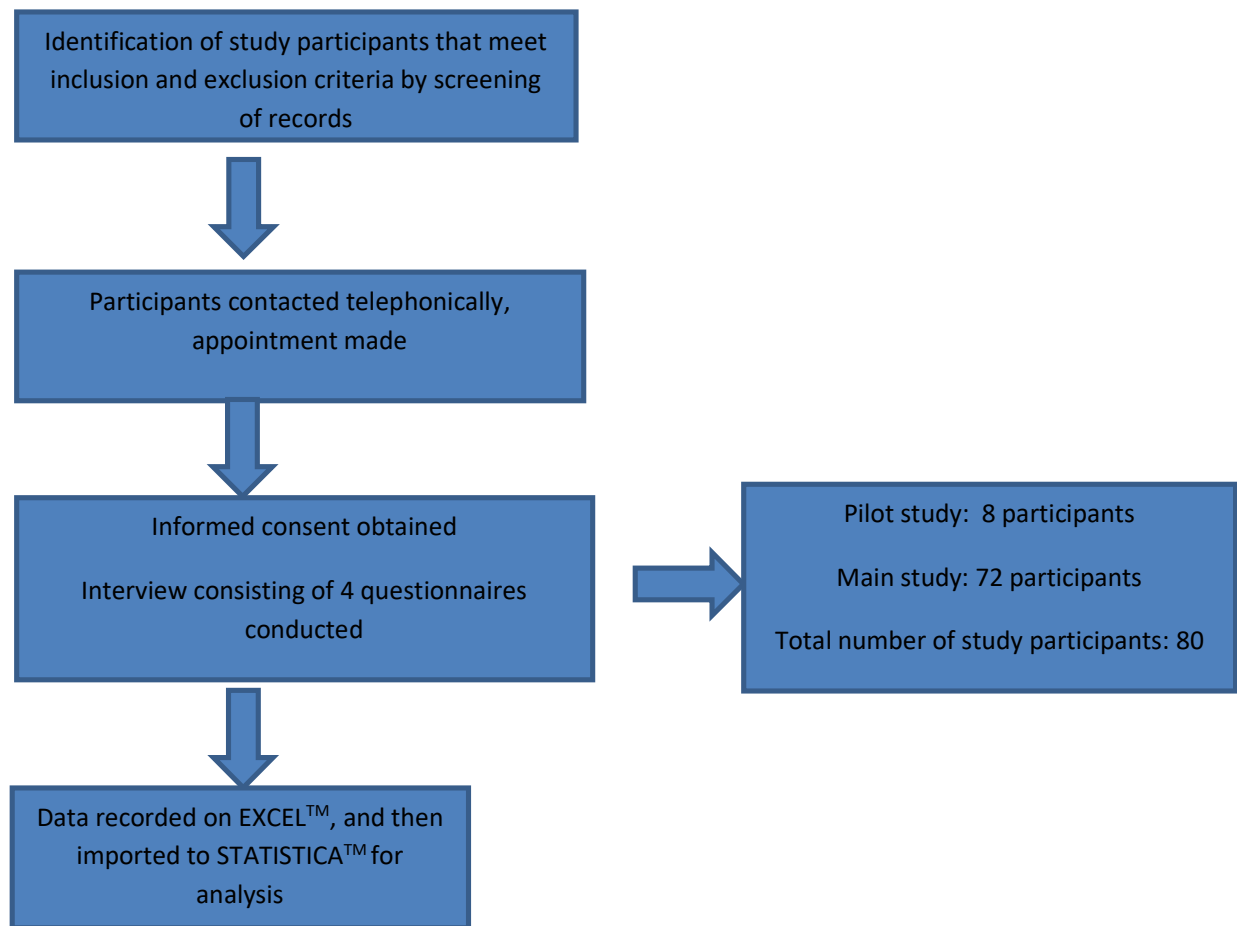


Figure 3.1: Study design flow diagram

3.2 STUDY DESIGN

The study used a quantitative, cross sectional analytical design.

3.3 STUDY POPULATION

Participants for the study were all patients who had sustained a TBI, had been admitted to Steve Biko Academic Hospital, who had been discharged home six to eighteen months prior to the research phase of this study, and who had met the inclusion criteria.

In the literature, studies predicting participation outcomes post-TBI vary from 3.3 months to 31 years post-injury (Sherer *et al.* 2014). Six months was chosen as the minimum time the patient had been at home following discharge in order to allow enough time for community reintegration to take place; and eighteen months was chosen as the cut-off mark to avoid too much variability within the study sample.

3.4 LOCATION FROM WHICH PARTICIPANTS WERE RECRUITED

The participants were sourced from a conveniently selected hospital, namely Steve Biko Academic Hospital (SBAH) in Pretoria, Gauteng. It is an 832-bed tertiary healthcare institution affiliated to the University of Pretoria that renders specialised services to medically-referred patients. Patients are referred to this institution from local clinics or hospitals in the catchment area from within and around Pretoria (Steve Biko Academic Hospital 2018).

3.5 SAMPLE SIZE AND SELECTION

As the researcher did not have access to recent, accurate records of patients with TBI in the study area, she was unable to calculate the size of the sample population. The secondary objective was thus used in calculating the sample size, as this was the next best option.

According to recommendations by Nunally (1978), 10 to 15 participants are required for every factor needed to show significance in the measures assessed. Thus, given that this study looked at eight factors assessed from the literature to have an influence on community reintegration post-TBI in the South African context, a minimum of 80 participants were selected.

The eight factors were discussed in detail in Chapter two, namely age, gender, level of education, occupation at the time of the injury, the cause of injury, the type of injury sustained, the severity of the injury, and the type of rehabilitative treatment received.

a) Inclusion Criteria

The following criteria were stipulated for inclusion in the study:

- It was the first time that the patient had sustained a TBI.
- The patient had been discharged from SBAH six to eighteen months (1 January 2015 – 31 December 2015) prior to the initiation of this research project.
- The patient was over the age of 18 years.
- The patient would be able to communicate verbally (no evidence of receptive or expressive aphasia), and be able to complete the questionnaires, or would have a caregiver present during the interview to provide informed consent and to complete the questionnaires as a proxy.

b) Exclusion Criteria

Participants were excluded from the study if they:

- Had been transferred from the date of their discharge to a long-term care-facility six to eighteen months prior to the initiation of this research project.
- Were disabled prior to the TBI.

3.6 INSTRUMENTATION AND OUTCOME MEASURES

Four tools were used for data collection:

3.6.1 Demographic questionnaire

The demographic questionnaire (Appendix 7) was compiled by the researcher, and consisted of demographic and clinical information such as age, gender, level of education, employment status, cause of TBI, as well as the type of lesion acquired. The initial Glasgow Coma Scale (GCS) score, as recorded in the participant's file was used to determine the severity of the TBI. The type of rehabilitative treatment that the participant received was also recorded on the demographic questionnaire.

The information gathered with this tool was used to establish factors that influence community reintegration in patients with TBI six to eighteen months post-discharge from the hospital. As part of the detail concerning the data collection process, it was indicated whether the interview process had been conducted with the participant him/herself, a proxy only, or a combination of the two.

3.6.2 Community Integration Questionnaire

The Community Integration Questionnaire (Appendix 8) allows for an objective, brief assessment of the reintegration of one into the community after a TBI (Hardaker 2011).

It consists of 15 questions in the format of a self-reporting questionnaire, which are divided into three performance areas, namely:

- Home integration (five items, involving a maximum sub-category score of 10),
- social integration (six items, involving a maximum sub-category score of 12),
and
- productivity (four items, involving a maximum sub-category score of 7).

The items are mostly rated on a scale of zero to two (on the three-point Likert scale), either according to the frequency of performing the activity, or according to the way in which the activity is performed (Salter *et al.* 2008). Total scores could range from zero to 29 points. Greater independence and community reintegration would be indicated by higher scores (Salter *et al.* 2008). No norms or effect change scores were available for this outcome measure.

The CIQ is favoured for demonstrating sensitivity to the types of impairments typically observed after a TBI, with minimal floor and ceiling effects (Sander *et al.* 2009). Reliability studies, also essential in such sensitive research projects, are known to produce mixed results (Dijkers *et al.* 2000). Furthermore, in the agreement between patient and proxy, the responses have been found to be adequate to excellent, ranging from 0.43 to 0.79, 0.52 to 0.65 and 0.81 to 0.94 for the home, social and productivity subscales. The CIQ also shows good test-re-test reliability scores, with ranges from 0.81 to 0.91 for the total CIQ score (Salter *et al.* 2008). There is also evidence for discriminant validity as the CIQ is able to differentiate between patients with TBI and those without. Furthermore, it can differentiate between different levels of independence (Saeki *et al.* 2006). Since there are no formal content or face validity studies (Dijkers *et al.* 2000), concurrent validity can be demonstrated through the determination of moderate to strong correlations between the variables on the disability rating scale, the FIM and Functional Assessment Measure (FAM), and the CHART (Sander *et al.* 2009).

In its current format, the CIQ can be administered in the form of an in-person interview or of a telephonic interview with the patient, or, if the patient is unable to complete the questionnaire him/herself, it can be administered via a proxy (Dijkers *et al.* 2000). It is available free of charge and takes 15 minutes to complete. Moreover, additional training is not required, and it is specific to patients with TBI (Salter *et al.* 2008). These reasons all led the researcher to the decision that the CIQ was the most suitable outcome measure to use in this study.

3.6.3 The World Health Organisation Disability Assessment Schedule 2.0

The World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0) (Appendix 9) is an overall measure of functioning and disability across six of the major life domains, which correspond directly with the “activities and participation” dimension of the ICF, and are applicable to any health condition (Üstün *et al.* 2010).

These are:

- cognition (understanding and communicating),
- mobility (moving and getting around),
- self-care (hygiene, dressing, eating and staying alone),
- getting along socially (interacting with other people),
- life activities (domestic responsibilities, leisure, work and school), and
- participation in society (joining in community activities) (World Health Organisation Disability Organisation Schedule 2.0 (WHODAS 2.0) 2017).

The WHODAS 2.0 has been found to be sensitive to change when tested in a variety of cultural settings and health populations (World Health Organisation Disability Organization Schedule 2.0 (WHODAS 2.0) 2017). A 2010 study by Garin *et al.* validated the WHODAS 2.0 in patients with 13 different chronic diseases, including TBI. It has the reputation of being very reliable and of being able to effectively discriminate between and detect changes over time (Garin *et al.* 2010).

The WHODAS 2.0 has undergone extensive psychometric testing, and its test-retest reliability shows an overall intra-class coefficient (ICC) of 0.98. Internal consistencies range from acceptable to very good, with a total internal consistency of 0.96 for the 36 items (Üstün 2010). The WHODAS 2.0 has a comprehensive factor structure that remains constant across different cultures and for different types of patients. Validation studies have shown that it is comparable with other measures of disability or health status (Üstün 2010). The overall score of the WHODAS 2.0 was found to be strongly correlated with the overall score of the LHS ($r=0.68$) and the FIM ($r=0.68$). The individual domain scores have been found to correlate strongly with

the scores on comparable instruments designed to measure disability in specific areas (Üstün 2010).

3.6.4 Quality of Life after Brain Injury Overall Scale

The Quality of Life after Brain Injury (QOLIBRI) assessment is a complex disease-specific measure of HRQoL for TBI (von Steinbuechel *et al.* 2012). The tool is based on the subjective evaluation of the patient's satisfaction with the different life domains typically affected by TBI (Koskinen *et al.* 2011).

It is a 37-item scale, divided into six subscales that measure areas of well-being and functioning. The six subscales are cognition, self, daily life and autonomy, social relationships, emotions and physical problems (Koskinen *et al.* 2011).

The Quality of Life after Brain Injury Overall Scale (QOLIBRI-OS) was developed from the QOLIBRI to be a brief TBI-specific HRQoL scale. It is a six-item scale, with satisfactory psychometric properties, and is available free of charge. Items are scored on a five-point Likert scale ranging from one (not at all) to five (very). The sum of all the items is then converted into a percentage, with zero representing the lowest possible HRQoL, and 100 the best possible HRQoL (Truelle *et al.* 2010). There are no norms or effect change scores available for this outcome measure.

The internal consistency and reliability of this scale are good (Cronbach's $\alpha=0.86$; test-retest reliability=0.81), and the results seem to be similar for patients with higher and lower cognitive performance, which indicates that the scale has positive implications for use in the TBI demographic. It was also found that the QOLIBRI-OS correlates strongly with the full QOLIBRI scale. Furthermore, the construct validity in the TBI group was found to be good (von Steinbuechel *et al.* 2012).

3.7 RESEARCH PROCEDURE

3.7.1 Pilot study

Following approval from the University of the Witwatersrand's Human Research Ethics Committee (HREC) (M160661, Appendix 1), permission was obtained from SBAH to carry out the study.

A pilot study was done on eight randomly selected patients with TBI (10% of the sample size) that met the study's inclusion and exclusion criteria.

The purpose of the pilot study was to:

- test the participants' understanding of the questionnaires/outcome measures and make any adjustments if necessary;
- determine the average duration it would take to administer the questionnaires; and
- test the methodological process for any unforeseen eventualities that could hamper the data collection process.

It could be deduced from the pilot study that no changes would be required in respect of the questionnaires and the data collection process. As a result, the main study was carried out in the same manner, as described below. Since no changes were implemented, the data collected from the pilot study were included in the results of the study. No distinction was made between the data collected during the pilot study and the data collected during the main study.

3.7.2 Main study

Patients who had sustained a TBI and who were discharged from the hospital six to eighteen months prior to the initiation of this research study were identified by screening the Neurosurgery Ward's records (Ward 4.5) according to the type of brain lesion sustained (e.g.: extradural haemorrhage). Some of these lesions were

caused by non-traumatic events, (e.g.: intracerebral haemorrhage), however, and for this reason all identified patient files were drawn from the Patient Records Department to establish the cause of injury and, in compliance with the inclusion criteria, whether it was the first time that a TBI had been sustained.

All participants identified through the initial screening process were contacted telephonically and invited to participate in the study. Those that had not been discharged from the Neurosurgery Clinic and still had follow-up dates at the clinic (only three participants) were interviewed face-to-face at the clinic, while those who did not were given a follow-up appointment date and time at the Physiotherapy Department. Participants unable to attend the appointment at SBAH were interviewed by the researcher at their home or at an agreed-upon location. Only four participants were unable to attend the appointment at SBAH and were interviewed elsewhere.

Participants and caregivers who had to travel to the hospital especially to participate in the study were reimbursed for their travelling costs. This amount was calculated according to the average price that public transport charges per person for the average distance travelled to reach SBAH.

In cases where the participant was interviewed at SBAH, the participant's file accompanied him/her to the appointment venue. This allowed the researcher to determine the participant's initial GCS and the type of lesion sustained. In cases where the therapist interviewed the participant at another location, the file was drawn the previous working day in order to gather this information.

Before the interview was conducted, the participant or his/her caregiver was given an information letter (Appendices 3 and 4), and an informed consent form (Appendices 5 and 6) to complete. All of the participants were able to sign these forms.

A participation number was assigned to each participant, which was then inserted on all of the relevant documentation. Because no names or any other details that could be used for identifying the participant appeared on any of the documentation, the participant remained anonymous and the relevant information confidential. The

participant was assured that he/she would be permitted to withdraw from the study at any time, and would not face any negative consequences in such a case.

If a language barrier emerged during the interview process, the services of an interpreter were used, to ensure that all participants and their caregivers understood the questions.

The participants were made to complete the following documents (described in section 3.6 above) through an interviewer, who administered the interviewing process.

The interviews involved the completion of the following questionnaires:

- The general demographic questionnaire
- The Community Integration Questionnaire (CIQ)
- The World Health Organisation Disability Assessment Schedule 2.0 (WHODAS 2.0)
- The Quality of Life after Brain Injury Overall Scale (QOLIBI-OS)

If it was found that the participant would benefit from out-patient physiotherapy, an appointment was made at SBAH as per standard practice. Alternatively, the participant could be referred to his/her nearest clinic or community-based therapist. If the therapist deemed it necessary, participants could also be referred back to the Neurosurgery Clinic or to members of the multidisciplinary team.

3.8 VARIABLES

The independent and dependent variables for this study are as depicted below in Table 3.1.

Table 3.1: Independent and dependent variables

Independent variables	Dependent variables
Age	Level of community reintegration
Gender	Level of functioning and disability
Level of education	Quality of Life
Employment status	
Cause of injury	
Type of injury	
Severity of the injury	
Type of rehabilitative treatment	

3.9 DATA ANALYSIS

The data collected were recorded in EXCEL™, and then imported to STATISTICA™, where they were analysed. The level of significance was set at $p \leq 0.05$.

To help extract meaning from the data, demographic and clinical data were summarised using descriptive analysis. Data such as age, gender, level of education, employment status, severity of the injury, cause of injury, type of injury sustained, and the type of rehabilitative treatment – either in- or out-patient - that the participant received, were summarised in terms of frequencies and percentages. The rest of the data were analysed, as presented in Table 3.2 below.

Table 3.2: Data analysis

Objective	Type of data and data analysis
To establish the level of community reintegration after TBI.	The data could be classified as quantitative (ratio) data. A descriptive analysis of the data was carried out. Measures of central tendency and of dispersion were determined. The data were not normally distributed, and were therefore expressed as medians with interquartile ranges.
To describe the levels of functioning and disability based on the ICF for patients with TBI	The data could be classified as quantitative (ratio) data. A descriptive analysis of the data was carried out. Measures of central tendency and of dispersion were determined. The data were not normally distributed, and were therefore expressed as medians with interquartile ranges.
To describe the health-related quality of life in patients with TBI	The data could be classified as quantitative (ratio) data. A descriptive analysis of the data was carried out. Measures of central tendency and of dispersion were determined. The data were not normally distributed, and were therefore expressed as medians with interquartile ranges.
To establish the respective associations between level of functioning and disability and HRQOL and community reintegration in	Firstly, a bivariate Pearson Correlation Coefficient Analysis was performed to establish a relationship between the WHODAS2.0 and the QOLIBRI-OS and CIQ scores. Secondly, as there was a strong relationship between both variables and the CIQ score, a Multiple Linear Regression Analysis was performed to further investigate these associations. The Regression Analysis made use of the Stepwise Method, where the variable, QOLIBRI-OS was

patients with TBI	discarded on account of its non-significant association and high co-linearity with the WHODAS 2.0 scores.
To establish factors that influence community reintegration in patients with TBI	Independent Samples t-tests were run for categorical variables at two levels to determine whether the categorical variables or factors that had any influence on community reintegration were significant. Additionally, One-Way ANOVAs were run for categorical variables which had more than two levels to determine the significance of the association between the variables. In these cases, each of the categorical factors or variables was considered to be the independent variable, while the CIQ score was considered to be the dependent variable. If the ANOVA models were significant, least significant difference (LSD) post-hoc tests were performed to determine the group levels between which the differences lay. Relatively speaking, all the data were normally distributed. Homogeneity of variance was tested using Levene's Test, and descriptives were used to assess normality. Using Pearson's Correlation Coefficient Test, the scale factor of patient age was tested for association with the CIQ score. Using the Stepwise Method, factors or variables found to be significantly associated with CIQ scores were applied in a Multiple Linear Regression Analysis to determine the factors influencing community reintegration. Dummy variables were created for all of the categorical variables.

3.10 ETHICAL CONSIDERATIONS

- Ethical clearance was sought and obtained from the University of the Witwatersrand HREC (clearance certificate number M160661, Appendix 1).
- Permission to do the study was sought and obtained from the Head of the Physiotherapy Department and the Chief Executive Officer of SBAH (Appendix 2).
- Participants were recruited only after they had given informed consent.
- Participants were assured that refusal to participate in the study would not be prejudicial to them in any way.
- Should a participant decline to participate in the study, he/she would not be contacted again.
- The collected data were kept strictly confidential and used for the sole-purpose of this study.
- No names were used on any of the data collection sheets; instead, participant numbers, recorded in a separate file, were used to identify the participants.

CHAPTER 4

4. RESULTS

4.1 DEMOGRAPHIC AND CLINICAL DATA PERTAINING TO THE STUDY SAMPLE

This section presents the results for the demographic and clinical data pertaining to the study sample. Descriptive statistics, first combined, and then separated into categories according to the male or female gender, were used. For the purposes of this research study, the demographic and clinical data included variables such as gender, age, mechanism of injury, type of lesion, level of education, severity of injury, pre-morbid occupation, duration of hospitalisation, current occupation, type of rehabilitative treatment, and time from discharge to assessment.

4.1.1 Gender

The total sample size amounted to 80 participants, 72 (90%) of which were male and eight (10%), female.

4.1.2 Age

The age range of the participants for the study sample is shown in Table 4.1 below.

Table 4.1: Age distribution for the study sample (n = 80)

Category	Median	Minimum	Maximum	Interquartile range
Age	32	18	69	14

The median age was 32 years, with an interquartile range of 14. The minimum age was 18 years, and the maximum age was 69 years.

The categorised age distribution for the study sample is shown in Table 4.2 below.

Table 4.2: Categorised age distribution for the study sample (n=80)

Age	Total n (%)	Male (n =72) n (%)	Female (n = 8) n (%)
≤20 years	3(3.75)	2(2.78)	1(12.5)
21 to 30 years	32(40)	27(37.5)	5(62.5)
31 to 40 years	25(31.25)	25(34.72)	0(0)
41 to 50 years	14(17.5)	13(18.06)	1(12.5)
51 to 60 years	4(5)	3(4.17)	1(12.5)
61 to 70 years	2(2.5)	2(2.78)	0(0)
71 to 80 years	0(0)	0(0)	0(0)
≥81 years	0(0)	0(0)	0(0)
Total	80(100)	72(90)	8(10)

The 21- to 30-year age group had the highest percentage of participants (40%), followed by the 31- to 40-year age group (31.25%) and the 41- to 50-year age group (17.5%).

4.1.3 Mechanism of injury

The mechanism of injury for the study sample is shown in Table 4.3 below.

Table 4.3: Mechanism of injury for the study sample (n=80)

Mechanism of Injury	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
Motor vehicle accident	27 (33.75)	23 (31.94)	4 (50)
Pedestrian vehicle accident	10 (12.5)	9 (12.5)	1 (12.5)
Gunshot wound to the head	3 (3.75)	3 (4.17)	0 (0)
Fall	5 (6.25)	5 (6.94)	0 (0)
Assault	34 (42.5)	31(43.06)	3(37.5)
Other	1 (1.25)	1 (1.39)	0 (0)
Total	80 (100)	72 (90)	8 (10)

The most common mechanism of injury, irrespective of gender, was assault (42.5%), followed by motor vehicle accident (MVA) (33.75%) and pedestrian vehicle accident (PVA) (12.5%). The most common mechanism of injury in males was assault (43.06%), while in females it was MVA (50%).

4.1.4 Type of lesion

The type of lesion for the study sample is shown in Table 4.4 below.

Table 4.4: Distribution of type of lesion for the study sample (n=80)

Type of Lesion	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
Extradural haematoma	9 (11.25)	9 (12.5)	0 (0)
Subdural haematoma	3 (3.75)	3 (4.17)	0 (0)
Intracerebral	19 (23.75)	17 (23.61)	2 (25)
Diffuse axonal injury	3 (3.75)	2 (2.78)	1 (12.5)
Open depressed skull fracture	11 (13.75)	10 (13.89)	1 (12.5)
Subdural haemorrhage	10 (12.5)	9 (12.5)	1 (12.5)
Base-of-skull fracture	5 (6.25)	5 (6.94)	0 (0)
Combination of more than one lesion	20 (25)	17 (23.61)	3 (37.5)
Total	80 (100)	72 (90)	8 (10)

The most common type of injury, irrespective of gender, was a combination of more than one lesion (25%). In males, the most common type of injury was a combination of more than one lesion (23.61%), as was the case in females (37.5%).

4.1.5 Level of education

The highest level of education for the study sample is shown in Table 4.5 below.

Table 4.5: Distribution of the highest level of education for the study sample (n=80)

Level of Education	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
None	6 (7.5)	5 (6.94)	1 (12.5)
Up to Grade 7	18 (22.5)	18 (25)	0 (0)
Up to Grade 11	24 (30)	21(29.17)	3 (37.5)
Up to Grade 12	22 (27.5)	20 (27.78)	2 (25)
Grade 12 +3 years	10 (12.5)	8 (11.11)	2 (25)
Total	80 (100)	72 (90)	8 (10)

The highest level of education, irrespective of gender, was up to Grade 11 (30%), followed by up to Grade 12 (27.5%). The highest level of education in males was up to Grade 11 (29.17%), which was also the case in females (37.5%).

4.1.6 Severity

The severity of the injury for the study sample is shown in Table 4.6 below.

Table 4.6: Distribution of severity by initial Glasgow Coma Scale score for the study sample (n=80)

Initial GCS score	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
Mild (13-15)	43 (53.75)	39 (54.17)	4 (50)
Moderate (9-12)	24 (30)	21 (29.17)	3 (37.5)
Severe (3-8)	13 (16.25)	12 (16.67)	1 (12.5)
Total	80 (100)	72 (90)	8 (10)

Irrespective of gender, the most common category for representing the severity of TBI was the mild one (53.75%). This was similar in the case of males, where the mild category included the highest percentage of males (54.17%). The same applied to the females (50%).

4.1.7 Pre-morbid occupation

The distribution of pre-morbid occupation for the study sample is shown in Table 4.7 below.

Table 4.7: Distribution of pre-morbid status by occupation for the study sample (n=80)

Pre-morbid occupation	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
Paid employment	52 (65)	51 (70.83)	1 (12.5)
Self-employed	9 (11.25)	8 (11.11)	1 (12.5)
Student	7(8.75)	2 (2.78)	5 (62.5)
Retired	1 (1.25)	1 (1.39)	0 (0)
Unemployed (other)	11 (13.75)	10 (13.89)	1 (12.5)
Total	80 (100)	72 (90)	8 (10)

The most common distribution of pre-morbid occupation, irrespective of gender, was in the paid employment category (65%). In males, 70.8% were in paid employment, while in females 62.5% were students.

4.1.8 Current occupation

The distribution of current occupation for the study sample is shown in Table 4.8 below.

Table 4.8: Distribution of current occupational status for the study sample (n=80)

Current occupation	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
Paid employment	30 (37.5)	28 (38.89)	2 (25)
Self-employed	5 (6.25)	5 (6.94)	0 (0)
Unemployed (health)	20 (25)	19 (26.39)	1 (12.5)
Student	7 (8.75)	3 (4.17)	4 (50)
Receiving grant	1 (1.25)	1 (1.39)	0 (0)
Retired	2 (2.5)	2 (2.78)	0 (0)
Unemployed (other)	15 (18.75)	14 (19.44)	1 (12.5)
Total	80 (100)	72 (90)	8 (10)

The most common category in the distribution of current occupation, irrespective of gender, was in paid employment (37.5%). In males, 38.89% were in paid employment whereas 50% of the females were students.

4.1.9 Rehabilitative treatment

The distribution of the type of rehabilitative treatment received for the study sample is shown in Table 4.9 below.

Table 4.9: Distribution of type of rehabilitative treatment received for the study sample (n=80)

Type of rehabilitative treatment	Total n (%)	Male (n = 72) n (%)	Female (n = 8) n (%)
Acute in-patient rehabilitative treatment	22 (27.5)	19 (26.39)	3 (37.5)
Acute in-patient + out-patient rehabilitative treatment	10 (12.5)	9 (12.5)	1 (12.5)
Out-patient rehabilitative treatment only	4 (5)	3 (4.17)	1 (12.5)
None	44 (55)	41 (56.94)	3 (37.5)
Total	80 (100)	72 (90)	8 (10)

Most of the participants (55%), irrespective of gender, did not receive rehabilitative treatment. The majority of males (56.9%) did not receive rehabilitative treatment. Of the females, 37.5% did not receive rehabilitative treatment, while 37.5% received acute in-patient rehabilitative treatment only.

4.1.10 Time in days from discharge to assessment

The time in days from discharge to assessment is shown in Table 4.10 below.

Table 4.10: Time in days from discharge to assessment for the study sample (n=80)

Category	Minimum	Maximum	Median	Interquartile range
Time in days from discharge to assessment	231	719	432	250

According to the Shapiro-Wilk Test for time from discharge to assessment, ($p < 0.001$), the data were not normally distributed. The median time from discharge to assessment of the sample was 432.0 days, with an interquartile range of 250 days.

4.1.11 Duration in days of hospitalisation

The duration in days of hospitalisation is shown in Table 4.11 below.

Table 4.11: Duration in days of hospitalisation

Category	Minimum	Maximum	Median	Interquartile range
Duration in days of Hospitalisation	0	98	8	11

According to the Shapiro-Wilk Test the data were not normally distributed for the number of days spent in hospital ($p < 0.001$). The median duration of hospitalisation for the sample was eight days (IR = 11).

4.2 COMMUNITY REINTEGRATION

A descriptive analysis of the data was carried out to establish the level of community reintegration post-TBI, as measured on the CIQ. Measures of central tendency and of dispersion were determined.

The data were not normally distributed, and were therefore expressed as medians with interquartile ranges. The level of community reintegration measured on the CIQ scale is shown in Table 4.12 below.

Table 4.12: CIQ scores for the study sample (n=80)

Category	Minimum	Maximum	Median	Interquartile range
Total CIQ score (29)	8	29	22	7.5
CIQ home integration score (10)	0	10	9	5
CIQ social integration score (12)	4	12	10	3
CIQ productive activities score (7)	0	7	5	3

The median total CIQ score was 22, with an interquartile range of 7.5.

The distribution of the level of community reintegration by gender measured on the basis of the CIQ is shown in Table 4.13.

Table 4.13: CIQ scores per gender (n=80)

Category	Gender	Minimum	Maximum	Median	Inter-quartile range
CIQ home integration score (10)	Male	0	10	9	4
	Female	2	10	6	6
CIQ social integration score (12)	Male	4	12	10	3
	Female	6	12	8	3
CIQ productive activities score (7)	Male	0	7	4	3
	Female	1	6	5	3
Total CIQ score (29)	Male	8	29	22.5	7
	Female	11	27	19	11

The median total CIQ score for males was 22.5 (IR 7) and for females, 19 (IR 11). The minimum score for males was eight, and the maximum score was 29, and for females, the minimum score was 11, and the maximum score was 27.

4.3 LEVEL OF FUNCTIONING AND DISABILITY

In order to describe the level of functioning and disability for patients with TBI, a descriptive analysis of the data was carried out. Measures of central tendency and of dispersion were determined.

The level of functioning and disability as measured on the WHODAS 2.0 is shown in Table 4.14.

Table 4.14: WHODAS 2.0 percentage for the study sample (n=80)

Category	Gender	Minimum	Maximum	Median	Interquartile range
WHODAS 2.0 percentage (100%)	Male	30	20	80	17
	Female	36.5	22	78	28.5
	Total	20	80	31	18

According to the Shapiro-Wilk Test for the WHODAS 2.0 percentage, ($p < 0.001$) the data were not normally distributed. The median WHODAS 2.0 percentage, irrespective of gender, was 31%, with an interquartile range of 18%. The median WHODAS 2.0 percentage, irrespective of gender, was 31%, with an interquartile range of 18%. The median WHODAS 2.0 percentages were similar for males (30%) and females (36.5%).

4.4 HEALTH-RELATED QUALITY OF LIFE

In order to describe the HRQoL in patients with TBI, a descriptive analysis of the data was carried out. Measures of central tendency and of dispersion were determined.

The HRQoL, as measured on the QOLIBRI-OS, is shown in Table 4.15.

Table 4.15: QOLIBRI-OS percentage for the study sample (n=80)

Category	Gender	Minimum	Maximum	Median	Interquartile range
QOLIBRI-OS percentage (100%)	Male	20	100	73	47
	Female	37	100	63	40
	Total	20	100	73	45.5

According to the Shapiro-Wilk Test for the QOLIBRI-OS percentage, ($p=0.0001$), the data were not normally distributed. The median QOLIBRI-OS percentage was 73%, with an interquartile range of 45.5%. The median QOLIBRI-OS percentage for males was 73%, which was higher than the median of 63% for females.

4.5 RESPECTIVE ASSOCIATIONS BETWEEN LEVEL OF FUNCTIONING AND DISABILITY AND HEALTH-RELATED QUALITY OF LIFE AND COMMUNITY REINTEGRATION

A Pearson Correlation Analysis (as shown in Table 4.17) was performed to determine any association between the level of functioning and disability (WHODAS 2.0) and health-related quality of life (QOLIBRI-OS) respectively and community reintegration (CIQ).

As the data were normally distributed, the means and standard deviations for the total CIQ Score, the WHODAS 2.0 percentage and the QOLIBRI-OS percentage are presented in Table 4.16.

Table 4.16: Descriptives of the total CIQ score, the WHODAS 2.0 percentage, and the QOLIBRI-OS percentage (n=80)

	Mean	Standard Deviation
Total CIQ score	21.26	5.46
WHODAS 2.0 percentage	20.7	9.22
QOLIBRI-OS percentage	21.28	7.73

The mean total CIQ score was 21.26 with a standard deviation of 5.46; the mean WHODAS 2.0 percentage was 20.7 with a standard deviation of 9.22; and the mean QOLIBRI-OS percentage was 21.28 with a standard deviation of 7.73.

Table 4.17: Pearson's Correlation Analysis results for the respective associations between level of functioning and disability and health-related quality of life and community reintegration (n=80)

Pearson's Correlation Analysis			
	Total CIQ Score	WHODAS 2.0 %	QOLIBRI-OS %
Total CIQ score	1		
WHODAS 2.0 %	-0.68**	1	
QOLIBRI-OS %	0.54**	-0.76**	1

** . Correlation is significant at the 0.01 level (2-tailed).

All of the selected variables were found to be significantly related to the level of community reintegration. There was a negative relationship between WHODAS 2.0 percentage and the total CIQ score ($r = -0.68$; $p < 0.001$), and a positive correlation between QOLIBRI-OS percentage and the CIQ score ($r = 0.54$; $p < 0.001$). There was a negative percentage ($r = -0.76$; $p < 0.001$).

As there was a strong relationship between both variables and the CIQ score, a Multiple Linear Regression Analysis, with the WHODAS 2.0 percentage and QOLIBRI-OS percentage as the independent variables and the CIQ score as the

dependant variable, was performed to further investigate these associations. The Regression Analysis made use of the Stepwise Method, which means that the variables of concern were all thrown into the model and the non-significant ones were removed one by one. The variable of QOLIBRI-OS percentage was discarded on account of its insignificant association and high co-linearity with the WHODAS 2.0 percentage.

The regression coefficients to determine any association between level of functioning and disability and community reintegration are shown in Table 4.18 below.

Table 4.18: Regression coefficients to determine the association between the levels of functioning and disability and community reintegration (n=80)

Coefficients^a						
Model		Unstandardised coefficients		Standardised coefficients	T	Sig.
		Beta	Std. error	Beta		
1	(Constant)	29.56	1.12		26.44	< 0.001
	WHODAS 2.0 %	-0.4	0.05	-0.68	-8.12	< 0.001

The final model was statistically significant, $F(1, 78) = 65.883$, $p < 0.001$, and had an adjusted R-square value of 0.451, indicating that the predictors accounted for approximately 45% of the variance in the total CIQ score. As shown in Table 4.18 above, WHODAS 2.0 percentage was found to be a significant negative predictor of the CIQ score. For every decrease by Beta = - 0,4 in WHODAS 2.0 percentage, there would be a unit increase of one in the CIQ score (this is also true of the opposite, namely that an increase of 0.4 in WHODAS 2.0 percentage, would lead to a unit decrease of one in the CIQ score).

4.6 FACTORS INFLUENCING COMMUNITY REINTEGRATION

A statistical analysis of the data for this study sample was conducted to establish factors that influence community reintegration in patients with TBI. A descriptive analysis was also carried out and measures of central tendency and dispersion were determined.

In determining whether the categorical factors had any influence on community reintegration, Independent Samples t-tests for categorical variables with two levels were run with each factor as the independent variable and the CIQ score as the dependent variable. One-Way ANOVAs for categorical variables which had more than two levels were also run. If the results of the ANOVA models were significant, LSD post-hoc tests were performed to determine the group levels between which the differences lay. Homogeneity of variance was tested using Levene's test, and descriptives were used to assess normality. Factors found to be significantly associated with CIQ scores were entered into a Multiple Linear Regression Analysis so that, using the Stepwise Method, the factors influencing community integration could be determined. Dummy variables were created for all categorical variables.

4.6.1 Gender

The total CIQ scores per gender are presented in Table 4.19 below.

Table 4.19 The relationship between total CIQ scores for males and females respectively (n=80)

Total CIQ Score						
Gender	n (%)	Mean	Std. D	Levene's Test for Equality of Variances		
				Df	F	Sig.
Male	72 (90)	21.44	5.38	0.38	0.21	0.65
Female	8 (10)	19.63	6.28			

The mean CIQ score for males was 21.44, and for females, 19.63. An Independent Samples t-test was performed with gender as the independent variable and the CIQ score as the dependent variable. Levene's Test did not come up with significant results ($p = 0.65$) and thus homogeneity of variance of the groups could be assumed. There was no significant difference in the CIQ score between males ($M = 21.44$, $SD = 5.38$) and females ($M = 19.625$, $SD = 6.28$), $t(78) = 0.375$, which suggests that there was no relationship between gender and community reintegration in this sample of patients with TBI.

4.6.2 Level of education

The relationship between level of education and the total CIQ score is presented in Table 4.20 below.

Table 4.20: The relationship between level of education and the total CIQ score ($n=80$)

Total CIQ Score						
	n (%)	Mean	Standard Deviation	Levene's Test for Equality of Variances		
				Df	F	Sig.
None	6 (7.5)	21.33	5.72	4	1.01	0.41
Up to Grade 7	18 (22.5)	19.78	6.15			
Up to Grade 11	24 (30)	21.13	5.01			
Up to Grade 12	22 (27.5)	21.32	5.93			
Grade 12 + 3 years	10 (12.5)	24.1	3.57			

About 27.5% of the sample had reached up to a Grade 12 educational level, while 7.5% did not have any formal education. A One-Way ANOVA was performed with the CIQ score and educational levels as variables. Overall, no significant differences were found between these variables ($F(4) = 1.01$; $p = 0.41$). This suggests that

there was no relationship between education level and community reintegration in this sample of patients with TBI.

4.6.3 Pre-morbid occupation

The relationship between pre-morbid employment status and total CIQ for the study population is presented in Table 4.21 below.

Table 4.21: The relationship between the pre-morbid employment status (pre-morbid occupation) and the total CIQ score for the study population (n=80)

Total CIQ Score						
	n (%)	Mean	Std. D	Levene's Test for Equality of Variances		
				Df	F	Sig.
Paid employment	52 (65)	21.46	5.24	3	1.05	0.38
Self-employed	9 (11.25)	22.22	6.4			
Student	7 (8.75)	17.86	7.06			
Unemployed (other)	12 (15)	21.67	4.66			

About 65% of the sample were employed before acquiring the TBI, while 15% were unemployed. A One-Way ANOVA was performed with CIQ and pre-morbid occupation as variables. Overall, no significant differences between pre-morbid occupation and CIQ score were found; $F(3) = 1.05$; $p = 0.38$. This suggests that there was no relationship between pre-morbid occupation and community reintegration in this sample of patients with TBI.

4.6.4 Current occupation

The relationship between current employment status and total CIQ for the study population is presented in Table 4.22 below.

Table 4.22: Relationship between employment status (current occupation) and total CIQ for the sample population (n=80)

Total CIQ Score						
	n (%)	Mean	Std. D	Levene's Test for Equality of Variances		
				Df	F	Sig.
Paid employment	30 (37.5)	24.13	3.38	5	8.58	0
Self-employed	5 (6.25)	25.2	3.7			
Unemployed (health)	20 (25)	16.4	5.1			
Student	7 (8.75)	22.43	3.26			
Retired	2 (2.5)	16	9.9			
Unemployed (other)	16 (20)	20.88	5.48			
Total	80 (100)	21.26	5.46			

Only 37.5% of the sample population were employed after having acquired the TBI as opposed to the 65% who were in paid employment before acquiring the TBI. While 15% were unemployed before the TBI, 45% were subsequently unemployed. A One-Way ANOVA with CIQ scores and current occupation as variables was performed. Overall, significant differences between at least two of the groups were found: $F(5) = 8.58$; $p < 0.001$.

The LSD post-hoc test results are presented in Table 4.23, with current occupation as the independent variable and the total CIQ score as the dependent variable.

Table 4.23: Least significant difference post-hoc test results with current occupation as the independent variable and total CIQ score as the dependent variable

Dependent variable: Total CIQ score						
Least significant difference						
(I) Current occupation	(J) Current occupation	Mean Difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Paid employment	Self-employed	-1.07	2.17	0.62	-5.39	3.26
	Unemployed (health)	7.73*	1.3	0	5.15	10.32
	Student	1.70	1.89	0.37	-2.05	5.46
	Retired	8.13*	3.28	0.02	1.6	14.67
	Unemployed (other)	3.26*	1.39	0.02	0.49	6.03
Self-employed	Paid employment	1.07	2.17	0.62	-3.26	5.39
	Unemployed (health)	8.8*	2.25	0	4.33	13.27
	Student	2.77	2.63	0.3	-2.47	8.01
	Retired	9.2*	3.76	0.02	1.71	16.69
	Unemployed (other)	4.33	2.3	0.06	-0.26	8.91
Unemployed (health)	Paid employment	-7.73*	1.3	0	-10.32	-5.15
	Self-employed	-8.8*	2.25	0	-13.27	-4.33
	Student	-6.03*	1.97	0	-9.96	-2.1
	Retired	0.4	3.33	0.91	-6.24	7.04
	Unemployed (other)	-4.48*	1.51	0	-7.48	-1.47
Student	Paid employment	-1.7	1.89	0.37	-5.46	2.05
	Self-employed	-2.77	2.63	0.3	-8.01	2.47
	Unemployed (health)	6.03*	1.97	0	2.1	9.96
	Retired	6.43	3.6	0.08	-0.75	13.60
	Unemployed (other)	1.55	2.04	0.45	-2.5	5.61
Retired	Paid employment	-8.13*	3.28	0.02	-14.67	-1.6
	Self-employed	-9.2*	3.76	0.02	-16.69	-1.71

	Unemployed (health)	-0.4	3.33	0.91	-7.04	6.24
	Student	-6.43	3.6	0.08	-13.6	0.75
	Unemployed (other)	-4.88	3.37	0.15	-11.59	1.84
Unemployed (other)	Paid employment	-3.26*	1.39	0.02	-6.03	-0.49
	Self-employed	-4.33	2.3	0.06	-8.91	0.26
	Unemployed (health)	4.48*	1.51	0	1.47	7.48
	Student	-1.55	2.04	0.45	-5.61	2.5
	Retired	4.88	3.37	0.15	-1.84	11.59
*. The mean difference is significant at the 0.05 level.						

It was found that participants with TBI in this study sample who were in paid employment attained significantly higher CIQ scores compared to those participants who were unemployed on account of poor health (MD = 7.73, $p < 0.001$), retired (MD = 8.13, $p = 0.02$), and unemployed for any other reason (MD = 3.26, $p = 0.02$). Self-employed participants with TBI attained significantly higher CIQ scores than both the unemployed on account of poor health (MD = 8.8, $p < 0.001$) and retired participants (MD = 9.2, $p = 0.02$). Participants with TBI who were grouped as unemployed on account of poor health, attained significantly lower CIQ scores compared to both the students (MD = -6.03, $p < 0.001$) and the unemployed (for any other reason) (MD = -4.48, $p < 0.001$).

4.6.5 Mechanism of injury

The relationship between mechanism of injury and total CIQ score for the study population is presented in Table 4.24 below.

Table 4.24: Relationship between mechanism of injury and total CIQ score for the study population (n=79)

Total CIQ Score						
	n (%)	Mean	Standard Deviation	Levene's Test for Equality of Variances		
				Df	F	Sig.
Motor vehicle accident	27 (34.18)	20.52	5.92	4	4.21	0
Pedestrian vehicle accident	10 (12.66)	21.3	3.59			
Gunshot wound to the head	3 (3.8)	10.33	2.31			
Fall	5 (6.33)	23	4.85			
Assault	34 (43.04)	22.38	4.81			

About 43% of the sample acquired their TBI from assault, while 34% were injured in a motor vehicle accident. A One-Way ANOVA was performed. Overall, significant differences between at least two of the groups were found ($F(4) = 4.21$; $p = 0.004$).

The LSD post-hoc test results are presented in Table 4.25, with mechanism of injury as the independent variable and the total CIQ score as the dependent variable.

Dependent variable: Total CIQ score						
Least significant difference						
(I) Mechanism of injury	(J) Mechanism of injury	Mean Dif (I-J)	Std. Error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Motor vehicle accident	Pedestrian vehicle accident	-0.78	1.87	0.68	-4.51	2.95
	Gunshot wound to the head	10.19*	3.08	0	4.05	16.32
	Fall	-2.48	2.46	0.32	-7.39	2.43
	Assault	-1.86	1.3	0.16	-4.46	0.73
Pedestrian vehicle accident	Motor vehicle accident	0.78	1.87	0.68	-2.95	4.51
	Gunshot wound to the head	10.97*	3.33	0	4.33	17.6
	Fall	-1.7	2.77	0.54	-7.22	3.82
	Assault	-1.08	1.82	0.55	-4.71	2.54
Gunshot wound to the head	Motor vehicle accident	-10.19*	3.08	0	-16.32	-4.05
	Pedestrian vehicle accident	-10.97*	3.33	0	-17.6	-4.33
	Fall	-12.67*	3.69	0	-20.03	-5.31
	Assault	-12.05*	3.05	0	-18.12	-5.98
Fall	Motor vehicle accident	2.48	2.46	0.32	-2.43	7.39
	Pedestrian vehicle Accident	1.7	2.77	0.54	-3.82	7.22
	Gunshot wound to the head	12.67*	3.69	0	5.31	20.03
	Assault	0.62	2.42	0.8	-4.21	5.45
Assault	Motor vehicle accident	1.86	1.30	0.16	-0.73	4.46
	Pedestrian vehicle accident	1.08	1.82	0.55	-2.54	4.71
	Gunshot wound to the head	12.05*	3.05	0	5.98	18.12
	Fall	-0.62	2.42	.08	-5.45	4.210

*. The mean difference is significant at the 0.05 level.

It was found that participants in this sample who acquired their TBI through a gunshot wound to the head had significantly lower CIQ scores compared to those participants who acquired their TBI as a result of a motor vehicle accident (MD = -10.19; $p = 0.001$), a pedestrian vehicle accident (MD = -10.97; $p = 0.002$), a fall (MD = -12.67; $p = 0.001$) or assault (MD = -12.05; $p < 0.001$).

4.6.6 Type of lesion

The relationship between the type of lesion and the total CIQ score for the study population is presented in Table 4.26.

Table 4.26: Relationship between type of lesion and total CIQ score for the study population (n=80)

Total CIQ score						
	n (%)	Mean	Standard Deviation	Levene's Test for Equality of Variances		
				Df	F	Sig.
Extradural haemorrhage	9 (11.25)	21.33	3.57	7	0.96	0.47
Subarachnoid haematoma	3 (3.75)	16.67	7.51			
Intracerebral haematoma	19 (23.75)	20.63	5.27			
Diffuse axonal injury	3 (3.75)	20.67	8.39			
Open depressed skull fracture	11 (13.75)	21	5.88			
Sub Dural haemorrhage	10 (12.5)	19.5	6.19			
Base of skull fracture	5 (6.25)	24.2	4.66			
Combination of more than one	20 (25)	22.9	5.25			

About 25% of the sample of participants with TBI presented with a combination of more than one lesion, while 23.75% had intracerebral lesions. Overall, no significant differences between type of lesion and CIQ score were found ($F(7) = 0.96$; $p = 0.47$). This suggests that there was no relationship between type of lesion and community reintegration in this sample of participants with TBI. Owing to the fact that the group sizes were quite small, this result should not be regarded as conclusive.

4.6.7 Severity

The relationship between severity of the injury and the total CIQ score for the study population is presented in Table 4.27 below.

Table 4.27: Relationship between severity of injury and total CIQ score for the study population (n=80)

Total CIQ score						
	n (%)	Mean	Standard Deviation	Levene's Test for Equality of Variances		
				Df	F	Sig.
Mild	43 (53.75)	21.65	5.24	2	1.16	0.32
Moderate	24 (30)	21.7	5.12			
Severe	13 (16.25)	19.15	6.66			

A mild TBI classification applied to 53.75%, a moderate classification for 30%, and a severe classification for 16.25% of the sample of participants. A One-Way ANOVA was performed. Overall, no significant differences between severity of injury and the CIQ score were found ($F(2) = 1.16$; $p = 0.32$), which suggests that there was no relationship between severity of injury and community reintegration in this sample of participants with TBI.

4.6.8 Rehabilitative treatment

The relationship between type of rehabilitative treatment received and the total CIQ score for the study population is presented in Table 4.28 below.

Table 4.28: Relationship between type of rehabilitative treatment received and total CIQ score (n=80)

Total CIQ score						
	n (%)	Mean	Standard Deviation	Levene's Test for Equality of Variances		
				Df	F	Sig.
Acute in-patient rehabilitative treatment only	22 (27.5)	20.86	4.38	3	7.46	0
Acute in-patient + out-patient rehabilitative treatment	10 (12.5)	14.8	6.25			
Out-patient rehabilitative treatment only	4(5)	22	6.38			
None	44 (55)	22.86	4.69			

A very high percentage of participants in this sample did not receive any rehabilitative treatment post-TBI (55%). A One-Way ANOVA was performed, with significant differences between at least two of the groups being found ($F(3) = 7.46$; $p = < 0.001$).

The LSD post-hoc test results are presented in Table 4.29, with the type of rehabilitation treatment received as the independent variable and the total CIQ score as the dependent variable.

Table 4.29: The least significant difference post-hoc test results with type of rehabilitative treatment received as the independent variable and total CIQ score as the dependent variable

Dependent variable: Total CIQ score						
Least significant difference						
(I) Rehabilitation	(J) Rehabilitation	Mean Diff (I-J)	Std. Error	Significance	95% confidence interval	
					Lower bound	Upper bound
Acute in-patient rehabilitative treatment only	Acute in-patient + out-patient rehabilitative treatment	6.06*	1.87	0	2.35	9.78
	Out-patient rehabilitative treatment only	-1.14	2.66	0.67	-6.44	4.16
	None	-2	1.28	0.12	-4.55	0.55
Acute in-patient + out-patient rehabilitative treatment	Acute in-patient rehabilitative treatment only	-6.06*	1.87	0	-9.78	-2.35
	Out-patient rehabilitative treatment only	-7.2*	2.9	0.02	-12.97	-1.43
	None	-8.06*	1.72	0	-11.48	-4.65
Out-patient rehabilitative treatment only	Acute in-patient rehabilitative treatment only	1.14	2.66	0.67	-4.16	6.434
	Acute in-patient + out-patient rehabilitative treatment	7.2*	2.9	0.02	1.43	12.97
	None	-0.86	2.56	0.74	-5.96	4.23
None	Acute in-patient rehabilitative treatment only	2	1.28	0.12	-0.55	4.55

	Acute in-patient + out-patient rehabilitative treatment	8.06*	1.72	0	4.65	11.48
	Out-patient rehabilitative treatment only	0.86	2.56	0.74	-4.23	5.96
*. The mean difference is significant at the 0.05 level.						

LSD post-hoc tests were carried out with type of rehabilitative treatment received as the independent variable and the total CIQ score as the dependent variable. In this sample of participants with TBI, those who received acute in-patient and out-patient rehabilitative treatment had significantly lower CIQ scores than those who received acute in-patient rehabilitative treatment only (MD = -6.06; $p < 0.001$), out-patient rehabilitative treatment only (MD = -7.2; $p = 0.02$); and no rehabilitative treatment at all (MD = -8.06; $p < 0.001$).

4.6.9 Age

As both age and CIQ score are continuous variables, it was not possible to use an ANOVA to determine the relationship between these variables. Thus, a Pearson's Correlation (Two-Way), the results of which are presented in Table 4.30, was performed.

Table 4.30: Two-way Pearson's Correlation with age and CIQ as the variables (n=80)

		Total CIQ score	Age
Total CIQ score	Pearson's Correlation	1	-0.14
	Significance (two-tailed)		0.21
	n=80 (100)	80 (100)	80 (100)
Age	Pearson's Correlation	-0.14	1
	Significance (two-tailed)	0.21	
	n=80 (%)	80 (100)	80 (100)

No significant association was found between age and total CIQ score ($r = -0.14$; $p = 0.208$), which suggests that there was no relationship between age and community reintegration in this sample of participants with TBI.

4.7 SUMMARY OF FINDINGS

A summary of the demographic and clinical data, and the community reintegration, level of functioning and disability scores pertaining to this study, as well as the HRQoL findings concerning the study population follows:

- The total size of the sample amounted to 80 participants, 72 of which were male and eight of which were female. This gives a male to female ratio of nine to one.
- The median age was 32 years, with an interquartile range of 14.
- The most common mechanism/cause of injury, irrespective of gender, was assault (42.5%), followed by motor vehicle accident (33.75%) and pedestrian vehicle accident (12.5%).

- The most common type of lesion, irrespective of gender, was a combination of more than one lesion (25%), followed by intracerebral (23.75%) and extradural haematoma (11.25%).
- The highest level of education, irrespective of gender, was up to Grade 11 (30%), followed by up to Grade 12 (27.5%) and up to Grade 7 (22.5%).
- Irrespective of gender, most commonly, the severity of TBI was found to be mild (53.75%). This was followed by moderate (30%), and, even less frequent, severe (16.3%).
- Irrespective of gender, the most common pre-morbid occupational category in which participants were employed was in paid employment (65%).
- Irrespective of gender, the most common post-TBI occupational category in which participants were employed was in paid employment (37.5%).
- Most of the participants (55%) did not receive rehabilitative treatment.
- The median duration of hospitalisation for the sample population was eight days, with an interquartile range of 11 days.
- The median total CIQ score was 22, with an interquartile range of 7.5, a minimum score of 8 and a maximum score of 29.
- Irrespective of gender, the median WHODAS 2.0 percentage was 31%, with an interquartile range of 18%.
- The median QOLIBRI-OS percentage was 73%, with an interquartile range of 45.5%.
- There was a strong relationship between WHODAS 2.0 percentage and the CIQ score. Thus, for every Beta = -0.4 reduction on the WHODAS 2.0 percentage, there would be a unit increase of one in the CIQ score.
- No relationship was found between gender, educational level, pre-morbid occupation, type of lesion, severity of injury, or age, respectively, and community reintegration. This indicates that in this study sample these factors did not influence community reintegration.
- Participants who were in paid employment attained significantly higher CIQ scores compared to those participants who were unemployed on account of poor health (MD = 7.73, $p < 0.001$), retired (MD = 8.13, $p = 0.02$), and unemployed (for any other reason) (MD = 3.26, $p = 0.02$). Self-employed participants attained significantly higher CIQ scores than both the unemployed

on account of poor health (MD = 8.8, $p < 0.001$) and the retired participants (MD = 9.2, $p = 0.02$). Participants who were grouped as unemployed on account of poor health attained significantly lower CIQ scores compared to both students (MD = -6.03, $p < 0.001$) and the unemployed (for any other reason) (MD = -4.48, $p < 0.001$).

- Participants who had acquired their TBI on account of a gunshot wound to the head attained significantly lower CIQ scores as opposed to those who acquired their TBI as a result of a motor vehicle accident (MD = -10.19; $p = 0.001$), a pedestrian vehicle accident (MD = -10.97; $p = 0.002$), a fall (MD = -12.67; $p = 0.001$) or assault (MD = -12.05; $p < 0.001$).
- Participants who received acute in-patient and out-patient rehabilitative treatment attained significantly lower CIQ scores than those who received acute in-patient rehabilitative treatment only (MD = -6.06; $p < 0.001$), out-patient rehabilitative treatment only (MD = -7.2; $p = 0.02$); and no rehabilitative treatment (MD = -8.06; $p < 0.001$).

CHAPTER 5

5. DISCUSSION OF RESULTS

5.1 DEMOGRAPHIC AND CLINICAL DATA PERTAINING TO THE STUDY SAMPLE

This section discusses the demographic and clinical data of the study sample, and includes gender, age, mechanism of injury, type of lesion, level of education, severity, pre-morbid occupation, current occupation, rehabilitative treatment and duration of hospitalisation.

5.1.1 Gender

The total sample size amounted to 80 participants, 72 of whom were male and eight of whom were female, which gives a male-to-female ratio of nine to one. The findings of this study are comparable to those of a 2013 study with similar sample sizes that was conducted in Johannesburg with 60 participants with TBI. The latter study included 56 males (93%) and four females (7%), with a male-to-female ratio of fourteen to one (Haffejee, Ntsiea & Mudzi 2013).

This study's findings are in contrast to those of a South African study by Nel & Brown (1991), where a 4.80 to 1 male-to-female ratio was found. Although this study was conducted many years ago, it is still relevant, as no other epidemiological study on TBI in SA has been conducted since.

In another South African study by Alexander *et al.* (2009), 78% of 150 patients admitted to the Accident and Emergency Department of a Durban hospital with head injuries were male, and 12% were female, with a ratio of 6.5 to 1. A possible explanation for the large discrepancy between this current study and the two other South African studies mentioned could be the large difference in study sample size – 80 in this current study compared to 5 106 and 150 in the last-mentioned studies respectively.

In the same study conducted by Alexander *et al.* (2009), 10 of the 150 patients that were admitted to the Accident and Emergency Department required transfer to the Neurosurgical Unit. Of these 10, nine were males, and one was female, with a male to female ratio of nine to one.

The method above is similar to the one used in selecting the participants for this current study since patient files were drawn from the Neurosurgery Ward and not from the Accident and Emergency Unit. Therefore, a possible explanation for the higher than usual male-to-female ratio in this study may be that more females sustain very mild TBIs that do not require admission.

In this study, similar percentages of mild TBI were found for males and females (54.17% and 50% respectively), but owing to the small sample size, this result should not be taken as conclusive. This study supports the findings of other studies that have found a much higher male-to-female ratio in SA than those in Western countries such as the US, where the male-to-female ratio ranges from 1.5:1 to 2.8:1 (Bruns & Allen Hauser 2003).

Research has shown that there are no significant gender differences in children and in older patients with TBI. The gender difference in TBI cases is only significant from puberty until middle age (Farace & Alves 2000). Research shows that falls are the most common cause of injury in children and the elderly, with no significant difference between males and females (Nel & Brown 1991).

A possible explanation for the gender difference seen from puberty until middle age is that the mechanism of injury in this age group is most often assault, since males possibly participate more frequently than females in risky behaviour which could lead to a TBI (Nel & Brown 1991).

As the inclusion age of this study was 18 years, no comparisons could be made with research findings in the literature regarding gender differences and the incidence and cause of TBI in children.

With regard to gender differences in TBI in the elderly, a similar male and female percentage (2.78% and 0% respectively) was found in the age group 61 to 70 years. No males or females acquired TBIs beyond the age group of 61 to 70 years. This study therefore supports the view of Farace & Alves (2000) that there are no differences in gender in older patients with TBI.

In the results chapter of this study, the mechanism of injury was stratified according to gender, and not according to age groups. Thus, it was impossible to draw objective conclusions about the most common cause of TBI in males and females between the ages of 21 and 30 years (or in the case of any of the other age groups). Since such a low percentage of TBI over the age of 61 was found, no valuable information would have been found regarding cause of TBI in the elderly.

5.1.2 Age

The median age of the sample population with TBI was 32 years, with an interquartile range of 14. The minimum age was 18 years, and the maximum age was 69 years. The 21-to-30-year-old age group had the highest percentage of participants with TBI (40%).

The results of this study compare well with those of Haffejee *et al.* (2013), where the average age of the 60 participants with TBI was 28 years, with a standard deviation of ± 8.5 years. Half of the participants in Haffejee's study were between the ages of 20 years and 29 years (Haffejee *et al.* 2013).

In a study in Durban in SA by Alexander *et al.* (2009), 10 of the 150 patients that were admitted to the Accident and Emergency Department required transfer to the Neurosurgical Unit. Of these 10, the average age was 27 years, ranging from eight to 78 years. These results could not be compared, as the inclusion criteria for this study differ from those in the study of Alexander *et al.* in that the minimum age for inclusion in this study was 18 years, compared to all ages in the Alexander *et al.* (2009) study.

In this study, the 21-to-30-year age group had the highest percentage of TBI participants (40%), followed by the 31-to-40-year age group (31.25%) and the 41- to-50-year age group (17.5%). Owing to the differences in how the ages were grouped, it is difficult to accurately compare these results to those of Nel & Brown (1991). In the latter study, the 15-to-24-year age group included 29.48% of the participants with TBI, the 25-to-44-year age group included 53.19% of the participants with TBI and the 45-to-65-year age group included 14.9% of the participants with TBI. As previously mentioned, only participants aged 18 and older were included in this study.

It is said that the incidence of TBI peaks in early childhood, late adolescence/early adulthood, and in the elderly (Bruns & Allen Hauser 2003). Because this study excluded all patients with TBI that were under the age of 18, the researcher cannot comment on the early childhood peak, but agrees that the late adolescence/early adulthood group reflects a peak in TBI incidence (40% in the 21-to-30-year age group).

With regard to the incidence of TBI in the elderly, a combined male and female percentage of 2.5% was found in the age group 61-to-70 years and older. Thus, this study does not support the views of Bruns & Allen Hauser (2003) with regard to the peak usually found in the elderly. The Bruns & Allen Hauser (2003) study was conducted in the US, and it would therefore be more appropriate to compare the results to those of a South African study, but owing to the paucity of literature on this subject, no South African studies could be found that look into the incidence of TBI as stratified per age group. As such, the researcher hypothesises that the sample size of this study was too small to find significant results. There should not have been a difference in the findings for SA and the US with regard to falls in the elderly.

5.1.3 Mechanism of injury

The most common mechanism/cause of injury in this study sample of patients with TBI, irrespective of gender, was assault (42.5%), followed by MVAs (33.75%) and PVAs (12.5%). The most common mechanism of injury in males was assault (43.06%), while in females it was MVA (50%).

In their study, Nel & Brown (1991) do not comment on mechanism of injury irrespective of gender. They found that the most common mechanism of injury in males and females respectively was interpersonal violence (45% and 38% respectively), followed by vehicle accidents with the occupant of the vehicle sustaining a TBI (17.6% and 17.0% respectively) and PVAs (15.5% and 21% respectively). Nel & Brown's study (1991) comments on all aspects researched in terms of race, which is not a factor that was considered in this study. As such, accurate and valuable comparisons proved to be problematical.

By examining the results of this study and that of Nel & Brown (1991), the impact of the high level of interpersonal violence in SA is evident. The results of these two studies are further supported by the results of two more recent South African studies. In a study by Alexander *et al.* (2009), assault accounted for 41% of the mechanisms of injuries, and in a study by Haffejee *et al.* (2013) for 43.72% of the mechanisms of injury in TBI patients.

The high rate of interpersonal violence experienced in SA is in contrast to this factor in developed countries such as the US, where the leading causes of TBI are falls and MVAs (Normal *et al.* 2007). Alcohol is likely to be a factor in TBIs caused by interpersonal violence, MVAs and even PVAs. However, no attempt was made in this study to measure these effects.

Regardless of gender, falling is the most common cause of injury in children and the elderly (Nel & Brown 1991). In a study in the US, approximately one third (36%) of the older patients were injured from falls, compared to 10% of the younger patients (Cifu *et al.* 1996). With regard to the incidence of TBI in the elderly, a combined male and female percentage of 2.5% was found in the age group, 61-to-70 years and older. As such, this study does not support the views of Bruns & Allen Hauser (2003) with regard to the peak usually being found in the elderly. It was beyond the scope of this study to look at cause of injury per age group, although these aspects would have been interesting to compare.

5.1.4 Type of lesion

Owing to methodological differences in the way in which participants were classified into “type of lesion”, and the differences in the group headings between this study and other studies, the results are interesting to note. However, further conclusions and accurate comparisons are not possible.

The most common type of lesion found in this study, irrespective of gender, was a combination of more than one lesion (25%), followed by intracerebral (23.75%) and extradural haematoma (11.25%). Since participants were drawn from the Neurosurgery Ward and not the Accident and Emergency Unit as in other studies, far fewer mild TBIs (53.75%) were included than were reported in the other studies. The more severe cases of TBI may explain why the most common type of lesion is associated with a combination of more than one lesion.

According to Lee *et al.* (2012), brainstem lesions, obliteration of the third ventricle or of the basal cistern, midline shift, SAH, lesion burden, and DAI are the types of brain lesions reported as being predictive of poor outcomes. Once a participant was marked in the category representing a combination of more than one lesion group, he /she would not be marked in another group. This is unlike the study by Haffejee *et al.* (2013), where participants were marked in multiple groups. This may explain why the results from this study are so different from those of other South African studies, and also why the type of lesion in this sample of patients with TBI was not found to be predictive of community reintegration.

5.1.5 Level of education

The highest level of education, irrespective of gender, was up to Grade 11 (30%), followed by up to Grade 12 (27.5%) and up to Grade 7 (22.5%). The highest level of education in males was up to Grade 11 (29.17%), as was the case with females (37.5%). Although the level of education in this study population is similar to that of Statistics South Africa (27.5% of participants attained Grade 12 compared to 29.2% in the general population aged 20 years and older), it is still an alarming statistic to note (Statistics South Africa 2017).

The findings in respect of the top three highest educational level categories in this study are the same as those in the study by Haffejee *et al.* (2013). The up to Grade 7 category decreased from 38% in 2013 to 22.5% in 2019. The combined percentage of participants who had an educational level of up to Grade 11, up to Grade 12 and Grade 12 + 3 years in this current study amounted to 70% as opposed to the 59% in the study by Haffejee *et al.* (2013). These results may indicate that the South African government is succeeding in making basic education progressively available and accessible; the number of participants with tertiary education on the other hand is still lacking. It was found that 12.5% of this study sample that has completed Grade 12+3 years, which was in line with what Statistics South Africa found in a 2017 household survey (13.9%) (Statistics South Africa 2017). This result is in contrast to that of a US study by Gollaher *et al.* (1998), where 42% of the sample had completed some college or vocational training, which the researcher found similar to other US studies.

Basic education is a right all South Africans have. The Bill of Rights obliges the government to make education progressively available and accessible through reasonable measures (Statistics South Africa 2017). In 2017, the percentage of individuals 20 years and older who attained at least Grade 12 was 43.6%. Those that attained Grade 12 was 29.2%, those with some post-school education was 13.9%, some secondary education was 38.3%, completed primary education was 4.4%, had some primary education was 9.1% and without any schooling was 4.7% (Statistics South Africa 2017).

Although this study found no significant association between education and community reintegration, other studies have found that higher pre-injury education is positively associated with improved long-term employment, and satisfactory social functioning and community integration outcomes (Ponsford *et al.* 2008). A higher educational level is linked to a more skilled job, a greater chance of employment, a higher income earned and a greater chance to return to productive activity after a TBI (Wagner *et al.* 2002).

5.1.6 Severity

Irrespective of gender, the most common severity category for people with TBI in this sample was mild (53.75%), followed by moderate (30%) and severe (16.3%). These results differ from those of the South African study conducted by Nel & Brown (1991), where the severity of TBI of inpatients were very mild in 78% of cases, (full GCS of 15), 10% were mild (a combined mild percentage of 88%), 8% were moderate and 5% were severe.

The results of the current study also differ from the general global severity rates, where mild TBI is suffered by approximately 80% of the population, moderate TBI by 10% and severe TBI by 10% of the population (Stiver & Manley 2008).

As files in this current study were drawn from the Neurosurgery Ward, and not from the Accident and Emergency Unit, as in many epidemiological studies, those patients with milder TBIs not requiring admission were not included. Patients with more severe TBIs that died while in the Accident and Emergency Unit or in the ICU before being admitted to the Neurosurgical Ward were also not taken into account. However, the researcher hypothesises that this effect would be far less than in the milder cases that were not admitted to the ward. As opposed to the methodologies in global categories, methodological differences such as these may explain the higher percentage of moderate and severe TBI cases (30% and 16.3% respectively) and the lower percentage of mild TBI cases (53.75%).

Methodological differences between this study and a 2013 study conducted in Johannesburg also rendered a comparison of the results impossible. The study by Haffejee *et al.* (2013) categorised the GCS scores in terms of whether the patient was intubated on admission (a value out of 10), that is whether the verbal component of the GCS score (out of 15) was eliminated or not. This study used the initial GCS score before the patient was intubated.

Another methodological difference between these two studies, is that this study used the different categories of severity (mild, moderate and severe), whereas Haffejee *et al.* (2013) reported the GCS score as a mean with standard deviations.

5.1.7 Occupation

The most common category for pre-morbid occupation in this sample of participants with TBI, irrespective of gender, was paid employment (65%). In males, 70.8% were in paid employment, while in the female category, 62.5% were students.

The most common category for current occupation in this post-TBI sample, irrespective of gender, was paid employment (37.5%). In males, 38.89% were in paid employment while 50% of the females were students. It was beyond the scope of this study to analyse the percentage of participants who had been employed and were still employed.

This study did not look at income, or delve deeper into the type of employment or number of hours/days per week employed. The researcher marked a participant as employed, even if he/she was doing casual work to earn a livelihood. This may explain the relatively high percentage of people with TBI in paid employment, with only 13.75% of the participants being unemployed at the time that they sustained their TBI.

The much higher percentage accorded to the paid employment category in the current study - with 70.8% of the TBI sample population involved - could be attributed to the higher level of education attained by the participants. This stands in sharp contrast to the findings of Haffejee *et al.* (2013) (42%). The combined percentage of participants who had an educational level of up to Grade 11, up to Grade 12 and Grade 12 + 3 years was 70% in this current study as opposed to the 59% in the study by Haffejee *et al.* (2013).

In this study, 13.75% of the participants in the sample were unemployed before acquiring the TBI, which is lower than the national unemployment rate of 27.5% (Statistics South Africa 2018). A possible explanation for this could be the higher educational level of the study population, or, as discussed above, what the researcher considered “to be employed” to signify.

Post-TBI, a much higher percentage of 45%⁵ of participants with TBI were unemployed. It was beyond the scope of this study to analyse the participants who were employed, how many were still employed, whether the type of employment had changed and the reasons why the participant was unemployed.

Since 53.75% of the participants were classified as mild TBI cases, it is alarming to note the high unemployment percentage post-TBI. This finding is supported in the literature. Often, inspite of having few physical sequelae, patients with TBI often lack insight into their residual neurocognitive condition and their behavioural fallouts, often present with reduced inhibitions, are sensitive to noise, suffer from sleep-related problems, depression, anxiety and headaches (Webster *et al.* 2015), all which may affect their ability to return to productive activity and job post-TBI.

In a US study by Gollaher *et al.* (1997), 56% of previously productive patients with TBI were unemployed one to three years post-TBI. Their level of education was found to be a predictor of whether they would return to work or not. In fact, a higher pre-injury education was found to be associated with a greater chance of returning to work.

It was beyond the scope of this study to analyse the level of education against employment status. Owing to the quantitative nature of this study, the researcher did not look at the complaints most reported by participants post-TBI, but a study by van der Naalt *et al.* (1999) found that although 73% of the patients returned to their previous work post-TBI, 84% of them still reported complaints, including headache, irritability, forgetfulness, poor concentration and fatigue.

5.1.8 Rehabilitative treatment

Most of the participants with TBI (55%) in this sample did not receive any rehabilitative treatment. The majority (56.9%) of the males did not; neither did 37.5% of the females. In fact, only 37.5% of the females received only acute in-patient rehabilitative treatment. A 2013 study conducted in Johannesburg with 60

⁵ The categories of unemployed on account of poor health, of receiving a grant, and of unemployed for any other reason, were added together and converted into a percentage to reach this figure.

participants with TBI found the average of 5 ± 5.6 physiotherapy sessions, an average of 2 ± 3.5 occupational therapy sessions, and an average of 2 ± 2.7 speech therapy sessions (Haffejee *et al.* 2013). On account of methodological differences, the findings of this current study and the study of Haffejee *et al.* (2013) are not comparable. In the current study, participants were merely asked whether they had received or were receiving rehabilitative treatment or not. The number of sessions and the type of rehabilitative treatment were not counted.

Two explanations were offered for the finding that 55% of the participants in this current study did not receive any rehabilitative treatment – either the participants did not present with physical or cognitive symptoms that warranted referral to a physiotherapist, occupational therapist or speech therapist, or the doctors working in the Neurosurgery Ward did not refer these patients to the relevant multidisciplinary team member. Owing to the scope of this research report, the researcher did not endeavour to answer this question.

Since unemployment in this current study was found to have increased from 13.75% pre-TBI to 45% post-TBI, the researcher hypothesises that the participants with TBI could have experienced many more physical and cognitive fallouts than those that were perceived by the doctors, and that these patients may have benefitted from referrals for rehabilitative treatment.

Since 55% of the participants with TBI in this sample were not exposed to rehabilitative treatment, it appears that they were being discharged home to untrained caregivers. In interviews with family members of patients with TBI conducted by Webster *et al* (2015), it emerged that more information and education is required when it comes to handling personality change and aggressive behaviour, memory fallouts, diminished motivation, sleep disturbances, language and communication difficulties, a lack of interest and of inhibition in respect of sex, and depression and anxiety around safety and security issues. These are the types of cognitive fallouts that are typical of what a person with mild TBI could experience long after the physical fallout has been resolved. The former types of fallout may affect the person's return to productive activity, and his/her reintegration into the community, and even his/her HRQoL.

The South African Department of Health published the National Rehabilitation Policy in 2010, with the aim of improving the accessibility to all rehabilitation services, to meet every citizen's constitutional right to access to health care services. The South African government has adopted the Primary Health Care approach in its commitment to bringing health services closer to the people, of which rehabilitation is an important component (Department of Health 2000).

Although people in certain parts of SA are still faced with the inaccessibility of health services, this cannot be said for SBAH where this research was conducted. SBAH employs a full rehabilitation team, as well as directly feeds patients to a specialised hospital, namely the Tshwane Rehabilitation Hospital, for rehabilitative care. Although community reintegration programmes have little impact on outcomes in mild TBI patients, the outcomes of patients with moderate to severe TBIs improve with community reintegration programmes, and these should be considered for such patients (Hardaker 2011).

It was beyond the scope of this study to assess the severity of the TBI of the participants that were referred for rehabilitative treatment.

5.1.9 Duration of hospitalisation

The median duration of hospitalisation for the participants in this research study was eight days, with an interquartile range of 11 days. The minimum was zero days, and the maximum was 98 days. As the data from this study were not normally distributed, the relevant data were reported as medians with interquartile ranges. The findings from this study are therefore not comparable to those of other studies where the data were reported as means with standard deviations.

Alexander *et al.* (2009) found the mean duration of hospitalisation to be 9.8 days, Webster *et al.* (2015) found the mean duration of hospitalisation to be 10.2 days, and Haffejee *et al.* (2013) found the mean duration of hospitalisation to be 17 days, with a standard deviation of 15.9 days. The minimum days were three, and the maximum days were 72.

In this current study, the maximum duration of hospitalisation was found to be 26 days longer than that reported in Haffejee *et al.* (2013). The reasons for this are not clear, as explanations for extraneous data were not sought. The researcher did not set out to determine whether those participants who remained in hospital for a longer period of time had suffered a more severe TBI. However, the researcher came to the conclusion that this was in fact the case.

The relatively short median for duration of hospitalisation is in line with the predominantly mild severity (54%) of the study sample. Although the level of community reintegration for the study sample was fairly good (discussed in 5.2 below), the large number of participants that were unemployed post-TBI (45%) compared to pre-TBI (13.75%) led the researcher to hypothesise that had the length of stay and the amount of rehabilitative treatment received been more, the return to productive activity might also have been more.

5.2 COMMUNITY REINTEGRATION

The median total CIQ score was 22 out of a possible score of 29, the minimum score, eight and the maximum score, 29. The CIQ does not have norms for scoring. However, a median score of 22 out of 29 is considered by the researcher as fairly good community reintegration. The only South African studies that the researcher is aware of that looked at functional outcomes in patients with TBI are those of Haffejee *et al.* (2013) and Gretschel (2016). Haffejee *et al.* (2013) set out to establish factors that influence functional mobility outcomes post-TBI, and consequently used the Rivermead Mobility Index as the outcome measure. Gretschel (2016) set out to determine the levels of community reintegration in adults with disabilities, and grouped patients with stroke and head injury together as “brain injured”. These researchers used the RNLI as the outcome measure. Thus, neither of these studies can be compared to the results obtained from the CIQ scores in this study.

When comparing the findings of this study with those of other studies on the reintegration of people with TBI into the community elsewhere to SA, the following were found:

- The mean total CIQ score $\pm$ standard deviation was 17.64 ± 5.84 (105 participants) (Wagner *et al.* 2002).
- The mean total CIQ score $\pm$ standard deviation was 16.1 ± 6.37 (Fleming *et al.* 1999).
- The mean total CIQ score at six months $\pm$ standard deviation was 13.3 ± 4.3 (Felmingham, Baguley & Crooks 2001).

The median total CIQ score for this study was much higher than the mean total CIQ score in these other studies. Even though it was found that the severity of the injury does not influence community reintegration (see section 4.5.7), these results should be interpreted carefully, as almost 54% of the study sample presented with mild TBIs, and therefore there was not a large variance in the scores obtained. This could possibly explain the high median CIQ score determined in this study.

According to the respective studies that were referred to in this study, differences were found in the location from which the participants were recruited. The participants in the current study were sourced from an acute hospital, whereas the other studies mentioned that their participants were often sourced from rehabilitation units and community programmes. Patients who were admitted to rehabilitation units possibly had more severe TBIs that warranted their admission in the first place, and thus had lower CIQ scores than those in this study.

There are many flaws related to the outcome measure chosen. The CIQ measures the frequency of completing a task or the assistance and supervision required to complete a task, and not the manner in which it is completed, or whether the patient is satisfied with the manner in which he/she was able to complete the task (Salter *et al.* 2008). The CIQ is not a reflection of whether one chooses to participate in an activity, and may therefore be a reflection of a personal choice or of one's circumstances, as it does not take environmental barriers into account. Neither does it measure the level of pre-injury activity. One cannot assume, for instance, that the person is unable to do a task on account of an injury, if in the first place that person had never actually completed the task beforehand (Goranson *et al.* 2003).

There is a ceiling effect, with mild TBIs leading to higher CIQ scores (Salter *et al.* 2008), and since almost 54% of the sample presented with mild TBIs, this may explain the relatively high median CIQ score that was determined.

The CIQ is a self-reporting measure which may lead to the overestimation (or underestimation) of actual performance on account of impaired self-awareness. This happens especially when a proxy is filling out the questionnaire.

The researcher felt that some items in the CIQ were not true reflections of community reintegration, but rather of personal choice and circumstances, and as a result, the researcher did not mark the participant down if he/she did not perform an allotted task pre-morbidly.

The CIQ does not have a non-applicable option, which would have been more appropriate and would have given more accurate results. For example, scoring in the case of the CIQ tends to favour those who complete household chores without assistance, irrespective of how these chores are completed pre-morbidly. It favours those who are able to look after their children independently, irrespective of whether they did this pre-morbidly or not or whether they even have children; and, irrespective of their pre-morbid socialising tendencies and preferences, it favours those who choose to socialise with able-bodied friends, instead of family members or disabled friends. Methodological differences in scoring may therefore explain the higher CIQ median determined in this current study as compared to that established in other studies.

Questions regarding leisure-time activities and shopping were met with very poor responses, as these were not priorities or tasks frequently undertaken for participants even prior to the TBI. The lack of normative data in SA affected the interpretation of the results and the generalisations that could then be made. The only South African studies that the researcher is aware of that looked at functional outcomes in patients with TBI are those of Haffejee *et al.* (2013) and Gretschel (2016), neither of which used the CIQ.

Many consider optimal community reintegration and the return of the patient with TBI to productive activity as the final goals of rehabilitation (Fleming *et al.* 1999). Given the relatively high median community reintegration score (22 out of 29) that was established in the study sample, one would not expect such an increase in unemployment from 13.75% pre-TBI to 45% post-TBI. Research has shown that patients with TBIs may struggle with different aspects of community reintegration, including RPA (Sander *et al.* 2009), and this is evident from the results found in this study.

5.3 LEVEL OF FUNCTIONING AND DISABILITY

The WHODAS 2.0 is based on the ICF, and is a general measure of functioning and disability in the major life domains, as identified by the ICF. Irrespective of gender, the median WHODAS 2.0 percentage in this sample of participants with TBI was 31%, with an interquartile range of 18%. The minimum percentage was 20%, and the maximum percentage, 80%. Higher scores indicate higher levels of disability, and there are no norms or effect change scores available for the WHODAS 2.0. The researcher considered a median WHODAS 2.0 percentage of 31% as a high level of functioning and low levels of disability.

Despite a male-to-female ratio of nine to one, it appears that males and females in this study sample were found to have similar levels of disability (30% and 36.5% respectively). Although the WHODAS 2.0 was found by Üstün *et al.* (2010) to have the potential to serve as a reliable and valid tool when assessing functioning and disability across countries, populations and diseases, very few studies could be identified where the WHODAS 2.0 was used for patients with TBI. A 2010 study by Garin *et al.* validated the WHODAS 2.0 in patients with 13 different chronic diseases/ailments, including TBI. No studies were found where the WHODAS 2.0 assessed level of functioning and disability in patients with only TBI.

Common impairments resulting from a TBI are often more cognitive than physical, and include memory difficulties, cognitive problems, increased fatigue, reduced decision-making and personality changes (Hardaker 2011).

The WHODAS 2.0 tool measures both cognitive problems and physical difficulties experienced on account of poor health, but tends to look more at physical functioning than at cognitive functioning. An analysis of the results that this tool came up with in this study established that the levels of disability for people with TBI in this study sample were low while their levels of functioning were high. Since the WHODAS 2.0 is based on the ICF's "activities and participation" chapters, the high level of community reintegration (based on the CIQ score) established in this sample of patients with TBI correlates with the low level of disability and high level of functioning established through the WHODAS 2.0 tool.

5.4 HEALTH-RELATED QUALITY OF LIFE

The median QOLIBRI-OS percentage was 73%, with an interquartile range of 45.5%. The minimum percentage was 20%, and the maximum percentage was 100%. A zero percentage represents the worst possible HRQoL and 100 the best possible HRQoL. There are no norms or effect change scores available for this outcome measure (Truelle *et al.* 2010). Despite this, the researcher considered a median QOLIBRI-OS percentage of 73% as fairly high.

There was a 10% difference in mean scores between males (73%) and females (63%), which might indicate that males had slightly higher HRQoL levels than females. On account of the nine to one male-to-female ratio, no accurate conclusions could be drawn. Bazarian *et al.* (2010) hypothesised that females attain poorer scores than their male counterparts because females are more likely to report on their post-TBI symptoms and also have poorer coping abilities.

Given the increase in unemployment in the study sample from 13.75% (pre-TBI) to 45% (post-TBI), one might expect lower levels of HRQoL, which was not the case in this sample of patients with TBI. The results found in this study differ from those of other researchers, who found that patients with TBI often report worse post-injury HRQoL scores compared to the general population and people who have been subjected to various other types of trauma (Arango-Lasprilla *et al.* 2012). Arango-Lasprilla *et al.* (2012) found that patients with TBI who live in developed countries

have higher HRQoL levels compared to individuals in the developing countries where there are fewer resources.

It has been shown that employment is the strongest factor contributing to quality of life (Wagner *et al.* 2002). In the light of these two studies, one could infer that patients living with TBI in SA have poor HRQoL, which is not what this study found. The unemployment status for the study sample increased from 13.75% pre-morbidly to 45% post-TBI; yet the median HRQoL was 73%.

The scope of this study did not allow the researcher to look at factors that influence HRQoL. However, it appears that in this sample employment does not influence HRQoL. As there was no control group in this study, it is not known what the HRQoL for the South African population is on the QOLIBRI-OS.

An explanation for the findings is that the majority of the study population presented with mild TBIs (53.75%). As a result, patients with moderate and severe TBIs were not as well represented. No distinction was made between the patients with different levels of severity in terms of their injuries (mild, moderate or severe) and HRQoL.

Other studies assessing HRQoL often draw their sample participants from rehabilitation facilities, where the distribution of severity of TBI leans more toward the moderate and severe categories, and not predominantly to the mild, as in the acute hospital setting of this study (Koskinen *et al.* 2011). Some studies found low health-related quality of life levels in patients with less severe TBIs, and hypothesise that, as opposed to those with more severe TBI; these patients might report poorer HRQoL levels as they have more insight and better cognitive ability (Koskinen *et al.* 2011).

This was not the case in this study. An explanation as to why this hypothesis is not valid in this study could be the lower levels of education attained by the participants as opposed to those of the Western nations in countries such as the US. HRQoL is a fairly abstract concept, and the readings on the Likert scale might have been difficult for the participants to truly understand. This might have led to the high median QOLIBRI-OS percentage. As there was no control group in this study, it is

not known what the HRQoL of the general South African population would be on the QOLIBRI-OS. It is also possible that the participants felt that they had to score themselves “higher” on the QOLIBRI-OS, after already having scored high on the CIQ and the WHODAS 2.0. The researcher hypothesises that the results would differ somewhat if different researchers were to administer the three different questionnaires at different points in time, and not directly one after the other.

A large cross-country study, with participants from Belgium, Finland, France, Italy, the Netherlands, the UK and the US, found a mean total QOLIBRI-OS percentage of 58.0% $\pm$ standard deviation of 21.5. There were obvious differences between this current study and the one discussed above in terms of the characteristics of the populations researched which made accurate comparisons across the two studies impossible. Furthermore, the TBI classification category denoting severity of injury in the multi-national study mentioned above predominantly included severe cases as opposed to the predominance of mild cases in the current study. Furthermore, there were vast differences in the respective educational levels (von Steinbuechel *et al.* 2012).

5.5 RESPECTIVE ASSOCIATIONS BETWEEN LEVEL OF FUNCTIONING AND DISABILITY AND HEALTH-RELATED QUALITY OF LIFE AND COMMUNITY REINTEGRATION

It was found that in this sample of patients with TBI, WHODAS 2.0 percentage proved to be a significant negative predictor of the CIQ score. For every decrease of Beta = -0,4 in WHODAS 2 percentage, there would be a unit increase of 1 in the CIQ score. This also means the opposite: for every increase of Beta = 0,4 in WHODAS 2.0 percentage, there would be a unit decrease of one in the CIQ score. This means that if a patient with TBI were to experience increasing difficulties in respect of his/her functioning and disability, the community reintegration of the said patient would be lower. As the CIQ is based on the ICDH, and the WHODAS 2.0 is based on the ICF, it is not surprising to see such a relationship between the two outcome measures.

Pearson's Correlation Analysis revealed a positive correlation between the QOLIBRI-OS score and the CIQ score ($r = 0.54$; $p < 0.001$). The relatively high level of community integration (a median of 22 out of 29 on the CIQ) of patients with TBI in this sample correlated positively with the relatively high HRQoL (median of 73% on the QOLIBRI-OS).

Health-related quality of life post-TBI is affected by a variety of factors, such as changes in emotional status, neuro-behavioural fallouts, cognitive fallouts, sleep disturbance, fatigue, pain, communication difficulties, loss of autonomy in advanced ADLs, co-morbid health conditions, changes in the level of participation and in vocational status (Koskinen *et al.* 2011).

These factors are not examined in the CIQ, and a qualitative study design may have obtained more detailed and accurate results about these types of fallout. It is possible that the participants felt that they had to score themselves "higher" on the QOLIBRI-OS, after already having scored high on the CIQ and WHODAS 2.0. The researcher hypothesises that the results would differ somewhat if different researchers were to administer the three different questionnaires at different points in time and not directly one after the other.

It was not possible to make direct comparisons of these findings with other studies as the researcher is unaware of any study that employs all the three of the outcome measures used in this study.

5.6 FACTORS EVALUATED IN COMMUNITY REINTEGRATION

Based upon the literature and the researcher's scope of practice as a physiotherapist, eight factors possibly influencing community reintegration in this sample of patients with TBI were evaluated. They included age, gender, level of education, occupation at the time of the injury, cause of injury, type of injury sustained, severity of the injury, and type of rehabilitative treatment received.

5.6.1 Factors influencing community reintegration

Significant associations or relationships were found between some of the categorical factors including, amongst others, current occupation, mechanism of injury, and type of rehabilitative treatment received, respectively and the total CIQ score. An analysis of the data concerning this sample of patients with TBI indicated that these factors had an influence on community reintegration.

Current occupation

Current occupation was found to have an influence on community integration in this sample of patients with TBI. No distinction was made between the different sub-scales of the CIQ – one would automatically score higher on the productive activities sub scale if the current occupation was favourable.

Individuals who had been in paid employment had significantly higher CIQ scores compared to those individuals who were unemployed on account of poor health) (MD = 7.73, $p < 0.001$), retired (MD = 8.13, $p = 0.02$), and unemployed (for any other reason) (MD = 3.26, $p = 0.02$).

Self-employed individuals attained significantly higher CIQ scores than both unemployed (on account of health) (MD = 8.8, $p < 0.001$) and retired individuals (MD = 9.2, $p = 0.02$). Individuals who were grouped as unemployed on account of poor health attained significantly lower CIQ scores compared to both students (MD = -6.03, $p < 0.001$) and the unemployed (for any other reason) (MD = -4.48, $p < 0.001$).

As long as a participant was successfully employed, whether full-time, part-time, self-employed, or studying, he/she would score higher on the productive activities sub-score of the CIQ than a participant who was unemployed or retired. This could explain an improved CIQ score. As discussed above, the researcher marked a participant as employed, even if he/she was doing casual labour as his source of income, which may have led to a higher percentage of paid employment compared to other studies.

In a study by Haffejee *et al.* (2013), patients who were self-employed were 4.03 times more likely than those who were employed to present with better functional mobility. The explanation given was that possibly those who were employed had the benefit of sick leave, and might have been less focused, therefore, on regaining function more quickly.

Owing to the high general unemployment rate in SA, the researcher separated unemployed into unemployed for health reasons (i.e. on account of the residual effects of the TBI), and unemployed for any other reason (i.e. if, regardless of his/her TBI, the participant could not find a job). Participants who were unemployed for health reasons attained significantly lower CIQ scores than participants who were unemployed for any other reason. The researcher was pleased to note that the CIQ score proved to be sensitive enough to show up this important difference.

Because this study failed to assess whether there was any change in occupational status, the number of participants who were employed prior to sustaining the TBI and still employed post-TBI is unknown.

Mechanism of injury

Mechanism of injury was found to be significant in predicting level of community reintegration in this sample of patients with TBI. Participants who had acquired their TBI from a gunshot wound to the head had significantly lower CIQ scores compared to those participants who acquired their TBI as a result of a MVA (MD = -10.19; $p = 0.001$), a PVA (MD = -10.97; $p = 0.002$), a fall (MD = -12.67; $p = 0.001$) or assault (MD = -12.05; $p < 0.001$).

Associations between mechanism of injury, severity of injury and type of acquired brain injury were not sought, but the researcher hypothesises that a gunshot wound to the head would cause extensive tissue damage and result in a severe TBI, which would in turn explain the lower CIQ scores.

According to the literature, survivors of intentional or violence-related TBI are often more inclined to present with more physical symptoms such as headaches and

sleep-related problems, and more severe disabilities. As such, they are less likely to successfully reintegrate into the community (Kim *et al.* 2013).

This current study did not group mechanism of injury into intentional or violence-related versus accidental, nor delve deeper into the residual symptoms patients experience, but gunshot wound to the head would certainly be classified as violence-related, and can, therefore, be considered to be in line with the results of other literature sources. A qualitative or mixed-study design would be better suited for gathering such information.

As opposed to this study, Lee *et al.* (2012) presented different categories for the mechanism of injury component and included falls, motor vehicle and pedestrian vehicle accidents, and bicycle and motorcycle accidents. In Lee's study (2012) motorcycle accidents were found to be predictors of unfavourable outcomes. This current study never differentiated MVAs into vehicle, motorcycle or bicycle accidents, but given that some South Africans rely on cycling/motorcycling as their mode of transport to work (1.1%) and school (0.9%) (Statistics South Africa 2018), this result would have been interesting to note. The researcher felt that for the purpose of this research report, the factors selected and the results of the research should be curtailed.

Type of rehabilitative treatment

Participants with TBI in this study sample who received acute in-patient and out-patient rehabilitative treatment achieved significantly lower CIQ scores than participants who received acute in-patient rehabilitative treatment only (MD = -6.06; $p < 0.001$), out-patient rehabilitative treatment only (MD = -7.2; $p = 0.02$); or no rehabilitative treatment at all (MD = -8.06; $p < 0.001$).

These findings can be interpreted as follows: the larger the amount of rehabilitative treatment the participant receives, the lower his/her CIQ scores. Literature has found that this is not the case, however.

No studies were found with comparable results on the type of rehabilitative treatment received. However, it has been shown in the literature that the rehabilitation of a

person with TBI improves his/her level of integration into the community. This has also been demonstrated in a study by Haffejee *et al.* (2013), where it was found that patients with TBI receiving occupational therapy showed significant improvements in terms of their mobility. Furthermore, Goranson *et al.* (2003) showed that patients who participate in multidisciplinary rehabilitation programmes show greater improvement in terms of the CIQ than those who do not.

The association between type of rehabilitation and severity of injury was not investigated. However, the researcher hypothesises that participants were referred for acute in-patient and out-patient rehabilitative treatment only if the TBI was severe, which would better explain the low CIQ scores. Since unemployment increased from 13.75% pre-TBI to 45% post-TBI, the researcher hypothesises that patients with TBI have many more physical and cognitive fallouts than those perceived by doctors, and that many more of the participants included in the study may have benefitted from referral to rehabilitation.

5.6.2 Factors not influencing community reintegration

No associations were found between the respective factors of gender, age, education level, pre-morbid occupation, type of injury, or severity of injury, and community reintegration. This indicates that these factors did not influence community reintegration in this study sample of participants with TBI.

Gender

As the ratio of male to female participants was nine to one, it is not surprising that no significant difference was found between gender and level of community reintegration, as the difference in the number of participants within each category was too large. Although different outcome measures were used, this finding is in contrast to Haffejee *et al.* (2013), where, as opposed to females, males had 2.95 times more functional mobility at discharge.

The CIQ has been shown to favour the female gender on the home integration sub-score (Salter *et al.* 2008), but in this study similar medians (nine for males and six for

females) and interquartile ranges (four for males and six for females) were found. In addition, it was found that the CIQ favours the male gender in the productive activities sub-score (Salter *et al.* 2008), but in this study similar medians (four for males and five for females) and interquartile ranges (three for both males and females) were found. A possible explanation for the lack of gender differences found in this study is that the researcher did not mark someone down if they did not perform a said task pre-morbidly. The researcher would give the participant the benefit of the doubt if they said they were able to do something, even though gender-roles in their household prevent them from doing so. Methodological differences in scoring may therefore explain the higher CIQ median compared to other studies, and the lack of gender difference.

Age

Some studies have found younger age to be a significant predictor of improved prognosis, whereas other studies have demonstrated no significant association between age and outcome (Ponsford *et al.* 2008, Gollaher *et al.* 1998). Generalisation of the findings of this study that age does not have an influence on community reintegration should be done with caution, as it may be linked to the limited age range of $32 \pm$ interquartile range 14. The minimum age of participants with TBI in this study was 18, which is in contrast to most other studies looking at age as a factor, where a much younger age (usually 15 years) is used. Only 2.5% of the sample was older than 61 years, which limits the range further, and which may explain why age was not found to be a predictor of community reintegration.

Level of education

It has been shown in the literature that a higher level of pre-injury education is an important predictor of post-injury employment (Gollaher *et al.* 1998). On account of the scope of the study, the researcher did not investigate the association between level of education and the productive activities subscale of the CIQ (only the total CIQ) or post-injury employment status, although this would have provided valuable information. An explanation as to why level of education was not found to influence community reintegration in this sample of participants with TBI could be that there were not enough participants with levels of education higher than Grade 12 (Hanks *et al.* 2013). Although, the combined percentage of participants who had Grade 11,

Grade 12 and Grade 12 + 3 years amounted to 70% in this current study as opposed to the 59% in the study by Haffejee *et al.* (2013), only 12.5% had an education higher than Grade 12. These results are in line with what Statistics South Africa found in a 2017 household survey (13.9%) (Statistics South Africa 2017), but are in contrast to those of a US study by Gollaher *et al.* (1998), where 42% of the sample had completed some college or vocational training, which the researcher found to be similar to other US studies.

Although the scope of this study did not investigate this, research has shown that education is linked to pre-morbid occupation, where the higher one's level of education, the higher the chances of employment are (Statistics South Africa 2018). This study did not look at the type of employment, but only at whether the participant was employed or not. The researcher marked a participant as employed, even if he/she was doing casual labour as his source of income, which explains the relatively high percentage of paid employment (65%), with only 13.75% of participants being unemployed at the time of the TBI. Methodological differences such as this may explain why pre-morbid occupation was not found to be a predictor of community reintegration. It would have been more beneficial to describe the type of pre-morbid occupation, rather than simply to mark a person as employed or not.

Type of lesion

Type of lesion was not a significant predictor of community reintegration in participants with TBI in this sample. This is in contrast to Lee *et al.* (2012), who found that DAI is associated with unfavourable outcomes, and other studies that found brainstem lesions to be associated with poor outcomes. Once a participant was marked in the combination of more than one lesion group, the participant was not marked in another group. This may explain why the results found are so different to other South African studies, and also why type of lesion was not found to be predictive of community reintegration outcome.

Severity of injury

Severity of injury, measured on the GCS, was found not to be a significant predictor of community reintegration in the participants with TBI in this sample. The GCS has shown limited use in predicting outcomes – at the extremes of the scale (mild and

severe), prediction is fairly consistent, but mid-range GCS scores have been found to be far less consistent (Gollaher *et al.* 1998). The GCS score as a predictor of community reintegration following TBI is often inconclusive or contradictory owing to methodological differences amongst studies (Maas *et al.* 2008). An example of this is the methodological difference between this study and that of Haffejee *et al.* (2016), where some GCS scores were out of 10 on account of patients being intubated in the Accident and Emergency Unit, and others out of 15. Although it happened that participants in this current study were also intubated in the Accident and Emergency Unit, the researcher used the GCS prior to intubation, even if it was reported by the paramedics at the scene of the accident. Unfortunately, since this study involved a retrospective review of files, the researcher did not have a choice as to which severity measure to use as the GCS is the scale used by the doctors and paramedics admitting patients to the Accident and Emergency Unit of SBAH. The duration of PTA is not routinely reported by the doctors of SBAH.

Irrespective of gender, the most common severity of TBI was mild (53.75%), followed by moderate (30%) and severe (16.3%), which is dissimilar to the general global severity rates, where mild TBI comprises approximately 80% of the population, moderate TBI comprises 10% and severe comprises another 10% (Stiver & Manley, 2008). As files in this current study were drawn from the Neurosurgery Ward, and not from the Accident and Emergency Unit, patients with milder TBIs not requiring admission were not included. This may explain the higher percentage of moderate and severe TBI (30% and 16.3% respectively) and the lower percentage of mild TBI (53.75%) compared to global rates. These methodological differences may be the reason why severity was not found to influence community reintegration in this sample of patients with TBI.

CHAPTER 6

6. CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

As most of the current literature pertaining to people with TBI and their reintegration into the community is derived from random observations or sources, or clinically-referred cases, the broad population is not well represented (Hank *et al.* 2003). Given the paucity of data surrounding TBI and community reintegration in post-TBI cases, especially in the unique setting of SA, there is little understanding of the long-term functional and social outcomes and challenges that TBI cases experience.

SA is a developing country with a unique history that has been plagued by a past of racial segregation and political violence. Although this has given way to a non-racial democracy, high levels of interpersonal violence still remain, and are further fuelled by the social problems arising from rapid urbanisation and the ongoing socioeconomic inequalities (Norman *et al.* 2007).

- The participants had good community reintegration as indicated by good CIQ scores⁶.
- The participants in this study presented with low levels of disability and high levels of functioning, which is in tandem with the good CIQ scores.
- In line with the favourable CIQ scores, the low levels of disability and high levels of functioning, the participants with TBI could be classified as having a good quality of life.

• ⁶ The CIQ does not have norms for scoring, but a median score of 22 out of 29 in this sample of patients with TBI was interpreted as a fairly good indicator of community reintegration. The median total CIQ score of this study was much higher than the mean total CIQ score in other studies. This could be attributed to the high percentage of mild TBI in this study (53.75%).

- The WHODAS 2.0 percentage proved to be a significant negative predictor of the CIQ score in this sample of participants with TBI. For every reduction of Beta = -0,4 in the WHODAS 2.0, there was an increase of one unit in the CIQ score.
- No relationship was found between the respective variables of gender, educational level, pre-morbid occupation, type of lesion, severity of injury, or age, and level of community reintegration. This indicates that in this sample these factors did not influence community reintegration.
- In this sample, those with TBI who were in paid employment post-TBI attained significantly higher CIQ scores compared to those who were unemployed on account of poor health, retired or unemployed for any other reason. Self-employed participants had significantly higher CIQ scores than both unemployed on account of poor health and retired participants. Participants who were grouped as unemployed on account of poor health had significantly lower CIQ scores compared to both students and the unemployed (for any other reason).
- Those participants who acquired their TBI through a gunshot wound to the head had significantly lower CIQ scores compared to those who suffered traumatic brain injury as a result of a MVA, a PVA, a fall or an assault.
- In this sample of participants with TBI, those who received acute in-patient and out-patient rehabilitative treatment had significantly lower CIQ scores than those who received acute in-patient rehabilitative treatment only, out-patient rehabilitative treatment only or no rehabilitative treatment at all.
- On account of a short stay in hospital (a median of eight days, with an interquartile range of 11 days) and with limited rehabilitative treatment (55% received no rehabilitative treatment), the patients with TBI in this study sample were possibly discharged home to untrained caregivers. Such circumstances have a negative impact on the patient's chances of being reintegrated into the community.
- There is a need to improve the duration and intensity of the rehabilitative treatment, especially in the case of outpatient rehabilitation, that is offered to patients post-TBI in all hospitals and not just in specialised rehabilitation units. The focus of the rehabilitation process should be on community reintegration

and participation since a significant number of participants (27.5%) with TBI in this study sample were limited to only acute in-patient rehabilitative treatment.

6.2 STUDY LIMITATIONS

One of the major difficulties the researcher faced in comparing this study with other studies was the wide variation in the research methodologies and the paucity of South African studies investigating TBI. There was no suitable study in SA with which to compare the results of this study and to come to firm conclusions. In fact, the researcher is aware of only one large-scale epidemiological study on TBI in SA, which was conducted in 1991, during the apartheid era. Since then, the circumstances have changed radically. Furthermore, because the current South African scenario is so unique, the findings from Western countries such as the US could not be easily generalised in order to apply them to the South African situation.

Because the participants for this study were recruited from a single in-patient facility, the value of the generalisations which could be made and the applicability of the findings might easily be diminished. As Steve Biko Academic Hospital is a tertiary hospital in one of SA's largest cities, the clinical and demographic findings of this research could not be generalised appropriately to be relevant to the rural areas of SA.

Furthermore, a larger number of mild TBI (53.75%) cases were included in the sample population as opposed to their inclusion in other studies investigating community reintegration. This could be attributed to the nature of the acute hospital study setting.

In spite of the limitations associated with this study, the researcher feels that there is much potential for future studies to be undertaken in SA on the reintegration of people with TBI into the community. Furthermore, valuable information was gathered for the purposes of this study, in terms of the demographics of patients with TBI, the activities that they participate in, their quality of life, and ultimately, their reintegration into the community. As such, the relevant data pertaining to these variables could be applied to other similar spheres of research.

6.2.1 Limitations linked to outcome measures chosen

Although the CIQ was found to be the most popular instrument for measuring community reintegration, many limitations associated with it should be taken into account (these are discussed in detail in section 5.2).

As tools for measuring functioning and disability and health related quality of life, WHODAS 2.0 and the QOLOBRI-OS were good choices theoretically. However, owing to the paucity of studies with which to compare the results of this sample study, their suitability in the context of this research was compromised

6.2.2 General limitations to the study

General limitations to the study include the following:

- The sample size: while larger than that of many studies, the size of the sample in this research study was relatively small.
- An omission from the study: race was not evaluated. As such, it was not possible to comment on ethnic diversity in its role in influencing community reintegration.
- The researcher was not able to comment on the number of records screened and how many of these were included in the study, as this information was never obtained.
- The researcher did not comment on the number of participants who filled in their own questionnaires versus those that did so via a proxy⁷. This is important in that the patient-proxy agreement in the case of the completion of the CIQ ranges from adequate-to-excellent. However, research has shown that proxy respondents tend to achieve lower scores than the participants themselves on the cognitive aspects of the CIQ and higher scores in the areas of assessing activity (Salter *et al.* 2008).

⁷ One of the inclusion criteria was that participants be able to communicate verbally or have a proxy available.

- No distinction was made as to the type of rehabilitative treatment received, namely whether it involved physiotherapy, occupational therapy or speech therapy.
- The discussion on the type of rehabilitative treatment received did not include a category for specific vocational rehabilitation programmes. However, according to the knowledge of the researcher, none of the participants attended specific vocational rehabilitation facilities.
- The researcher did not investigate whether the participants were applying for disability grants and whether they were being refused, which, owing to a lack of physical sequelae post-TBI, would have been a worthwhile possibility to investigate.
- The reasons why participants who needed disability grants were not receiving the said grants were not explored in this research report.
- As a result of the quantitative nature of this study, the complexity of community reintegration post-TBI was not adequately reflected. A mixed-study design may have provided more valuable information for the reintegration of patients with TBI into the community in the South African context.

6.3 FUTURE DIRECTIONS

6.3.1 Information for clinicians

- In order to minimise loss of productivity to the individual and the economy, rehabilitation should be patient-centered with a focus on vocational goals (Soeker *et al.* 2012b). Programmes that teach viable productive alternatives for patients with TBI not able to return to work should be made available to the community.
- As many of the difficulties experienced by a person with TBI are not visible to the general public, the programmes to promote general awareness and education in the community should be improved.
- Clinicians should be aware of the barriers to and facilitators of successful community reintegration, especially in the case of TBI patients.

- The referral system between the discharging hospital and the local community health centre needs to be improved, to ensure that all patients have access to rehabilitative treatment post-discharge from hospital.
- Where applicable, referral to social workers needs to be promoted in order to assist patients in their applications for disability grants.

6.3.2 Future research

- Further research is needed regarding the epidemiology of TBI in SA and the characteristics of such patients.
- Further research should identify environmental barriers and facilitators to community reintegration in SA and the approaches to adopt for rehabilitative treatment to achieve better community reintegration outcomes for patients with TBI.
- Further research is needed to find/create a community reintegration outcome measure suitable for using on TBI patients in SA.
- Doig *et al.* (2010) found the variability within the TBI population too great, and thus described community reintegration as measured with the CIQ within subgroups of the population rather than to describe the group in terms of measures of central tendency. Through cluster analysis, three groups were yielded: working, balanced and poorly integrated. However, the researcher feels that it is too advanced for the purpose of a research report such as the current one. She wishes to acknowledge however, the advantage and great amount of valuable data one would gain from doing cluster analysis.

REFERENCES

Abbot, A.L., Silvestrini, M., Topakian, R., Golledge, J., Brunser, A.M., de Borst, G.J., Harbaugh, R.E., Doubal, F.N., Rundek, T., Thapar, A., Davies, A.H., Kam, A. & Wardlaw, J.M. (2017). Optimizing the Definitions of Stroke, Transient Ischemic Attack, and Infarction for Research and Application in Clinical Practice. *Frontiers in Neurology*. 8, pp 537

Alexander, T., Fuller, G., Hargovan, P., Clarke, D.L., Muckart, D.J. & Thomson, S. R. (2009). An audit of the quality of care of traumatic brain injury at a busy regional hospital in South Africa. *South African Statistical Journal*. 47(4), pp 120-126

Angeles Fernandez-Gil, M., Palacios-Bote, R., Leo-Barahona, M & Mora-Encinas, J.P. (2010). Anatomy of the brainstem: a gaze into the stem of life. *Seminars in Ultrasound CT and MR*. 31(3), pp 196-219

Arango-Lasprilla, J.C., Krch, D., Drew, A., De Los Reyes Aragon, C.J. & Stevens, L.F. (2012). Health-related quality of life of individuals with traumatic brain injury in Barranquilla, Colombia. *Brain Injury*. 26(6), pp 825-833

Bazarian, J.J., Blyth, B., Mookerjee, S., He, H. & McDermott, M.P. (2010). Sex differences in outcome after mild traumatic brain injury. *Journal of Neurotrauma*. 27, pp 527-539

Bruns, J. & Allen Allen Hauser, W. (2003). The Epidemiology of Traumatic Brain Injury: A Review. *Epilepsia*. 44 (Suppl.10), pp 2-10

Chang, F.H., Coster, W. & Helfrich, C. A. (2013). Community participation measures for people with disabilities: a systematic review of content from an International Classification of Functioning, Disability and Health Perspective. *Archives of Physical Medicine and Rehabilitation*. 94, p771-781

Cifu, D.X., Kreutzer, J.S., Marwitz, J.H., Rosenthal, M., Englander, J. & High, W. (1996). Functional outcomes of older adults with traumatic brain injury: a

prospective, multicentre analysis. *Archives of Physical Medical Rehabilitation*. 77, pp 883-888

Dijkers, M.P.J.M., Whiteneck, G. & El Jaroudi, R. (2000). Measures of social outcomes in disability research. *Archives of Physical Medical Rehabilitation*. 81 (Suppl. 2), pp 563-580

Department of Health. (2000). National Rehabilitation Policy, Rehabilitation for all. Republic of South Africa.

Doig, E., Fleming, J. & Tooth, L. (2000). Patterns of community integration two to five years post-discharge from brain injury rehabilitation. *Brain Injury*. 15(9), pp 747-762

Farace, E. & Alves, W.M. (2000). Do women fare worse? A meta-analysis of gender differences in outcome after traumatic brain injury. *Neurosurgical Focus*. 8(1), pp1-8

Felmingham, K.L., Baguley, I.J. & Crooks, J. (2001). A Comparison of Acute and Post-Discharge Predictors of Employment two years after Traumatic Brain Injury. *Archives of Physical and Medical Rehabilitation*. 82, pp 435-439

Fleming, J., Tooth, L., Hassel, M. & Chan, W. (1999). Prediction of community integration and vocational outcomes two to five years after traumatic brain injury rehabilitation in Australia. *Brain Injury*. 13 (6), pp 417-431

Garin, O., Ayuso-Mateos, J.L., Almansa, J., Nieto, M., Chatterji, S., Vilagut, G., Alonso, J., Cieza, A., Svetskova, O., Burger, H., Racca, V., Francescutti, C., Vieta, E., Kostanjsek, N., Raggi, A., Leonardi, M. & Ferrer, M for the MHADIE Consortium (2010). Validation on the "World Health Organization Disability Assessment Schedule, WHODAS-2" in patients with chronic diseases. *Health and Quality of Life Outcomes*. 8(51)

Grebe, C. (2009). An investigation into the Use of the Oswestry Disability Index in a Zulu-speaking Population. A Pilot Study. Unpublished MSc Research Report. The University of the Witwatersrand.

Gretschel, D. (2016). Levels of community integration achieved by adults with disabilities: post-discharge from a specialised in-patient rehabilitation unit in the Western Cape. Unpublished MSc Research Report. Stellenbosch University.

Goranson, T.E., Graves, R.E., Allison, D. & La Freniere, R. (2003). Community integration following multidisciplinary rehabilitation for traumatic brain injury. *Brain Injury*.17 (9), pp 759-774

Haffejee, S., Ntsiea, V. & Mudzi, W. (2013). Factors that influence Functional Mobility Outcomes of Patients after Traumatic Brain Injury. *Hong Kong Journal of Occupational Therapy*.23, pp39-44

Hardaker, N. (2011). Pragmatic evidence-based Review – Community Integration in moderate to severe Traumatic Brain Injury. *Accident Compensation Corporation*.

Harwood, R., Rogers, A., Dickinson, E. & Ebrahim, S. (1994). Measuring handicap: the London handicap scale: a new outcome measure for chronic disease.

Hilario, A., Ramos, A., Millan, J.M., Salvador, E., Gomez, P.A., Cicuendez, M., Diez-Lobato, R. & Lagares, A. (2012). Severe Traumatic Head Injury: Prognostic Value of Brain Stem Injuries detected at MRI. *American Journal of Neuroradiology*. 33, pp 1925-1931

Hyder, A.A., Wunderlich, C.A., Puvanachandra, P., Gururaj, G. & Kobusingye, O.C. (2007). The impact of traumatic brain injuries: a global perspective. *Neuro Rehabilitation*. 22, pp 341-353

Jensenius, A.R. (2012). Disciplinaries: intra, cross, multi, inter, trans. *Alexander Refsum Jensenius*. Accessed from: <http://www.arj.no/2012/03/12/disciplinaries-2/>. Accessed: 19 August 2019.

Jette, D.U., Halbert, J., Iverson, C., Miceli, E., & Shah, P. (2009). Use of Standardized Outcome Measures in Physical Therapist Practice: Perceptions and Applications. *Physical Therapy*. 89, pp125-135

Kalyan, S.R., Nadasam, T.M. & Puckree, T. (2007). The Epidemiology of Traumatic Brain Injuries (TBI) – a Literature Review. *South African Journal of Physiotherapy*. 63 (3), pp 32-36

Kim, H., Colantonio, A., Dawson, D.R. & Bayley, M.T. (2013). Community integration outcomes after traumatic brain injury due to physical assault. *Canadian Journal of Occupational Therapy*. 80(1), pp 49-58

Klimek, L., Bergmann, K-C., Biedermann, T., Bousquet, J., Hellings, P., Jung, K., Merk, H., Olze, H., Schlenter, W., Stock, P., Ring, J., Wagenmann, M., Wehrmann, W., Mosges, R. & Pfaar, O. (2017). Visual analogue scales (VAS): Measuring instruments for the documentation of symptoms and therapy monitoring in cases of allergic rhinitis in everyday health care. *Allergo Journal International*. 26(1), pp 16-24

Koskinen, S., Hokkinen, E-M., Wilson, L., Sarajuuri, J., von Steinbuchel, N. & Truelle, J-L. (2011). Comparison of subjective and objective assessments of outcome after traumatic brain injury using the International Classification of Functioning, Disability and Health (ICF). *Disability and Rehabilitation*. 33(25-26), pp 2464-2478

Laxe, S., Zasler, N., Tschiesner, U., Lopez-Blazquez, R., Tormos, J.M & Bernabeu, M. (2011). ICF use to identify common problems on a TBI neuro-rehabilitation unit in Spain. *Neuro Rehabilitation*. 29, pp 99-110

Laxe, S., Cieza, A. & Castano-Monsalve, B. (2015). Rehabilitation of traumatic brain injury in the light of the ICF. *Neuro Rehabilitation*. 36, pp 37-43

Laxe, S., Zasler, N., Selb, M., Tate, R., Tormos, J.M. & Bernabeu, M. (2013). Development of the International Classification of Functioning, Disability and Health core sets for Traumatic Brain Injury: An International consensus process. *Brain Injury*. 27(4), pp 379-387

Lee, S-Y., Kim, S. S., Kim, C-H., Park, S-W., Park, J.H. & Yeo, M. (2012). Prediction of Outcome after Traumatic Brain Injury using Clinical and Neuro-imaging Variables. *Journal of Clinical Neurology*. 8, pp 224-229

Maas, A.I., Stocchetti, N. & Bullock, R. (2008). Moderate and severe traumatic brain injury in adults. *Lancet Neurology*. 7, pp 728-741

Maleka, M.E.D. (2010). The development of an outcome measure to assess community reintegration after stroke for patients living in poor socioeconomic urban and rural areas of South Africa. In fulfilment for the requirements for a PhD, University of the Witwatersrand.

Mc Inerney, S.J. (2002). Introducing the Biopsychosocial Model for good medicine and good doctors. The *British Medical Journal*. 324, pp 1537

Mellick, DI (2000). The Craig Handicap Assessment and Reporting Technique. The Centre for Outcome Measurement in Brian Injury. Retrieved from:
<http://www.tbims.org/combi/chart>. Accessed: 27 March 2016.

Menon, D.K., Schwab, K., Wright, D.W. & Maas, A.I. (2010). Position statement: definition of traumatic brain injury. *Archives of Physical and Medical Rehabilitation*. 91, pp 1637-1640

McColl, M.A., Davies, D., Carlson, P., Johnson, J. & Minners, P. (2001). The Community Integration Measure: Development and Preliminary Validation. *Archives of the Physical and Medical Rehabilitation*. 82, pp 429-434

Mudge, S. & Stott, N.S. (2007). Outcome measures to assess walking ability following stroke: a systematic review of the literature. *Physiotherapy*. 93, pp 189-200

Naidoo, D. (2013). Traumatic Brain Injury: The South African landscape. *South African Medical Journal*. 103(9), pp 613-614

Nel, V. & Brown, D.S. (1991). Epidemiology of traumatic brain injury in Johannesburg – II. Morbidity, mortality and etiology. *Social Science Medicine*. 33(3), pp 298-296

Norman, R., Matzopoulos, R., Groenewald, P. & Bradshaw, D. (2007). The high burden of injuries in South Africa. *Bulletin of the World Health Organisation*. 85(9), pp 695-702

Nunally, J. (1978). Psychometric Theory (2nd Ed.) New York: McGraw Hill. pp 420-424

Okonkwo, D.O. (2008). Introduction: Traumatic Brain Injury. *Neurosurgery Focus*. 25(4), pp 1

Parvaneh, S & Cocks, E. (2012). Framework for describing community integration for people with acquired brain injury. *Australian Occupational Therapy Journal*. 59, pp 131-137

Perenboom, R.J.M. & Chorus, A.M.J. (2003). Measuring participation according to the International Classification of Function, Disability and Health (ICF). *Disability and Rehabilitation*. 25(11-12), pp 577-587

Ponsford, J., Draper, K. & Schonberger, M. (2008). Functional outcome 10 years after traumatic brain injury: its relationship with demographic, injury severity, and cognitive and emotional status. *Journal of the International Neuro-psychological Society*. 14, pp 233-242

Post, M.W.M., de Witte, L.P., Reichrath, E., Verdonschot, M.M., Wijhuizen, G.J. & Perenboom, R.J.M. (2008). Development and validation of IMPACT-S: an ICF-based questionnaire to measure activities and participation. *Journal of Rehabilitation Medicine*. 40, pp 620-627

Reistetter, T. A & Abrea, B.C. (2005). Appraising evidence on community integration following brain injury: a systematic review. *Occupational Therapy International*. 12(4), pp 196-217

Resnik, L.J. & Allen, A. (2007). Using International Classification of Functioning, Disability and Health to understand challenges in community reintegration of injured veterans. *Journal of Rehabilitation Research and Development*. 44(7), pp 991-1006

Roozenbeek, B., Maas, A.I.I. & Menon, D.K. (2013). Changing patterns in the epidemiology of traumatic brain injury. *Nature Reviews Neurology*. 9, pp 231-237

Ruffolo, C.F., Friedland, J.F., Dawson, D.R., Colantonio, A. & Lindsay, P.H. (1999). Mild Traumatic Brain Injury from Motor Vehicle Accidents: Factors associated with Return to Work. *Archives of Physical and Medical Rehabilitation*. 80, pp 392-398

Saeki, S, Okazaki, T. & Hachisuka, K. (2006). Concurrent validity of the community integration questionnaire in patients with traumatic brain injury in Japan. *Journal of Rehabilitation Medicine*. 38, pp 333-335

Sander, A.M., Pappadis, M.R., Davis, L.C., Clark, A.N., Evans, G., Struchen, M.A & Mazzei, D.M. (2009). Relationship of race/ethnicity and income to community integration following traumatic brain injury: investigation into a non-rehabilitation trauma sample. *Neuro Rehabilitation*. 24, pp 15-27

Salbach, N.M., Guilcher, S.J.T. & Jaglal, S.B. (2011). Physical Therapists' perceptions and use of standardized assessments of walking ability: post stroke. *Journal of Rehabilitation Medicine*. 43, pp 543-549

Salter, K., Foley, N., Jutai, J., Bayley, M. & Teasell, R. (2008). Assessment of community integration following traumatic brain injury. *Brain Injury*. 22(11), pp 820-835

Shiel, W.C. (2018). Medical Definition of Sequela. *Medicine Net*. Retrieved from: <http://www.medicinenet.com>. Accessed: 18 August 2019.

Sherer, M., Davis, L.C., Sander, A.D., Caroselli, J.S., Clark, A.N. & Pastorek, N.J. (2014). Prognostic Importance of Self-Reported Traits/Problems/Strengths and Environmental Barriers/Facilitators for Predicting Participation Outcomes in Persons with Traumatic Brain Injury: A Systematic Review. *Archives of Physical Medicine and Rehabilitation*. 95, pp 1162-1173

Sloan, S., Winkler, D. & Callaway, L. (2004). Community Integration Following Severe Traumatic Brain Injury: Outcomes and Best Practice. *Brain Impairment*. 5(1), pp 12-29

Soeker, M.S., Van Rensburg, V. & Travill, A. (2012a). Are rehabilitation programmes enabling clients to return to work? Return to work perspectives of individuals with mild to moderate brain injury in South Africa. *Work*. 43, pp 171-182

Soeker, M.S., Van Rensburg, V. & Travill, A. (2012b). Individuals with traumatic brain injuries: perceptions and experiences of returning to work in South Africa. *Work*. 42, pp 589-600

Stark, S.L., Edwards, D.F., Hollingsworth, H. & Gray, D. B. (2005). Validation of the Reintegration to Normal Living Index in a Population of Community-dwelling People with Mobility Limitations. *Archives of Physical and Medical Rehabilitation*. 86, pp 344-345

Statistics How To. Retrieved from www.statisticshowto.datasciencecentral.com. Accessed 16 August 2019.

Statistics South Africa, Statistical Release P0318, General Household Survey, 2017. Retrieved from www.statssa.gov.za. Accessed: 8 November 2018.

Statistics South Africa, Statistical Release P0211, Quarterly Labour Force Survey, Q3:2018. Retrieved from www.statssa.gov.za. Accessed: 8 November 2018.

Steve Biko Academic Hospital, 2018. Retrieved from www.sbah.org.za. Accessed: 27 March 2016.

Stiver, S.I. & Manley, G.T.M. (2008). Pre-hospital management of traumatic brain injury. *Neurosurgery Focus*. 25(4), pp 1-11

Stucki, G. (2005). International Classification of Functioning, Disability, and Health (ICF): a promising framework and classification for rehabilitation medicine. *American Journal of Physical and Medical Rehabilitation*. 84, pp 733-740

Tate, R.L., Godbee, K., Sigmundsdottir, L. (2013). A systematic review of assessment tools for adults used in traumatic brain injury research and their relationship to the ICF. *Neuro Rehabilitation*. 32, pp 729-750

Truelle, J.L., Koskinen, S., Hawthorne, G., Sarajuuri, J., Formisano, R., von Wild, K., Neugebauer, E., Wilson, L., Gibbons, H., Powell, J., Bullinger, M., Hofer, S., Maas, A., Zitnay, G., von Steinbuechel, N. & the QOLIBRI task force (2010). Quality of life after traumatic brain injury: The clinical use of the QOLIBRI, a novel disease-specific instrument. *Brain Injury*. 24(11), pp 1272-1291

Üstün, T.B., Chatterji, S., Kostanjsek, N., Rehm, J., Kennedy, C., Epping-Jordan, J., Saxena, S., von Korff, M., Pull, C. (2010). Developing the World Health Organisation Disability Assessment Schedule 2.0. *Bulletin of the World Health Organization*. 88, pp 815-823

Üstün, T.B. (2010). Measuring health and disability: Manual for WHO disability assessment schedule WHODAS 2.0. *Geneva: World Health Organization*.

Van der Naalt, J., van Zomeren, A.H., Sluiter, W.J. & Minderhoud, J.M. (1999). One-year outcome in mild to moderate head injury: the predictive value of acute injury characteristics related to complaints and return to work. *Psychiatry*. 66, pp 207-213

Van der Zee, C.H., Post, M.W., Brinkhof, M.W. & Wagenaar, R.C. (2014). Comparison of the Utrecht Scale for Evaluation of Rehabilitation - Participation with the ICF Measure of Participation and Activities Screener and the WHO Disability Assessment Schedule II in Persons with Spinal Cord Injury. *Archives of Physical Medicine and Rehabilitation*. 95, pp 87-93

Von Steinbuechel, N., Wilson, L., Gibbons, H., Muehlan, H., Schmidt, S., Sasse, N., Koskinen, S., Sarajuuri, J., Hofer, S., Bullinger, M., Maas, A., Neugebauer, E., Powell, J., von Wild, K., Zitnay, G., Bakx, W., Christensen, A.L., Formisano, R., Hawthorne, G. & Truelle, J.L. (2012). QOLIBRI overall scale: a brief index of health-related quality of life after traumatic brain injury. *Journal of Neurology, Neurosurgery and Psychiatry*. 83 (11), pp 1041-1047

Von Steinbuechel, N., Covic, A., Polinder, S., Kohlmann, T., Cepulyte, U., Poinstingl, H., Backhaus, J., Bakx, W., Bullinger, M., Christensen, A.L., Formisano, R., Gibbons, H., Hofer, S., Koskinen, S., Maas, A., Neugebauer, E., Powell, J., Sarajuuri, J., Sasse, N., Schmidt, S., Muhlan, H., von Wild, K., Zitnay, G. & Truelle, J.L. (2016). Assessment of Health-Related Quality of Life after TBI: Comparison of a Disease-Specific (QOLIBRI) with a Generic (SF-36) Instrument. *Behavioural Neurology*. pp 1-14

Wagner, A.K., Hammond, F.M., Sasser, H.C. & Wiercisiewski, D. (2002). Return to Productive Activity after Traumatic Brain Injury: Relationship with Measures of Disability, Handicap, and Community Integration. *Archives of Physical and Medical Rehabilitation*. 83, pp 107-114

Watt, N.P.C. (2000). Predictors and indicators of return-to-work following traumatic brain injury in South Africa: Findings from a preliminary experimental database. *South African Journal of Psychology*. 30, pp 27-37

Webster, J., Taylor, A. & Balchin, R. (2015). Traumatic brain injury: the hidden pandemic: a focused response to family and patient experiences and needs. *South African Medical Journal*. 105(3), pp 195-198

Weiss, N., Galanaud, D., Carpentier, A., Naccache, L. & Puybasset, L. (2007). Clinical Review: Prognostic value of magnetic resonance imaging in acute brain injury and coma. *Critical Care*. 11(5), pp 230-242

Willemse-van-Son, A.H.P., Ribbers, G.M., Verhagen, A.P. & Stam, H.J. (2007). Prognostic factors of long-term functioning and productivity after traumatic brain

injury: a systematic review of prospective cohort studies. *Clinical Rehabilitation*. 21, pp 1024-1037

Wood, J.P. (2010). 'Getting back to real living': a qualitative study of the process of community reintegration after stroke. *Clinical Rehabilitation*. 24, pp 1045-1056

(World Health Organisation Disability Organization Schedule 2.0 (WHODAS 2.0), 2017 Retrieved from: [http://www.who.int/classifications/icf/more_whodas/en/]. Accessed: 16 April, 2018).

World Health Organisation. (2001). International Classification of Functioning, Disability and Health: ICF. *Geneva: World Health Organization*

World Health Organisation. (2013). How to use the ICF: a practical manual for using the International Classification of Functioning, Disability and Health (ICF). Exposure draft for comment. *Geneva: World Health Organization*.

Yazbek, M., Stewart, A.S. & Becker, P. (2009). Tswana-speaking South Africans' Understanding of Pain Scales. *The South African Journal of Physiotherapy*. 65(1), pp 28-34

Appendix 1: Ethics Clearance Certificate



R14/49 Ms Heidi Gouws

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160661

NAME: Ms Heidi Gouws
(Principal Investigator)
DEPARTMENT: Physiotherapy
 Steve Biko Academic Hospital

PROJECT TITLE: Community Reintegration after Traumatic Brain Injury

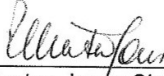
DATE CONSIDERED: 24/06/2016

DECISION: Approved unconditionally

CONDITIONS:

SUPERVISOR: Witness Mudzi

APPROVED BY:


 Professor P Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 22/07/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004, 10th floor, Senate House/2nd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in June and will therefore be due in the month of June each year.

Principal Investigator Signature _____

Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 2: Permission letter

Permission to do Research and access Records / Files / Data base at Steve Biko Academic Hospital

To: Chief Executive Officer/Information Officer
Steve Biko Academic Hospital

Dr. Mangwane

Date: 30 June 2016

From: The Investigator
Heidi Gouws
083 542 8687
012 354 1645

Re: Request to carry out research at Steve Biko Academic Hospital

My name is Heidi Gouws. I am currently employed at Steve Biko Academic Hospital as a Grade 1 Production Level Physiotherapist (Persal number: 91143543). I am a student of the University of the Witwatersrand in Johannesburg, currently doing my Master of Science in Physiotherapy degree.

I wish to apply for permission to conduct a research project at the above mentioned hospital.

I intend to publish the finding of the study in a professional journal and/or professional meetings like symposia, congresses, or other meetings of such a nature.

The title of my study is: Community Reintegration after a Traumatic Brain Injury.

I request permission in terms of the requirements of the Promotion of Access to Information Act. No. 2 of 2000 that I be granted access to patients, clinical records, files and databases.

Please note that there will be no financial implications to the hospital or the province. There are no physical risks involved in taking part in the study, and if patients do not wish to participate, it will not affect their management, as this is not an experimental study.

Please find attached a copy of my proposed research protocol.

I undertake not to commence with the study until ethical approval from the Faculty of Health Sciences Human Research Ethics Committee of the University of the Witwatersrand has been obtained.

Yours sincerely

Hospital Official Stamp

Heidi Gouws
Signature of the Principle Investigator

Permission to do the research study at this hospital and to access the information as requested, is hereby approved.

Chief Executive Officer
Steve Biko Academic Hospital

Dr. S. S. Mncwane

Signature of the CEO

GAUTENG PROVINSIALE INF. OERING DEPT. VAN GESONDHEID STEVE BIKO AKADEMIESE HOSPITAAL STEVE BIKO ACADEMIC HOSPITAL
2016 -05- 31
PRIVAATSAK/PRIVATE BAG X160 PRETORIA 0001 GAUTENG PROVINCIAL GOVERNMENT DEPT. OF HEALTH

Appendix 3: Information letter for patient**Information letter for patient**

Dear Patient

My name is Heidi Gouws; I am a post-graduate student busy with my Masters of Science Degree in Physiotherapy, at the University of the Witwatersrand in Johannesburg, in the Faculty of Health Sciences, School of Therapeutic Sciences - Department of Physiotherapy.

I would like to invite you to participate in my study.

The title of my study is: 'Community Reintegration after a Traumatic Brain Injury.'

The main aim of the study is: To establish the level of community reintegration after traumatic brain injury. Community reintegration is a multidimensional concept with many definitions, but in this study, it basically looks at returning to meaningful life after your traumatic brain injury.

I will be asking questions about how you occupy your time with activities, about where you live, the different activities you engage in around the house, and about your relationships with other people in your family and in the community. In addition, I will direct some questions at you as to, for example, your age, level of education and employment status.

A participation number will be assigned to you. It will appear on all of the documentation. I will not use your name or any other details that could be used to identify you, on any of the documentation, so that you will remain anonymous and your participation confidential.

You and/or your caregiver will be interviewed. The whole interview process is planned for about 30 minutes. If you have to travel to the Steve Biko Academic Hospital especially for this interview, I will cover your travelling costs.

The information that I obtain from this study will be used to improve the knowledge physiotherapists have on community reintegration in traumatic brain injury patients, as there is little knowledge on this topic in South Africa.

If it is found that you will benefit from out-patient physiotherapy, an appointment will be made at Steve Biko Academic Hospital, or I will refer you to your nearest clinic or community-based therapist. You will also be referred to other members of the multidisciplinary team, if necessary.

Participation is optional, and refusal to participate will not affect your treatment at Steve Biko Academic Hospital in any way. As this is only an interview, there are no risks involved in participating in the study. You may leave the interview process at any time, if you so wish.

If you agree to participate, please sign the consent form on the next page.

Thank you very much for your time.

Kind regards,

Heidi Gouws (Physiotherapist / Primary Researcher)

For further information, you are welcome to contact me, Heidi Gouws, on:

Tel: 0835428687 / 012 354 1645

E-mail: heidvz@gmail.com

[I am available at the Physiotherapy Department of Steve Biko Academic Hospital from Monday to Friday: 07H00 – 15H30.](#)

Alternatively, if you require any further information, please contact:

The University of the Witwatersrand

Human Research Ethics Committee

Prof. P Cleaton-Jones

Tel: 011 717 2301

Email: peter.cleaton-jones1@wits.ac.za

You can also contact the Human Research Ethics Committee administrative offices of Ms Zanele Ndlovu (zanele.ndlovu@wits.ac.za), Mr Rhulani Mkansi (Rhulani.mkansi@wits.ac.za), and Mr Lebo Moeng (Lebo.moeng@wits.ac.za) at 011 7172700 / 2656 / 1234 / 1252.

Appendix 4: Information letter for caregivers**Information letter for caregiver**

Dear Caregiver

My name is Heidi Gouws; I am a post-graduate student busy with my Masters of Science Degree in Physiotherapy, at the University of the Witwatersrand in Johannesburg, in the Faculty of Health Sciences, School of Therapeutic Sciences - Department of Physiotherapy.

I would like to invite you and your family member to participate in my study.

The title of my study is: 'Community Reintegration after a Traumatic Brain Injury.'

The main aim of the study is: To establish the level of community reintegration after traumatic brain injury. Community reintegration is a multidimensional concept with many definitions, but in this study, it basically looks at returning to a meaningful life after a traumatic brain injury.

I will be asking questions about how your family member occupies his/her time with activities, about where he/she lives, engages in different activities around the house, and about his/her relationships with other people in his/her family and in the community. In addition, I will direct some questions at him/her (e.g. his/her age, level of education and employment status).

A participation number will be assigned to you/ your family member, which will appear on all of the documentation. I will not use your or your family member's name, or any details that could be used to identify you or your family member on any of the documentation. Your participation will be completely anonymous and confidential.

You and/or your family member will be interviewed. If your family member is not able to talk or understand the questions, you will be asked to answer them on his/her

behalf. The whole interview process is planned for about 30 minutes. If you and your family member have to travel to the Steve Biko Academic Hospital especially for this interview, I will cover your travelling costs.

The information that I obtain from this study will be used to improve the knowledge physiotherapists have on community reintegration in traumatic brain injury patients, as there is little knowledge on this topic in South Africa.

If it is found that your family member will benefit from out-patient physiotherapy, an appointment will be made at Steve Biko Academic Hospital, or I will refer him/her to his/her nearest clinic or community-based therapist. He/she will also be referred to other members of the multidisciplinary team if it is necessary.

Participation is optional, and refusal to participate will not affect your family member's treatment at Steve Biko Academic Hospital in any way. As this is only an interview, there are no risks involved in participating in the study. You may leave the interview process at any time, if you so wish.

If you agree to participate, please sign the consent form on the next page.

Thank you very much for your time.

Kind regards,

Heidi Gouws (Physiotherapist / Primary Researcher)

For further information, you are welcome to contact me, Heidi Gouws, on:

Tel: 0835428687 / 012 354 1645

E-mail: heidvz@gmail.com

I am available at the Physiotherapy Department of Steve Biko Academic Hospital from Monday to Friday: 07H00 – 15H30.

Alternatively, if you require any further information, please contact:

The University of the Witwatersrand

Human Research Ethics Committee

Prof. P Cleaton-Jones

Tel: 011 717 2301

Email: peter.cleaton-jones1@wits.ac.za

You may also contact the Human Research Ethics Committee administrative offices of Ms Zanele Ndlovu (zanele.ndlovu@wits.ac.za), Mr Rhulani Mkansi (Rhulani.mkansi@wits.ac.za), and Mr Lebo Moeng (Lebo.moeng@wits.ac.za) at 011 7172700 / 2656 / 1234 / 1252.



Appendix 5: Informed consent for patient

participant number

INFORMED CONSENT FOR PATIENT

NAME OF RESEARCHER: Mrs Heidi Gouws

NAMES OF SUPERVISORS: Dr Witness Mudzi & Mrs Nicolette Comley-White

INSTITUTION: University of the Witwatersrand; Division of Physiotherapy

TITLE OF STUDY: Community Reintegration after a Traumatic Brain Injury

Declaration

I have read (or had read to me by _____) the information letter. I understand what is required of me, and I have asked any questions that I might have had.

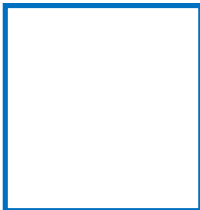
I therefore consent to participate in the study as outlined in the information sheet. I understand that I can withdraw at any time.

NAME: _____

DATE: _____

TEL NUMBER: _____

SIGNED: _____



Left thumbprint

RESEARCHER NAME: _____

DATE: _____

SIGNED: _____

**Appendix 6: Informed consent for caregiver**

participant number

INFORMED CONSENT FOR CAREGIVER**NAME OF RESEARCHER:** Mrs Heidi Gouws**NAMES OF SUPERVISORS:** Prof Witness Mudzi & Mrs Nicolette Comley-White**INSTITUTION:** University of the Witwatersrand; Division of Physiotherapy**TITLE OF STUDY:** Community Reintegration after a Traumatic Brain Injury**Declaration**

I have read (or had read to me by _____) the information letter. I understand what is required of me, and I have asked any questions that I might have had.

I therefore consent on behalf of _____ to participate in the study as outlined in the information sheet. I understand that I can withdraw at any time.

NAME: _____

DATE: _____

TEL NUMBER: _____

RELATIONSHIP TO PATIENT: _____

SIGNED: _____



Left thumbprint

RESEARCHER NAME: _____

DATE: _____

SIGNED: _____

Appendix 7: Demographic questionnaire

DEMOGRAPHIC QUESTIONNAIRE

COMPLETED BY: Patient and proxy [] ☐
 Patient only [] ☐
 Proxy only [] ☐ participant no.

AGE _____

GENDER FEMALE [] ☐ MALE [] ☐

DATE OF ASSESSMENT ____/____/____

DATE OF INJURY ____/____/____

DATE OF ADMISSION ____/____/____

DATE OF DISCHARGE ____/____/____

MECHANISM OF INJURY
 MVA [] PVA [] GSW Head []
 Falls [] Assault [] Other _____ []

TYPE OF LESION
 Extra dural haematoma [] Sub arachnoid haemorrhage []
 Intracerebral [] Diffuse axonal injury []
 Other _____ []

LEVEL OF EDUCATION
 None [] Grade 12 []
 Up to grade 7 [] Grade 12 + 3 years []
 Up to grade 11 [] Other _____ []

INITIAL GLASCOW COMA SCALE
 Mild (13-15) []
 Moderate (9-12) []
 Severe (8-3) []

COMPONENTS OF GLASCOW COMA SCALE
 EYE OPENING []
 MOTOR RESPONSE []
 VERBAL RESPONSE []

PREMORBID OCCUPATION
 Paid employment [] Student []
 Self employed [] Receiving grant/benefit []
 Non-paid work [] Retired []
 Unemployed (health) [] Unemployed (other) []
 Other _____ []

CURRENT OCCUPATION
 Paid employment [] Student []
 Self employed [] Receiving grant/benefit []
 Non-paid work [] Retired []
 Unemployed (health) [] Unemployed (other) []
 Other _____ []

IN- OR OUT-PATIENT REHABILITATION
 Acute in-patient rehabilitation only []
 Acute in-patient and out-patient rehabilitation []
 Out-patient rehabilitation only []
 In-patient rehabilitation at a rehabilitation centre []

Appendix 8: The Community Integration Questionnaire (CIQ)**Community Integration Questionnaire**

Name: _____

Date: _____

Home Integration	Answer (circle one)	Score
1. Who usually does shopping for groceries or other necessities in your household?	Yourself alone (2) Yourself and someone else (1) Someone else (0)	
2. Who usually prepares meals in your household?	Yourself alone (2) Yourself and someone else (1) Someone else (0)	
3. In your home who usually does normal everyday housework?	Yourself alone (2) Yourself and someone else (1) Someone else (0)	
4. Who usually cares for the children in your home?	Yourself alone (2) Yourself and someone else (1) Someone else (0) Not applicable (score is the average of 1,2,3 and 5)	
5. Who usually plans social arrangements such as get-togethers with family and friends?	Yourself alone (2) Yourself and someone else (1) Someone else (0)	
Home Integration Total Score	Add the above scores together	
Social Integration		
6. Who usually looks after your personal finances such as banking or paying bills?	Yourself alone (2) Yourself and someone else (1) Someone else (0)	
<i>Can you tell me approximately how many times a month you now usually participate in the following activities outside your home?</i>		
7. Shopping	5 or more (2) 1 – 4 times (1) Never (0)	
8. Leisure activities such as movies, sports, restaurants	5 or more (2) 1 – 4 times (1) Never (0)	
9. Visiting friends or relatives	5 or more (2) 1 – 4 times (1) Never (0)	

 Downloaded from www.rehabmeasures.org

Test instructions provided courtesy of Dr. Barry Willer, PhD

Please contact Dr. Willer at bswiller@buffalo.edu with any question about the CIQ

Page 1

10. When you participate in leisure activities do you usually do this alone or with other?	mostly alone (0) mostly with friends who have head injuries (1) mostly with family members (1) mostly with friends who do not have head injuries (2) with a combination of family and friends (2)	
11. Do you have a best friend with whom you confide?	Yes (2) No (0)	
Social Integration Total Score	Add the above scores together	
Integration into Productive Activities		
12. How often do you travel outside the home?	almost every day (2) almost every week (1) seldom/never (less than once per week) (0)	
13. Please choose the answer below that best corresponds to your current (during the past month) work situation: <i>Please see scoring for this item on next page</i>	Full-time employment (>20 hours/week) Part Time Employment ($\leq$ 20 hours/week) Not working, but actively looking for work Not working, not looking for work Not applicable, retired due to age Volunteer job in the community	
14. Please choose the answer below that best corresponds to your current (during the past month) school or training program situation <i>Please see scoring for this item on next page</i>	Full-time Part-time Not attending school or training program	
15. In the past month, how often did you engage in volunteer activities? <i>Please see scoring for this item on next page</i>	5 or more 1 – 4 times Never	
Total Score		

Scoring for items 13 to 15 - JobSchool

The patient receives a 0, if answers for the following questions are:

Item 13) not working, not looking for work

Item 14) not going to school

Item 15) no volunteer activities

The patient receives a 1, if answers for the following questions are:

Item 13) not working, not looking for work

Item 14) not going to school

Item 15) volunteers 1 to 4 times

The patient receives a 2, if answers for the following questions are:

Item 13) actively looking for work

AND/OR

Item 15) volunteers 5 or more times per month

The patient receives a 3, if answers for the following questions are:

Item 13) working part-time

OR

Item 14) attends school part-time

The patient receives a 4, if answers for the following questions are:

Item 13) working full-time

OR

Item 14) attends school full-time

The patient receives a 5, if answers for the following questions are:

Item 13) working full-time AND Item 14) attends school part-time

OR

Item 13) works part-time AND Item 14) attends school full-time

If the patient is retired due to age, use item 15 to score the JOBSCHOOL variable

5 or more receives 4 points

1 – 4 times receives 2 points

Never receives 0 points

Summing Scores:

The productivity score = item 12 score + Jobschool variable

The total CIQ score = Home integration score + social integration score + productivity score

Downloaded from www.rehabmeasures.org

Test instructions provided courtesy of Dr. Barry Willer, PhD

Please contact Dr. Willer at bswiller@buffalo.edu with any question about the CIQ Page 3

Appendix 9: World Health Organisation Disability Assessment Schedule 2.0
(WHODAS 2.0) 12-item version, proxy-administered



WHODAS 2.0

WORLD HEALTH ORGANIZATION
DISABILITY ASSESSMENT SCHEDULE 2.0

12-item version, proxy-administered

This questionnaire asks about difficulties due to health conditions experienced by the person about whom you are responding in your role as friend, relative or carer. Health conditions include diseases or illnesses, other health problems that may be short or long lasting, injuries, mental or emotional problems, and problems with alcohol or drugs.

Think back over the past 30 days and, to the best of your knowledge, answer these questions thinking about how much difficulty your friend, relative or carer had while doing the following activities. (Note: the questionnaire uses the term "relative" to mean "friend", "relative" or "carer".) For each question, please circle only one response.

H4 ^a	I am the _____ (choose one) of this person.	1 =	husband or wife	5 =	other relative
		2 =	parent	6 =	friend
		3 =	son or daughter	7 =	professional carer
		4 =	brother or sister	8 =	other (specify) _____

^a Questions H1–H3 appear at the end of the questionnaire.

In the past 30 days, how much difficulty did your relative have in:						
S1	<u>Standing for long periods</u> such as <u>30 minutes</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S2	Taking care of his or her <u>household responsibilities</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S3	<u>Learning a new task</u> , for example, learning how to get to a new place?	None	Mild	Moderate	Severe	Extreme or cannot do
S4	How much of a problem did your relative have <u>joining in community activities</u> (for example, festivities, religious or other activities) in the same way as anyone else can?	None	Mild	Moderate	Severe	Extreme or cannot do
S5	How much has <u>your relative</u> been <u>emotionally affected</u> by his or her health condition?	None	Mild	Moderate	Severe	Extreme or cannot do



WHODAS 2.0

WORLD HEALTH ORGANIZATION
DISABILITY ASSESSMENT SCHEDULE 2.0

12-item version, proxy-administered

This questionnaire asks about difficulties due to health conditions experienced by the person about whom you are responding in your role as friend, relative or carer. Health conditions include diseases or illnesses, other health problems that may be short or long lasting, injuries, mental or emotional problems, and problems with alcohol or drugs.

Think back over the past 30 days and, to the best of your knowledge, answer these questions thinking about how much difficulty your friend, relative or carer had while doing the following activities. (Note: the questionnaire uses the term "relative" to mean "friend", "relative" or "carer".) For each question, please circle only one response.

H4 ^a	I am the _____ (choose one) of this person.	1 =	husband or wife	5 =	other relative
		2 =	parent	6 =	friend
		3 =	son or daughter	7 =	professional carer
		4 =	brother or sister	8 =	other (specify) _____

^a Questions H1–H3 appear at the end of the questionnaire.

In the past 30 days, how much difficulty did your relative have in:						
S1	<u>Standing for long periods</u> such as <u>30 minutes</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S2	Taking care of his or her <u>household responsibilities</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S3	<u>Learning a new task</u> , for example, learning how to get to a new place?	None	Mild	Moderate	Severe	Extreme or cannot do
S4	How much of a problem did your relative have <u>joining in community activities</u> (for example, festivities, religious or other activities) in the same way as anyone else can?	None	Mild	Moderate	Severe	Extreme or cannot do
S5	How much has <u>your relative</u> been <u>emotionally affected</u> by his or her health condition?	None	Mild	Moderate	Severe	Extreme or cannot do



WHODAS 2.0

WORLD HEALTH ORGANIZATION
DISABILITY ASSESSMENT SCHEDULE 2.0

12

Proxy

In the past 30 days, how much difficulty did your relative have in:						
S6	<u>Concentrating</u> on doing something for <u>ten minutes</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S7	<u>Walking a long distance</u> such as a <u>kilometre</u> [or equivalent]?	None	Mild	Moderate	Severe	Extreme or cannot do
S8	<u>Washing</u> his or her <u>whole body</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S9	Getting <u>dressed</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S10	<u>Dealing</u> with people <u>he or she does not know</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S11	<u>Maintaining a friendship</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S12	His or her day-to-day <u>work</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do

H1	Overall, in the past 30 days, <u>how many days</u> were these difficulties present?	Record number of days ____
H2	In the past 30 days, for how many days were you <u>totally unable</u> to carry out your usual activities or work because of any health condition?	Record number of days ____
H3	In the past 30 days, not counting the days that you were totally unable, for how many days did you <u>cut back</u> or <u>reduce</u> your usual activities or work because of any health condition?	Record number of days ____

12-ITEM VERSION, SELF-ADMINISTERED

**WHODAS 2.0**

WORLD HEALTH ORGANIZATION
DISABILITY ASSESSMENT SCHEDULE 2.0

12-item version, self-administered

This questionnaire asks about difficulties due to health conditions. Health conditions include diseases or illnesses, other health problems that may be short or long lasting, injuries, mental or emotional problems, and problems with alcohol or drugs.

Think back over the past 30 days and answer these questions, thinking about how much difficulty you had doing the following activities. For each question, please circle only one response.

In the past 30 days, how much difficulty did you have in:						
S1	<u>Standing for long periods</u> such as <u>30 minutes</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S2	Taking care of your <u>household responsibilities</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S3	<u>Learning a new task</u> , for example, learning how to get to a new place?	None	Mild	Moderate	Severe	Extreme or cannot do
S4	How much of a problem did you have <u>joining in community activities</u> (for example, festivities, religious or other activities) in the same way as anyone else can?	None	Mild	Moderate	Severe	Extreme or cannot do
S5	How much have <u>you been emotionally affected</u> by your health problems?	None	Mild	Moderate	Severe	Extreme or cannot do



WHODAS 2.0

WORLD HEALTH ORGANIZATION
DISABILITY ASSESSMENT SCHEDULE 2.0

12

Self

In the past 30 days, how much difficulty did you have in:						
S6	<u>Concentrating</u> on doing something for <u>ten minutes</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S7	<u>Walking a long distance</u> such as a <u>kilometre</u> [or equivalent]?	None	Mild	Moderate	Severe	Extreme or cannot do
S8	<u>Washing your whole body</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S9	Getting <u>dressed</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S10	<u>Dealing</u> with people <u>you do not know</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S11	<u>Maintaining a friendship</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do
S12	Your day-to-day <u>work</u> ?	None	Mild	Moderate	Severe	Extreme or cannot do

H1	Overall, in the past 30 days, <u>how many days</u> were these difficulties present?	Record number of days ____
H2	In the past 30 days, for how many days were you <u>totally unable</u> to carry out your usual activities or work because of any health condition?	Record number of days ____
H3	In the past 30 days, not counting the days that you were totally unable, for how many days did you <u>cut back</u> or <u>reduce</u> your usual activities or work because of any health condition?	Record number of days ____

12-ITEM VERSION, INTERVIEWER ADMINISTERED

**WHODAS 2.0**

WORLD HEALTH ORGANIZATION
DISABILITY ASSESSMENT SCHEDULE 2.0

12

Interview

Section 4 Core questions**Show flashcard #2**

In the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
S1	<u>Standing for long periods</u> such as <u>30 minutes</u> ?	1	2	3	4	5
S2	Taking care of your <u>household responsibilities</u> ?	1	2	3	4	5
S3	<u>Learning a new task</u> , for example, learning how to get to a new place?	1	2	3	4	5
S4	How much of a problem did you have <u>joining in community activities</u> (for example, festivities, religious or other activities) in the same way as anyone else can?	1	2	3	4	5
S5	How much have <u>you</u> been <u>emotionally affected</u> by your health problems?	1	2	3	4	5

In the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
S6	<u>Concentrating</u> on doing something for <u>ten minutes</u> ?	1	2	3	4	5
S7	<u>Walking a long distance</u> such as a <u>kilometre</u> [or equivalent]?	1	2	3	4	5
S8	<u>Washing your whole body</u> ?	1	2	3	4	5
S9	Getting <u>dressed</u> ?	1	2	3	4	5
S10	<u>Dealing</u> with people <u>you do not know</u> ?	1	2	3	4	5
S11	<u>Maintaining a friendship</u> ?	1	2	3	4	5
S12	Your day-to-day <u>work/school</u> ?	1	2	3	4	5

H1	Overall, in the past 30 days, <u>how many days</u> were these difficulties present?	Record number of days ____
H2	In the past 30 days, for how many days were you <u>totally unable</u> to carry out your usual activities or work because of any health condition?	Record number of days ____
H3	In the past 30 days, not counting the days that you were totally unable, for how many days did you <u>cut back</u> or <u>reduce</u> your usual activities or work because of any health condition?	Record number of days ____

Appendix 10: Quality of Life after Brain Injury – Overall Scale (QOLIBI-OS)

QUALITY OF LIFE AFTER BRAIN INJURY – Overall Scale

We would like to know **how satisfied** you are with different aspects of your life since your brain injury. For each question please choose the answer which is closest to how you feel now (including the past week) and mark the box with an "X". If you have problems filling out the questionnaire, please ask for help.

These questions are about how you feel overall *now (including the past week)*.

	Not at all	Slightly	Moderately	Quite	Very
1. Overall, how satisfied are you with your physical condition?	☐	☐	☐	☐	☐
2. Overall, how satisfied are you with how your brain is working, in terms of your concentration, memory, thinking?	☐	☐	☐	☐	☐
3. Overall, how satisfied are you with your feelings and emotions?	☐	☐	☐	☐	☐
4. Overall, how satisfied are you with your ability to carry out day to day activities?	☐	☐	☐	☐	☐
5. Overall, how satisfied are you with your personal and social life?	☐	☐	☐	☐	☐
6. Overall, how satisfied are you with your current situation and future prospects?	☐	☐	☐	☐	☐

QOLIBRI – OS

© The authors, all rights reserved,

www.qolibrinet.com.

For details contact nvsteinbuechel@med.uni-goettingen.de.

Appendix 11: Turn-it-in report**Digital Receipt**

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author: Heidi Gouws
Assignment title: Heidi Gouws 927612
Submission title: 927612:community_reintegration_a...
File name: 4afc453c4_community_reintegration...
File size: 2.03M
Page count: 186
Word count: 42,426
Character count: 229,808
Submission date: 25-Sep-2019 03:20PM (UTC+0200)
Submission ID: 1179760866

COMMUNITY REINTEGRATION AFTER TRAUMATIC BRAIN INJURY

Heidi Gouws

A research report submitted to the Faculty of Health Sciences, University of the
Witwatersrand, Johannesburg, in partial fulfillment of the requirements for the Degree
of Masters of Physiotherapy.

Johannesburg, 2019

927612:community_reintegration_after_TBI_(unhighlighted).docx

ORIGINALITY REPORT

18%

SIMILARITY INDEX

15%

INTERNET SOURCES

8%

PUBLICATIONS

%

STUDENT PAPERS

PRIMARY SOURCES

1	wiredspace.wits.ac.za Internet Source	1%
2	www.tandfonline.com Internet Source	1%
3	link.springer.com Internet Source	1%
4	scholar.sun.ac.za Internet Source	<1%
5	Handbook of Disease Burdens and Quality of Life Measures, 2010. Publication	<1%
6	helda.helsinki.fi Internet Source	<1%
7	www.medicaljournals.se Internet Source	<1%
8	www.isec.ac.in Internet Source	<1%
9	open.uct.ac.za	

Appendix 12: Plagiarism declaration



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Heidi Gouws (Student number: 927612) am a student
registered for the degree of MSc. Physiotherapy in the academic year 2019.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature:  Date: 20 February 2019