The functional outcomes of stroke patients who are HIV positive, HIV negative and HIV undiagnosed, following rehabilitation: A descriptive study

Thesis

By

Tasneem Hartley

Presented in partial fulfilment of the requirements for the degree Masters in Physiotherapy at Stellenbosch University

December 2017

Supervisor: Mrs G. Inglis-Jassiem

Co-supervisor: Mrs M. Burger

Acknowledgements

I would like to sincerely thank the following people:

The staff at the Western Cape Rehabilitation Centre

for making the time and effort to accommodate me and my research needs into their busy schedules

The staff of the 3D Vicon Motion Analysis laboratory at Stellenbosch University

for their guidance and assistance.

Mavis Gidigidi, Mu'minah Regal, Monique Hermanus and Thaakirah Hartley

for assisting me throughout my data collection period and ensuring it ran smoothly

The Harry Crossley Foundation, Prof Q Louw and Gakeemah Inglis-Jassiem

for funding and affording me the opportunity to complete my degree

My Supervisors Gakeemah Inglis-Jassiem and Marlette Burger

for their patience, guidance and persistence. I truly appreciate all your efforts.

And last but not least my parents Shaheed and Ayesha Hartley

without whom this project would not have been possible. A special thank you for your unconditional and unwavering support.

"You give but little when you give of your possessions. It is when you give of yourself that you truly give." Khalil Gibran

Declaration

By submitting this thesis, I, Tasneem Hartley, declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

_____

Signature: Tasneem Hartley . **Date: December 2017**

December 2017

Abstract

Background

With the increase in human immunodeficiency virus (HIV) and non-communicable diseases in low to middle-income countries, the rise in HIV-related stroke incidences is becoming a concern. The sub-Saharan region is where the majority of the global HIV population reside. This places an even greater burden on an already strained healthcare system and economy, as HIV-infected people may have an increased chance of stroke and tend to be significantly younger than the conventional stroke population. With the physical and cognitive deficits that may occur due to HIV infection, along with the neurological deficits caused by stroke, this young population now becomes more dependent, increasing the number of unproductive members of society. Hence, it is important to know whether the combination of stroke and HIV further impairs the function of these individuals. Previous studies assessing the function of HIV-infected patients post stroke focused on mortality rather than the morbidity of HIV+ stroke patients. Furthermore, the outcomes measures used to assess their function were global and not specific enough to describe function adequately.

Aim

The primary aim of this thesis is to describe the functional outcomes of HIV positive, HIV negative and HIV undiagnosed patients post stroke following inpatient rehabilitation using various outcome measures. Secondary aims include describing demographics, risk factors, length of stay and patient perception.

Setting

The Western Cape Rehabilitation Centre (WCRC), situated in Cape Town, South Africa.

Study design

A prospective descriptive cohort study.

Methods

Approval for conducting the study was obtained from the Committee of Human Research (HREC) at Stellenbosch University (S15/10/232). From July to December 2016, patients who were admitted to the WCRC post stroke were recruited for the study. Written informed consent was obtained from all eligible participants. Data were collected on admission and just prior to discharge, using the Modified Rankin Scale for stroke severity; the Barthel Index and use of assistive devices to assess function in activities of daily living, level of independence and mobility; the Berg Balance Scale and MatScan (pressure mapping) to

assess balance. Data on HIV and immune status, demographics, risk factors and length of stay were also collected. The EQ5D was used to assess participant's perception of health related quality of life. All data were entered into an Excel spreadsheet, coded and analysed. Continuous data including mRS, BI, BBS and pressure mapping were summarised using median and range. Categorical data were represented as proportions and graphically displayed using a histogram. Statistical analysis was performed using STATA version 14.2 (Statacorp, 2015). Association between categorical variables was assessed using the chi-squared or Fisher's exact test. Differences in distribution of continuous variables over different levels of a categorical variable were evaluated using the Kruskal-Wallis test, and where differences were detected, the Dunn's test was used for pairwise comparisons. Relationships between patient characteristics and pain and anxiety were evaluated using ordinal logistic regression. The Kaplan-Meier curve was used to describe the length of stay. Statistical significance was assessed at 5%.

Results

Out of 54 potential participants, 49 met the inclusion criteria and were recruited; 9 HIV positive (+), 17 HIV negative (-) and 23 HIV undiagnosed participants. The study sample had 51.02% (n = 25) females and 48.98% (n = 24) males. The majority of the sample were mixed race (53.06%, n = 34), 34.69% (n = 17) were of black ethnicity, 10.20% (n = 5) were white and 2.04% (n = 1) were Indian. A significant difference was found with regard to age. The median age for the HIV+ groups was 30 years, and 50 and 51 years for the other groups, respectively (p = 0.0046). The more common risk factors for the HIV- and undiagnosed groups were hypertension and diabetes (p = 0.001 and p = 0.042) respectively. Substance abuse (p = 0.038) and opportunistic infections (p = 0.005) were more prevalent in the HIV+ group. The median CD4 count was 130 (54-883).

All groups showed significant improvements in all functional outcome assessments. The HIV+ group had a higher percentage of participants who scored in the higher percentiles for each functional outcome, but no significant results were seen among groups with regard to change in score in stroke severity (mRS p = 0.748), ADLs, independence and mobility (BI p = 0.886; use of assistive devices p = 0. 722) balance and risk of falling (BBS p = 0.4170 and MatScan results). The HIV+ group scored themselves lower than the other groups on the EQ5D VAS scale. This may have been attributed to their age as they were younger and possibly more functionally abled than their older counterparts, but no significant differences were seen among groups (EQ5D p = 0.805). The HIV+ group had a median length of stay

of 45 days, while the HIV- and undiagnosed groups stayed for 55 and 53 days respectively. This difference was not statistically significant (p = 0.0671).

Conclusion

Even though the HIV+ group was significantly younger and had fewer risk factors, no statistical significant differences were seen with regard to functional outcome. Functional outcome could be affected by a number of variables. In this sample, HIV status did not seem to affect functional outcome negatively. Larger cohorts are required for more generalisable results, to give a better understanding of the functional outcomes of HIV+ stroke patients.

Key words

Stroke, HIV, functional outcome.

Opsomming

Agtergrond

Met die toename in menslike immuniteitsgebreks virus (MIV) en nie-oordraagbare siektes in lae tot middelinkomste lande, word die styging in MIV-verwante beroertes kommerwekkend. Die Sub-Sahara-streek is waar die meerderheid van die wêreldwye MIV-bevolking woon. Dit plaas 'n groter las op 'n reeds belaste gesondheidsorgstelsel en ekonomie aangesien MIV-geïnfekteerde mense 'n groter kans op beroerte kan hê en geneig is om aansienlik jonger te wees as die konvensionele beroerte populasie. Met die fisiese en kognitiewe probleme wat mag voorkom as gevolg van MIV-infeksie, saam met die neurologiese disfunksie wat veroorsaak word deur beroerte, word hierdie jong bevolking nou meer afhanklike en onproduktiewe lede van die samelewing. Daarom is dit belangrik om te weet of die kombinasie van beroerte en MIV verder die funksie van hierdie individue benadeel. Vorige studies wat die funksie van MIV-geïnfekteerde pasiënte na beroerte beskryf, fokus op mortaliteit eerder as die morbiditeit van MIV-positiewe beroerte pasiënte. Meer so, die meet instrumente wat gebruik word om funksie te assesseer was globaal en nie spesifiek genoeg om die funksionele probleme in detail te beskryf nie.

Doel

Om die funksionele uitkomste van MIV-positiewe, MIV-negatiewe en MIV-ondiagnoseerde pasiënte, post beroerte, na binne-pasiënt rehabilitasie met behulp van verskeie meet instrumente te beskryf. Sekondêre doelwitte sluit in die beskrywing van demografie, risikofaktore, lengte van verblyf en pasiënt persepsie.

Omgewing

Wes-Kaapse Rehabilitasiesentrum (WKRS), geleë in Kaapstad, Suid-Afrika.

Studieontwerp

'n Voornemende beskrywende kohortstudie.

Metodes

Goedkeuring vir die uitvoering van die studie is verkry by die Komitee vir Menslike Navorsing van Stellenbosch Universiteit (S15/10/232). Van Julie tot Desember 2016 is pasiënte, post beroerte, wat tot WKRS toegelaat is, gewerf vir die studie. Skriftelike ingeligte toestemming is verkry van alle kwalifiserende deelnemers. Data is ingesamel by toelating en net voor

ontslag, met behulp van die *Modified Rankin Scale* om die erns van beroerte te bepaal; die Barthel-indeks en die gebruik van hulpmiddels om funksies in die daaglikse lewe, vlak van onafhanklikheid en mobiliteit te assesseer; die *Berg Balance Scale* en *MatScan* (druk metings) om balans te evalueer. MIV en immuunstatus, demografie, risikofaktore en lengte van verblyf is ook ingesamel. Die EQ5D is gebruik om pasiënt persepsie van hoe hulle gesondheid hulle kwaliteit van hulle lewe beïnvloed te beskryf. Alle data is in 'n Excel-sigblad ingevoer, gekodeer en ontleed. Opeenvolgende data, insluitend mRS, BI, BBS en *MatScan* (druk metings), is opgesom met behulp van mediane en omvang. Kategoriese data is as proporsies voorgestel en grafies vertoon met behulp van histogramme. Statistiese analise is uitgevoer met behulp van STATA weergawe 14.2 (Statacorp, 2015). Die assosiasie tussen kategoriese veranderlikes is geassesseer met behulp van die chi-kwadraat toets of *Fisher's exact test*. Verspreiding van deurlopende veranderlikes oor verskillende vlakke van kategoriese veranderlikes is geëvalueer met behulp van die Kruskal-Wallis toets, en waar die verskille opgespoor is, is die Dunn toets vir tweerigtingvergelykings gebruik. Verhoudings tussen die volgende pasiënt eienskappe naamlik pyn en angs is geëvalueer met behulp van ordinale logistieke regressie. Die Kaplan-Meier-kurwe is gebruik om die lengte van die verblyf te beskryf. Statistiese betekenisvolheid is geassesseer teen 5%.

Resultate

Uit 54 potensiële deelnemers het 49 aan die insluitingskriteria voldoen en is gewerf, naamlik 9 MIV-positiewe (+), 17 MIV-negatiewe (-) en 23 MIV-ondiagnoseerde deelnemers. Die studie het 51,2% (n = 25) vroue en 48,98% (n = 24) mans ingesluit. Meerderheid van die deelnemers was van gemengde ras (53.06%, n = 34), 34.69% (n = 17) was swart, 10.20% (n = 5) was wit en 2,04% (n = 1) was Indiër. 'n Beduidende verskil is gevind met betrekking tot ouderdom. Die mediane ouderdom vir die MIV + groepe was 30 jaar en 50 en 51 jaar vir die ander groepe onderskeidelik (p = 0.0046). Die algemene risikofaktore vir die MIV- en ondiagnoseerde groepe was onderskeidelik hipertensie en diabetes (p = 0.001 en p = 0.042). Middelmisbruik (p = 0.038) en opportunistiese infeksies (p = 0.005) was meer algemeen in die MIV +. Die mediaan CD4 telling was 130 (54-883).

Alle groepe het beduidende verbeterings in alle funksionele uitkomsmetings getoon. Die MIV+ groep het 'n hoër persentasie deelnemers gehad wat vir elke funksionele uitkoms in die hoër persentiele behaal het, maar daar was geen beduidende resultate tussen groepe met betrekking tot verandering in telling in erns van beroerte nie (mRS p = 0.748), ADL's, onafhanklikheid en mobiliteit (BI: p = 0.886; gebruik van hulpmiddels: p = 0.722) balans en risiko van val (BBS p = 0.4170 en MatScan resultate). Die MIV + groep het hulself laer ge-

evalueer as die ander groepe op die EQ5D VAS-skaal. Dit kan toegeskryf word aan hul ouderdom aangesien hulle jonger was en moontlik meer funksioneel as hul ouer eweknieë, maar geen beduidende verskille is tussen groepe (EQ5D p = 0,805) gevind nie. Die MIV + groep het 'n mediane hospitalisasie van 45 dae gehad, terwyl die MIV- en ondiagnoseerde groepe onderskeidelik 55 en 53 dae gehospitaliseer was. Hierdie verskil was nie statisties betekenisvol nie (p = 0.0671).

Samevatting

Alhoewel die MIV + groep aansienlik jonger was en minder risikofaktore gehad het, is daar geen statisties beduidende verskille met betrekking tot funksionele uitkomste gesien nie. Funksionele uitkomste kan beïnvloed word deur 'n aantal veranderlikes. In hierdie steekproef het MIV-status nie die funksionele uitkomste negatief beïnvloed nie. Groter kohorte word benodig vir meer veralgemeende resultate om 'n beter begrip van die funksionele uitkomste van MIV+ beroerte pasiënte te gee.

Sleutelwoorde

Beroerte, MIV, funksionele uitkoms.

Table of Contents

List of Tables

List of Figures

List of Acronyms and Abbreviations

ADL	Activities of daily living
AFO	Ankle foot orthosis
AIDS	Acquired Immune Deficiency Syndrome
AP	Anterior-posterior
ART	Antiretroviral therapy
ARV	Antiretroviral
BBS	Berg Balance Scale
BI	Barthel Index
CN Scale	Canadian Neurological Scale
CNS	Central nervous system
COP	Centre of pressure
CT scan	Computerised tomography scan
CTB	Computed Tomographic Scan of the Brain
DALY	Disability adjusted life year
EQ5D	European Quality of Life Five Dimensions
Euroqol	European Quality of Life Group
FIM scale	Functional independence measurement scale
HIV	Human immunodeficiency virus
HIV-	HIV negative
HIV+	HIV positive
HREC	Committee of Human Research
HRQoL	Health related quality of life
ICF	International Classification of Functioning, Disability and Health
LMIC	Low and middle-income countries
LOS	Length of stay
Max	Maximum
MCID	Minimally clinically important difference
MDC	Minimal detectable change
Mdn	Median
MDT	Multidisciplinary Team
Min	Minimum
ML	Mediolateral
mRankin scale	Modified Rankin Scale
MRI scan	Magnetic resonance imaging scan

mRS	Modified Rankin Scale
NEADL	Nottingham extended activities of daily living
NIHSS	National Institute of Health and Stroke Scale
OM	Outcome Measure/s
OR	Odds ratio
OT	Occupational therapy
PI	Principal investigator
PLWA	People living with HIV/AIDS
PWBA	Percentage of weight bearing asymmetry
QoL	Quality of life
RMS	Root mean square
SI	Symmetry index
SIS	Stroke Impact Scale
SF36	Short Form Health Survey-36
TB	Tuberculosis
UNAIDS	Joint United Nations Programme on HIV/AIDS
VAS	Visual Analog Scale
VL	Viral load
WBA	Weight bearing asymmetry
WCRC	Western Cape Rehabilitation Center (WCRC)
WHO	World Health Organisation

Chapter 1: Background and Rationale

Human immunodeficiency virus (HIV) related stroke has become an increasingly concerning issue as incidence of stroke is higher in regions with a high HIV prevalence (Zimba, Ntanda, Lakhi & Atadzhanov, 2017; Benjamin, Bryer, Emstey, Khoo, Solomin, & Conner, 2012). Internationally, the incidence of stroke and HIV infection have risen, particularly in low to middle-income countries (UNAID, 2016; Feigin, Forouzanter, Krishnamurthi… & Murray, 2014). With approximately 52% of the global population residing in sub-Saharan Africa, there is a disproportionately high HIV-infected population (UNAIDS, 2016).

HIV infection and HIV treatment can result in vascular damage adding to the already high rates of conventional vascular risk factors (i.e. aging, hypertension, diabetes, hyper-cholesterolaemia and smoking) which increase the incidence of stroke (Benjamin et al., 2012). Other than vascular changes, HIV positive (+) individuals may suffer from a range of neurological disorders. HIV infects, destroys and impairs cells of the immune system (i.e. macrophages and CD4 cells), making the infected person more susceptible to further infections (WHO, 2015). Macrophages and CD4 cells which play an important part in the central nervous system (CNS) are infected through the bloodstream (Ellis, Calero & Stockin, 2009). Patients often discover they are HIV+ once a stroke has occured and this arises due to CNS infections that occur in 10% to 20% of HIV+ patients (Ellis et al, 2009; Mochan, Modi & Modi, 2003).

The rise in HIV-related stroke, particularly in low to middle-income countries, is of great concern as it intensifies the burden of disease on an already strained healthcare system and economy (Zimba et al., 2017; Mochan et al., 2003). Furthermore, it is concerning that those suffering from HIV-related strokes are significantly younger than the conventional stroke population (Heikinheimo, Chimbayo, Kumwenda, Kampodeni & Allain, 2012; Mlay & Bakari, 2010; Tipping, de Villiers, Wainwright, Candy & Bryer, 2007). This may be a greater burden in sub-Saharan Africa as 34% of patients are aged between 15 and 24 years, whereas globally 22% of the HIV+ population are aged between 15 and 24 (UNAIDS, 2016). Studies show that 40% to 66% of stroke survivors still require assistance with activities of daily living (ADL) and mobility (Verma, Arya, Sharma & Garg, 2012; Connor, Thorogoog, Casserly, Dobson & Warlow, 2004). The inability to perform ADL impairs workability and the ability to be a functional member of society, putting further strain on the sub-Saharan economy (Mochan et al., 2003).

HIV in itself can negatively affect an infected person's physical and cognitive well-being (Moore, Letendre, Morris… & Grant, 2011; Woods, Moore, Weber & Grant, 2009; Dudgeon, Phillips, Carson, Sarson, Brewer, Durbstein & Hand, 2006). The added neurological impairments caused by conditions such as stroke may lead to these patients being more dependent and unable to be productive members of society (Mochan et al., 2003). More importantly, the quality of life of these individuals decreases drastically with these compounding conditions (Rouillard, de Weerdt, De Wit & Jelsma, 2012; Hughes, Jelsma, Maclean, Darder & Tinise, 2004).

Rehabilitation post stroke is aimed at improving quality of life by enhancing physical and cognitive well-being (Kitzman, Hudson, Sylvia, Feltner & Lovins, 2017; Langhorne, Bernhardt & Kwakkel, 2011). It is aimed at attaining the highest level of functional independence so that the patients may be reintegrated into their communities (Kitzman et al., 2017; Langhorne et al., 2011). Functional outcomes may differ between conventional and HIV+stroke patients due to demographic differences between groups as well as risk factors and disease manifestations (Heikinheimo et al., 2012; Tipping et al., 2007; Kumwenda, Mateyu, Kampondeni, van Dam, van Lieshout & Zijlstra, 2005). It is postulated therefore that the management of these groups would also differ.

Little is known about the functional outcomes of HIV+ stroke individuals living in sub-Saharan Africa. Hence, the current study is aimed at describing the differences in functional outcomes of stroke patients in terms of their HIV status. To understand this better, Chapter two, the literature review and scoping review, discusses the findings and limitations of current literature as they pertain to functional outcomes of stroke patients in sub-Saharan Africa according to their HIV status. Chapter three elaborates on the aims and objectives and the methods used to implement and conduct the study based on the limitations found in current literature. Chapter four describes the results obtained from the current study and Chapter five further discusses the findings and their relation to literature. Chapter six concludes the findings of the current study, identifies its limitations and presents recommendations for future research.

Chapter 2: Literature Review

2.1 Introduction

Stroke as an HIV-related manifestation is an increasingly recognised and evolving issue, but it is poorly characterised due to the fact that most HIV/AIDS patients presenting with a stroke are likely to have underlying central nervous system infection or tumours that are responsible for their symptoms (Modi, Modi & Mochan, 2008). Given that these patients are considerably younger than stroke patients who are HIV negative (HIV-), the aetiology or cause of stroke may be different and the diagnosis of stroke initially may be seen as unlikely (Modi et al., 2008). This literature review focuses on the relationship between HIV and stroke as well as the functional outcomes of the HIV+ group.

The aim of this literature review is to understand the relationship between stroke and HIV and to review the current literature on the functional outcome of HIV+ patients who have suffered a stroke.

This review describes HIV and stroke as separate entities, particularly their effects on patient function in terms of morbidity and mortality. A scoping review was also conducted to describe the causal relationship between HIV and stroke, showing the demographics and risk factors of these patients in Southern Africa, and reviewing the current literature describing the functional outcomes of HIV+ stroke patients.

2.2 A General Overview of HIV, Stroke and HIV Positive Stroke Patients

HIV is a group of retroviruses in which clinical symptoms take years to develop and patients are diagnosed only in the late stages of HIV or advanced AIDS (Senocak, Oguz, Ozgen, Ozgen, Kurne, Ozkaya, Unal & Cilia, 2010). The virus infiltrates the blood stream by infecting the CD4+ cells that are immune cells (Ellis et al., 2009). The virus reproduces quickly and infects the macrophages that also assist with the body's immunity. Macrophages play a vital part in the central nervous system (Ellis et al., 2009). They play an imperative part in the innate and adaptive immune response as they phagocytose pathogens and cellular debris. Macrophages also act as antigen presenting cells, triggering antibody responses when pathogen derived peptides are detected through the MHC-11 pathway to CD4 T cells and activating CD8 cytotoxic T cells by cross-presentation of HIV-1 antigens (Murray & Wynn, 2011; Ackerman & Cresswell, 2004). The CNS infections or abnormalities appear in 10% to 20% of HIV-infected patients (Ellis

et al., 2009; Mochan et al., 2003). Until these neurological manifestations, including stroke, arise many patients are not aware that they are HIV-infected.

The African continent is said to have a disproportionately high HIV-infected population. The global estimate of people living with HIV was 36.7 million for the year 2015, 19 million (approximately 52%) of whom reside in Eastern and Southern Africa (UNAIDS, 2016). Approximately seven million cases of HIV in South Africa were reported in 2015 (UNAIDS, 2016). The global mortality rate of AIDS related deaths in 2015 was 1.1 million; 470,000 of reported cases were from Eastern and Southern Africa (UNAIDS, 2016).

The HIV infected population is prone to chronic diarrhoea and weakness as well as a high prevalence of gastrointestinal disorders, leading to one of the most distinctive signs of HIV infection, known as the wasting syndrome (Dudgeon et al., 2006). This syndrome is defined as an involuntary weight loss of more than 10% of the baseline body weight (Dudgeon et al., 2006). This results in impaired functional ability and severe fatigue (Dudgeon et al., 2006). Robinson-Papp, Byrd, Mindt, Oden, Simpson & Morgello (2008) report that there is a high prevalence of cognitive, behavioural and motor impairments in HIV-infected people. These impairments include loss of concentration, distractibility, unsteady gait, balance disturbances, dementia and sensory neuropathies (Moore et al., 2011; Woods et al., 2009). Physical deficits, with the added effect of neurological impairments, put a great strain on the ability of an HIV-infected individual to perform activities of daily living (ADL). Being dependent on basic ADLs impacts their ability to work and be functioning members of society. This puts a major burden on the sub-Saharan economy (Mochan et al., 2003).

The World Health Organization (WHO) describes stroke as a “rapidly developing clinical sign of focal, or at times/global disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than vascular origin” (WHO, 2002:108).

Cardiovascular diseases including stroke are predicted to exceed infectious diseases in their cause of morbidity and mortality in sub-Saharan Africa by the year 2020 (Yusuf, Hawken, Oupuu, Dans… & Linsheng, 2004). Due to the high mortality rates and health systems being under-resourced, stroke and non-communicable diseases are some of the main priorities in public healthcare in Africa (Chin, 2012). Globally, cardiovascular disease kills more people than tuberculosis, HIV and malaria combined. In South Africa during 2001, stroke was the fourth leading natural cause of mortality (Modi, Modi, Mochan,

2006). In the 2014 annual report by the Heart and Stroke Foundation South Africa, cardiovascular diseases, including stroke, are second only to HIV/AIDS in mortality rate. This report also stated that per day ±240 people suffer a stroke and 60 of those strokes will be fatal.

The burden of stroke is on the rise in many low and middle-income countries (LMIC), particularly sub-Saharan Africa (Feigin et al., 2014). This has been attributed to the increase in cardiovascular disease modifiable risk factors namely, hypertension, diabetes, obesity, and high levels of cholesterol (Heart and Stroke Foundation South Africa, 2015; Hoshino, Mizuno, Shimizu & Uchiyama, 2013). According to the 2014 annual report by The Heart and Stroke Foundation South Africa, one in three adults over the age of 15 years has hypertension and 49% of women and 74% of men are unaware that they are hypertensive. This report also states that there is a 10% prevalence of diabetes in the entire population and nearly one in four people have increased levels of cholesterol. Additionally, obesity is prevalent in two in three women, one in three men and a quarter of all children in South Africa. HIV itself is considered a risk factor for stroke due to the neurological and vascular manifestations infected patients are prone to (this will further be elaborated on in the scoping review). Ellis et al (2009) reports that up to 20% of HIV infected patients suffer various neurological conditions including stroke.

People who suffer a stroke may suffer variable degrees of severity and symptoms of stroke depending on the area of the brain affected. Some of the common symptoms are: hemiparesis; hemisensory loss; hemineglect; dysphasia; dysarthria; ataxia; visual impairments; hearing impairments and vertigo (Markus, 2012). These impairments affect patient function and ultimately their ADL and quality of life. These impairments may be so severe that patients are no longer able to continue work or may need full-time care. Stroke with the added effects and impairment of HIV is thus of great concern for quality of life and is a heavy burden on the economy (Mochan et al., 2003).

2.3 Scoping Review on the Functional Outcomes of HIV PositiveStroke Patients

2.3.1 Searching

A search was conducted for relevant articles related to the functional outcomes of HIV+ stroke patients in sub-Saharan Africa during April 2015 by one researcher using the Stellenbosch University library website. The following databases were searched namely: Pubmed; Ebscohost; Scopus; Cochrane and PEDro.

The search strings used are listed below.

- HIV AND cerebrovascular infarction.
- HIV AND cerebrovascular accident.
- HIV AND cerebrovascular event.
- HIV AND ischemic cerebrovascular events.
- HIV AND intracerebral hemorrhage.
- HIV AND hemorrhagic stroke.
- Stroke AND HIV.
- Stroke AND HIV AND outcomes.
- Stroke AND HIV AND functional outcomes.
- Stroke AND HIV AND prognosis.
- Stroke AND HIV AND ICF.

2.3.2 Study eligibility

Inclusion criteria

- Published between January 1995 and March 2015.
- Conducted in sub-Saharan Africa.
- Written in English.
- HIV positive patients' with first ever stroke.
- Studies that looked at the association of HIV and stroke.
- Studies reported on patients' functional ability post stroke.

Exclusion criteria

Studies were excluded if they were not looking at adults and/or if they were pharmacological studies.

2.3.3 Study selection and data extraction

One reviewer independently screened and evaluated the titles, abstracts and then full texts of all publications supplied by the search strategy for potentially relevant publications. Full texts were retrieved by accessing electronic journals, manually searching journals or by contacting the authors via e-mail. Any uncertainty regarding paper selection and data extraction was resolved by consensus and discussion with supervisors if needed. The same reviewer independently extracted all relevant data items from the included papers, using an electronic data extraction form. The data form was compiled by the researcher in consultation with supervisors to optimise data synthesis.

2.3.4 Methods of analysis and synthesis

Included papers were assessed for homogenous data, such as comparable patient populations and outcome measures. Due to the heterogeneity of the data, statistical pooling was not appropriate and the results were summarised in a narrative form.

2.4 Results of the Scoping Review

2.4.1 Publications

The searches initially yielded 2,996 articles. Thereafter 1,772 duplicates were removed. Of the remaining articles, eleven were selected; seven South African studies (Modi et al., 2008; Modi, Hari, Modi & Mochan, 2007; Tipping et al., 2007; Modi et al., 2006; Patel, Sacoor, Francis, Bill, Bhigjee & Connolly, 2005; Mochan et al.,2003; Hoffman, Berger, Nath & Rayens, 2000), two Malawian studies (Heikinheimo et al., 2012; Kumwenda et al., 2005), one Tanzanian (Mlay & Bakari, 2010) and one Kenyan (Jowi, Mativo & Musoke, 2007) study were included.

2.4.2 Findings of scoping review

The scoping review describes the manifestations of HIV+ stroke patients in terms of neurological and vascular factors, as well as the effect of antiretroviral treatment and its relationship with stroke in HIV+ individuals. Furthermore, the demographics, risk factors and functional outcomes of the HIV+ stroke population in sub-Saharan Africa are described, and whether or not methods and outcome measures used were appropriate in describing their functional outcome.

2.4.2.1 Neurological manifestations caused by HIV

Mlay and Bakari (2010) reported that many studies seem to confirm HIV infection as a risk factor for stroke, but the underlying mechanism remains unclear. It has been said that the diagnosis of neurological manifestations is often delayed because in most instances the clinical presentation goes unnoticed, as they are subtle in the early stages of HIV (Jowi et al., 2007). It is thought that the CNS is one of the main sites for HIV infection (Peridsky, Stins, Way, Witte, Weinand, Kim, Bock, Gendelman & Fiala, 1997) and CNS infections happen as early as the first week of being infected (Albright, Soldon & Gonzalez-Scarano, 2003; Gartner & Liu, 2002). HIV is believed to enter the CNS via infected immune cells (CD4+ lymphocytes) or as a free virus, crossing one of the physical barriers that protect the CNS, namely the brain blood barrier and/or the cerebrospinal fluid (Albright et al., 2003). HIV being neurotropic, enters the glial cells via the surface and co-receptors (Albright et al., 2003; Gartner & Liu, 2002). The primary receptor is the CD4+ molecule and the co-receptors are CCR5 and CX CR4 (Jowi et al., 2007; Albright et al., 2003; Gartner & Liu, 2002). The primary receptors, along with other factors, increase the incidence of HIV/AIDS opportunistic infections (Li, Galey, Mattson & Nath, 2005). These factors may also include CD4 count depletion, immune dysfunction, chronic hyper immune activation and neuronal damage (Li et al., 2005).

There are two basic categories of HIV/AIDS neurological manifestations. The first category is primary HIV infection such as aseptic meningitis, HIV associated dementia, minor cognitive motor disorders, myelopathy, myopathy and peripheral neuropathy. The second category is opportunistic infections such as cryptococcal meningitis, encephalitis, tuberculosis (TB), CNS lymphoma, amongst others (Brew, Pemberton, Cunningham & Law, 1997). Another group of manifestations is the vasculitis phenomenon that is related to anti-thrombin and protein deficiency. These include ischemic stroke, intracranial hemorrhage, subdural haematoma, deep vein thrombosis and cerebral venous sinus thrombosis (Jowi & Musoke, 2004).

2.4.2.2 Vascular manifestations caused by HIV

Various HIV/AIDS neurological consequences have been shown to manifest according to CD4 count levels (Bartlett, 2002). The majority of severe complications, such as TB meningitis and HIV associated dementia complex, occur when CD4 cell count is below 200 (Jowi et al., 2010). In a severe immune compromised state where the CD4 count is

below 100, complications such as cerebral toxoplasmosis and cryptococcal meningitis occur (Jowi et al., 2007; Bartlett, 2002).

Patients with low CD4 counts usually have an increased risk of coronary event through atherosclerosis (Mlay & Bakari, 2010). Other studies suggest that HIV patients have increased systemic inflammation, making them susceptible to atherosclerosis (Stollberger & Finsterer, 2002). It is presumed that vascular damage induced HIV can result in coagulopathy by induced autoantibodies and protein deficiency (Mochan, Modi & Modi, 2005).

These vascular manifestations often result in stroke (Mochan et al., 2005). MRI and CT scans are critical in not only diagnosing but also distinguishing any differences between the HIV+ strokes and HIV- strokes. The main clinical subtypes were cerebral infarctions and intracerebral hemorrhage, as seen in all eleven studies included in the scoping review. In most studies cerebral infarcts constituted the majority of strokes ranging from 58% to 96% in the HIV+ population (Heinkinheimo et al., 2012; Tipping et al., 2007; Patel et al., 2005; Kumwenda et al., 2005; Modi et al., 2003). In these studies, no significant differences were reported between the HIV+ and HIV- groups with regard to the cerebral infarction. However, the majority of hemorrhagic strokes occurred in the HIV- group, possibly due to hypertension (Heinkinheimo et al., 2012; Tipping et al., 2007; Patel et al., 2005). There was, however, a statistical significance between HIV+ and HIV- groups with regard to large vessel occlusion and other vasculopathic findings, with the HIV+ group having a significantly higher large vessel occlusion, as reported by two studies (Modi et al., 2008; Hoffmann et al., 2000). Thus, considering the degree to which HIV+ individuals are affected neurologically, it is clear that the severity of stroke and extent of damage impact greatly on patient prognosis and outcome.

2.4.2.3 Antiretroviral (ARV) drugs

The standard adult antiretroviral therapy (ART) consists of a combination of at least three ARV drugs. They are used to maximally suppress the HIV and stop the progression of the disease with suppressive ART regimes. There are also non-suppressive ART regimes to reduce mother to child transmission or for healthcare workers following a low risk occupational exposure which normally consist of prophylaxis (Meintjies, Black, Conradie… & Wilson., 2014).

The main aims of ART are “to improve quality of life; reduce HIV-related morbidity and mortality, provide maximal and durable suppression of viral load (VL); restore and/or

preserve immune function." (Meintjies et al., 2014:121, 1). These aims are attained by suppressing viral replication entirely for as long as possible, using well-tolerated and maintainable treatment taken with good adherence. With lengthy viral suppression, the CD4+ lymphocyte count generally increases, which is accompanied by a renewal of pathogen-specific immune function. For most patients this results in a significant decrease in the risk of HIV-associated morbidity and mortality. It is still uncertain whether immune function ever returns to complete normality. Long-term cohorts show that patients who adhere well to ART (refer to Table 2.1) have a near-normal life expectancy (Johnson, Mossong, Dorrington… & Boulle, 2013).

Table 2.1: Classes of ARV Agents

Class	Abbreviation	Mechanism of action	Specific action
Nucleoside and nucleotide reverse transcriptase inhibitors	NRTIs and NtRTIs	Reverse transcriptase inhibition	Nucleic acid analogues mimic the normal building blocks of DNA, preventing transcription of viral RNA to DNA
Non-nucleoside reverse transcriptase inhibitors	NNRTIs	Reverse transcriptase inhibition	Alter the conformation of the catalytic site of reverse transcriptase and directly inhibit its action
Protease inhibitors	PIs	Protease inhibition	Inhibit the final maturation stages of HIV replication, resulting in the formation of non-infective viral particles
Integrase inhibitors (also termed integrase strand transfer inhibitors)	InSTIs	Inhibition of viral integration	Prevent the transfer of proviral DNA strands into the host chromosomal DNA
Entry inhibitors	-	Entry inhibition	Bind to viral gp41 or gp120 or host cell CD4+ or chemokine (CCR5) receptors
ARV = antiretroviral; CCR5 = C-C chemokine receptor type 5.			

(Meintjies, Black, Conradie et al., 2014)

The use of ARV therapy has been suggested to have an associated risk for cerebrovascular events including stroke via several metabolic complications that include hyperlipidemia, which is an established risk for cerebrovascular events (Brown, Cole, Li,

Kingsley, Palella, Riddler, Visscher, Margolick & Dobs, 2005). A review done by Modi et al. (2008) shows that evidence with respect to protease inhibitor ARVs can cause accelerated atherosclerosis with an increased risk of myocardial infarction. The observation of pathological and clinical studies is that stroke occurs in the advanced HIV infection but the role ARVs have in the causation of stroke remains controversial (Modi et al., 2008). The review by Modi et al. (2008) states that more case-control studies are needed to identify the atherogenicity in HIV patients on ARVs, as well as ARV naïve patients both with and without stroke.

Most studies have focused on the association and mechanism which include ARVs that cause stroke in the HIV positive population with the majority of these patients being ARV naïve (Mlay & Bakari, 2010; Modi et al. 2008; Jowi et al., 2007; Kumwenda et al., 2005; Mochan et al., 2005). Therefore, a clear conclusion on whether or not ARVs result in stroke cannot be confirmed.

2.4.2.4 Demographics of HIV+ stroke population in sub-Saharan Africa

In order to get a better sense of the HIV status of populations in sub-Saharan Africa, it is necessary to review the demographics of these countries. Most studies included in this scoping review showed that the majority of people with HIV were female, although the male to female ratio was not statistically significant (Heikinheimo, 2012; Mlay & Bakari, 2010; Tipping et al., 2007; Modi et al., 2007; Kumwenda et al., 2005; Patel et al., 2005; Mochan et al., 2003).

Although stroke is more common in the elderly, 25% of strokes occur in young adults who are HIV+, thus it is considered a risk factor for stroke in the younger population (Hoffmann, 2000). A common thread throughout was that HIV+ individuals with stroke were significantly younger than those without HIV (Heikinkeimo et al., 2012; Tipping et al., 2007; Kumwenda et al., 2005; Hoffmann et al., 2000). Nine of the eleven included studies reported this difference (Heikinkeimo et al., 2012; Tipping et al., 2007; Kumwenda et al., 2005; Hoffmann et al., 2000).

The mean age of the HIV+ stroke patients was also similar throughout the eleven included studies. In a study conducted by Tipping et al. (2007) in Johannesburg, South Africa, 6.16% of their stroke population was HIV+. Of the 6.16%, 91% were below 45 years of age and their mean age was 33.4 years, whereas the control group's mean age was 64 years. In a study conducted in Malawi (Kumwenda et al., 2005) where 48% of the sample population were HIV+, HIV+ patients had a mean age of 37.5 years, whereas HIV-

patients had a mean age of 58.6 years. This Malawian study also reported a bimodal pattern distribution with peaks at 21 to 30 years (with 74% of HIV patients) and more than 60 years (with 8% of the HIV population) indicating that the majority of the HIV+ patients were younger (Kumwenda et al., 2005). In another Malawian study (Heikinheimo et al., 2012), a similar difference was noted in the mean age of HIV+ participants being younger with a statistical significance of $p<0.0001$. A study conducted in Johannesburg, South Africa (Modi et al., 2006), discovered that 92% of HIV+ participants who had neurological manifestations were aged between 21 and 50 years; with a mean age of 37 years.

Markus (2012) conducted a study looking at causes and clinical features of stroke in the HIV- population. He reported that there was a higher percentage of stroke patients who were of black ethnicity compared to those who were white in the United Kingdom and America. Both hemorrhagic and ischemic stroke were increased in the black population, which he related to an increase in hypertension. A study conducted in KwaZulu Natal, South Africa by Hoffmann et al. (2000) showed significant differences between races. This study compared not only HIV+ and HIV- participants, but white and black ethnicities as well. Their control groups consisted of white and black HIV- participants. A significant difference was noted, since the mean age for the total population of white patients was 61 years, and the black population 41.5 years. Of a total of 1,298 stroke patients, 2.02% were HIV+, 96% of whom were black, the other percentage was Asian. The mean age for the black HIV+ group was 29.1 years while the control group of black HIV- patients was 31 years. There was no significant difference between these two groups. With none of the white population being HIV+, the comparison between the race groups could not be made with regard to the effect of HIV and stroke and its relation to their age. However, this study reiterates what previous studies have reported i.e. that HIV+ patients have a significantly younger mean age, showing that HIV may be a risk factor for stroke (Hoffmann et al., 2000).

It is important to note that these findings cannot be applied to the general population as none of these studies were epidemiological studies. Eight studies were hospital based, limited to one location (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007; Patel et al., 2005; Kumwenda et al., 2005; Mochan et al., 2003); two of the studies excluded patients over 50 years of age (Tipping et al., 2007; Patel et al., 2005). These led to selection biases or samples of convenience that were not representative of the entire population. The exclusion of people of a certain age

was also not reflective of the entire population, hence, a conclusion could not be drawn nor could study results be applied to their specific country or the sub-Saharan population. Epidemiological studies as well as large cohorts are needed to gather data that are more appropriate on the demographics of the HIV+ stroke population in sub-Saharan Africa.

2.4.2.5. Risk factors for HIV associated stroke

As pointed out before, HIV in itself may be a risk factor for stroke. Hoffmann et al. (2000) and Tipping et al. (2007) stated that the presentation of first stroke often coincided with the diagnosis of HIV in individuals who were unaware of their status. These authors suspected that these patients, being significantly younger, did not have the usual risk factors for stroke. Another study resulted in similar findings with young stroke patients being more likely to have HIV than the common risk factors such as hypertension, diabetes, excessive smoking and drinking (Heikinheimo et al., 2012). Seven of the eleven studies yielded similar results with thrombosis and opportunistic infections being the main causes of stroke in the HIV+ population (Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007; Kumwenda et al., 2005; Patel et al., 2005; Modi et al., 2003; Hoffmann, 2000).

All included studies evaluated participants for associated risk factors; past medical history was taken into account, and laboratory investigations were undertaken. Blood analysis was conducted. The most frequently used blood analysis test in indicating HIV severity, was checking the CD4 count levels. Five studies had similar findings and showed that a CD4 count of less than 200 cells/mm^3 was seen in most HIV+ stroke patients (Heikinheimo et al., 2012; Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007; Mlay & Bakari, 2010). This seems to support the assumption that suggests that stroke in HIV-infected patients occurs in the late stages of HIV or in extremely immune-compromised patients (Mlay & Bakari, 2010; Modi et al., 2008; Modi et al., 2006). Mlay and Bakari (2010) stated that early detection of HIV is imperative as stroke may be a late manifestation of HIV infection.

Another common investigation was cerebrospinal fluid via lumbar puncture (Kumwenda et al., 2005). In a study conducted by Mochan et al. (2003) 86.84% of HIV+ patients had lumbar punctures, 55% of which had abnormalities. Of these, 27.27% had meningitis, 9.09% had isolated lymphocytes and 18.18% had isolated raised protein levels. In another study it was found that of 150 HIV+ patients, 59 underwent a lumbar puncture. Of these patients 67.8% had 0 to 5 white cells/mm^3 and 45.76% of them presented with a stroke; 10.17% had infection and 11.86% had other diagnoses. Of the patients who had

6 to 100 white cells/mm³, 18.64% had a stroke, 1.7% had infection and 5.08% had other diagnoses, 6.78% of the patients had white cells more than 100 cells/mm³. Of those, 5.08% had TB meningitis and 1.7% had cerebral toxoplasmosis (Kumwenda et al., 2005). Five studies had similar findings and suggested that stroke in HIV patients may have a strong correlation with opportunistic infections (Tipping et al., 2007; Kumwenda et al., 2005; Patel et al., 2005; Mochan et al., 2003; Hoffmann et al., 2000). The risk factors of opportunistic infections in these studies were more prevalent than the conventional risk factors of hypertension, diabetes and long-term substance abuse (Modi et al., 2007; Jowi et al., 2007; Kumwenda et al., 2005).

Cardiac evaluations are important, as cardiovascular disease is a known risk factor for stroke (Kumwenda, 2005; Mochan et al., 2003). Four studies reported in their findings on cardiac evaluations that no significant results were found with regard to HIV status (Kumwenda et al., 2005; Mochan et al., 2005; Patel et al., 2005; Hoffmann et al., 2000) but results showed significant correlation with age. Patients over 40 years old in both HIV+ and HIV- groups were prone to cardiac conditions (Kumwenda et al., 2005; Mochan et al., 2003).

The usual risk factors for stroke such as diabetes mellitus and hypertension were not common features in the HIV+ population as they were significantly younger (Heikinheimo et al., 2012; Tipping et al., 2007; Hoffmann, 2000). In a study conducted by Heikinheimo et al. (2012), comparing HIV+ and HIV- stroke patients, of 147 first ever stroke patients, it was found that hypertension was significantly less of a risk factor with a significant difference between HIV+ and HIV- population of $p<0.0001$. These risk factors were again strongly correlated with age (Heikinheimo et al., 2012; Tipping et al., 2007; Hoffmann et al., 2000). The more common risk factors in HIV+ patients were vasculitis, coagulopathy (specifically protein S deficiency), cardiac embolism and opportunistic infections with the odds ratio (OR) of 6.4 (95% CI 3.1 to 13.2) as reported by Tipping et al. (2005). These results were also noted in two other studies (Heikinheimo et al., 2012; Mochan et al., 2003;). Deep vein thrombosis was significantly more common in the HIV+ population as seen in Tipping et al. (2007) with a statistical significance of $p = 0.02$. These risk factors also correlate with the significantly common ischemic stroke in HIV+ patients (Heikiniheimo et al., 2012; Tipping et al., 2007; Mochan et al., 2003).

In summary, conclusions could not be drawn from the four studies that compared HIV- and HIV+ stroke populations in terms of risk factors and demographics (Heikinheimo et

al., 2012; Mlay & Bakari, 2010; Patel et al., 2005; Kumwenda et al., 2005). Further research is needed with HIV+ and HIV- stroke groups who are age matched and have similar risk factors.

2.4.2.6. Outcome measures used to assess function in scoping review

To describe functional outcome adequately, relevant outcome measures should be used which appropriately describe function according to the International Classification of Functioning, Disability and Health (ICF). The ICF is a "multipurpose classification system designed to serve various disciplines and sectors" (WHO 2001:5). The ICF describes functioning as an "umbrella term for body function, body structures, activities and participation. It denotes the positive or neutral aspects of the interaction between a person's health condition(s) and that individual's contextual factors (environment and personal factors)" (WHO 2001:8,10). It also describes disability as "an umbrella term for impairments, activity limitations and participation restrictions. It denotes the negative aspects of the interaction between a person's health condition(s) and that individual's contextual factors (environmental and personal factors)" (WHO 2001:8,10). It is imperative that outcome measures encompass all the factors that make up function. Functional outcome measures are focused mainly on assessing a person's ability to perform ADL that are related to activities and participation components of the ICF (Scheepers, Ketelaar, van de Port, Visser-Meily, de Groot, Twisk & Lindeman, 2007). Functional outcome measures and the ICF are applied simultaneously to stroke rehabilitation, so understanding their relationship and which outcome measures are most appropriate is imperative (Stucki, Ewert & Cieza, 2003).

A total of four outcome measures were identified in the scoping review namely the Modified Rankin Scale, Canadian Neurological Scale, National Institute of Health and Stroke Scale and the Barthel Index. Each outcome measure and its psychometric properties will be discussed in this section.

i) *Modified Rankin Scale (mRS)*

The mRankin Scale is a commonly used scale to measure the degree of disability or dependence in activities of daily living (Bonita & Beaglehole, 1988; Rankin, 1957). Patients are given a score, ranging from one to six, which rates their degree of disability. Higher scores indicate more severe disability. A score of one indicates that patients have no significant disability and are able to carry out their usual daily activities. A score of two indicates slight disability where patients are unable to carry out all previous activities but are able to look after their own affairs without assistance. Three shows moderate disability where patients need help but are able to walk without assistance. Four indicates moderately severe disability where patients require assistance with all daily activities. A score of five shows severe disability where patients are bedridden, incontinent and require nursing care. A score of six indicates death.

A study conducted by Kasner (2006) who looked at the clinical interpretation of several stroke scales showed that the mRankin Scale lacks in inter-rater reliability. Due to the scale being so global and lacking more specific questions the authors suggested a structured interview. The scale has moderate concurrent validity with respect to infarct volumes that are similar to the Barthel Index, which is seen as the gold standard stroke scale. The mRankin Scale's construct validity has been shown to have excellent agreement with other rating scales such as the Glasgow Outcome Scale (Kasner, 2006). This scale is more suitable for (bio)medical investigations for infarct volumes and risk of mortality (Kasner, 2006).

ii) *Canadian Neurological Scale (CN scale)*

The CN scale is a tool used to monitor and evaluate the neurological symptoms of stroke patients in the acute phase (Cote, Battista, Wolfson et al., 1989; Bushnell, Johnston & Goldstein, 2001). The scale is divided into three subsections namely, mentation which assesses level of consciousness, orientation and speech. It also assesses the non-comprehensive deficit and comprehensive deficits (symmetry and weakness) of the face, upper and lower limbs (Cote, Battista, Wolfson, Boucher, Adam & Hachinski, 1989; Bushnell, Johnston & Goldstein, 2001). Each domain is assigned a score, and a total score from 1.5 to 11.5 is calculated (Cote et al., 1989). Muscle power is scored according to no weakness, mild weakness or severe weakness. No weakness scores 1.5; mild scores 1.0; severe weakness scores 0.5; and no movement scores 0.0. Each domain is scored similarly (Cote et al., 1989).

In a study conducted by Stavem, Lossius & Ronning (2003) a retrospective algorithm was used to evaluate the CN scale. A high inter-rater reliability was found as well as a high predictive validity. This was also a global scale more suitable for (bio)medical purposes to predict mortality and disability. Functional limitations were not assessed adequately using this scale.

iii) *National Institute of Health and Stroke Scale (NIHSS)*

The NIHSS is another assessment tool often used in the acute phase and follow-up evaluation (Meyer & Lyden, 2009). The assessment can be applied at baseline, two hours post stroke, 24 hours post stroke, seven to ten days post stroke, three months post stroke and where relevant. It assesses 11 categories. The first construct assessed is level of consciousness; second is best gaze (eye movement), third is vision or checking visual fields, fourth is facial palsy, fifth is motor function of the arms, sixth is motor function of the legs, seventh is the assessment of ataxia in the limbs, eighth is testing the sensation of touch, ninth is the assessment of best language, tenth assesses dysarthria and the eleventh category assesses the extinction and inattention or, in other words, neglect of the affected side (Meyer & Lyden, 2009).

Its reliability and validity have been established for prospective clinical research and its predictive validity for long-term stroke outcome (Kasner, 2006). Its intra-rater reliability is high but this has been established only with studies where raters were trained in using the NIHSS. It also has good concurrent validity in detecting infarct volumes (Kasner, 2006). The NIHSS is a global scale used mainly by doctors and paramedics to predict mortality and stroke severity (Kasner, 2006).

iv) *Gold standard - Barthel Index*

The Barthel Index (BI) is a commonly used outcome measure of functional disability. This index measures the degree to which somebody can function independently and has mobility in their ADLs, i.e. feeding, bathing, grooming, dressing, bowel control, bladder control, toileting, chair transfer, ambulation and stair climbing. These ten items are each scored from zero to five or zero to ten. The index indicates the need for assistance with these particular ADLs (Loewen & Anderson, 1990).

In terms of its psychometric properties, the BI has been shown to have good reliability and validity. In a study conducted by Hsueh, Lin, Jeng, Hsieh (2002) the BI was shown to have high concurrent validity and had a high responsiveness to detecting changes in ADLs. In another study by van der Putten, Hobart, Freeman & Thompson (1999) the BI

was compared to the functional independence measurement (FIM) scale, which is a widely used scale for stroke patients. Even though the FIM scale had more items, it was shown to have no advantage over the BI and was simpler and quicker to use. The reliability of the BI was shown to be excellent as reported by Collin et al. (1988); the BI had excellent test-retest reliability (k = 0.93) for both trained and untrained raters and this was echoed by Wolfe, Taub, Woodrow & Burney (1991) (k = 0.98). The BI also had excellent inter-rater reliability (k = 0.94) as seen in a study conducted by Hsueh, Lee & Hseih (2001).

Choosing an outcome measure for research or clinical purposes requires information on the specific content at item level. Unfortunately, the selection procedure is determined mainly by measures that are readily at hand (Finch, Brook, Stratford & Mayo, 2002) or is directed only by the psychometric properties. Scheepers et al. (2007) suggested that more emphasis should be placed on the question of whether an outcome measure is appropriate (Wade, 1992), i.e. which specific items should be measured and which outcome measures match these items. The ICF provides a framework to evaluate the content of a measure in a systematic way. Scheepers et al. (2007) used an ICF tool to evaluate outcome measures and found the mRankin Scale to be general and viewed it as a global health index (de Haan, Limburg, Bossuyt, van der Meulen & Aaronson, 1995). However, used in conjuction with the BI, as is common in stroke literature, the mRS could be a useful tool to gauge stroke severity (Cioncoloni, Tassi, Acampa, Guideri, Bielli, Martini & Mazzocchio, 2012; Huybrechts & Caro, 2007; Sulter, Steen & De Keyser, 1999).

2.4.3 Results of scoping review

Scoping review primary study articles are summarized in Table 2.2

Table 2.2: Primary Study Article Summaries **Page 1 of 2**

Name	Year	Study design	Country	Setting	Sample	Age	Gender	HIV status	Primary and secondary outcomes	Functional assessed	Outcome measures	Findings
Heikinheimo et al	2012	Prospective cohort	Malawi- Queen Elizabeth Central Hospital	Hospital based	n= 147	18 years or older, mean: 54.2 years. HIV+ mean: 39.8 yrs HIV- mean: 61.9 yrs	Both male and female	Both HIV+ and HIV-	To determine the functional outcome of first ever stroke at one year follow up in a population with a high prevalence of HIV.Secondary aim was to determine effect of baseline demographics, including presence of HIV infection	No specific function	mRankin Scale, NIHSS	No significant results found for outcome measures
Mlay &Bakari	2010	Cross-sectional	Tanzanian-Muhimbil National Hospital Dar es Salaam	Hospital	n= 215 20.9% HIV+)	Mean age of HIV+: 47.2 yrs HIV-: 56.1 yrs (p<0.001)	Both male and female	Both HIV+ and HIV-	To determine the prevalence of HIV and assess its impact on the clinical presentation and outcome of patients admitted with stroke	Commented on outcome	No outcome measure used	No significant results for outcome
Modi et al	2007	Prospective cohort	South Africa-Helen Joseph Hospital	Hospital	n= 506	Mean age 37 yrs	Both male and female	HIV only	To determine the frequency and spectrum of neurological illnesses in black South African hospital based HIV infected pts	Commented on outcome	No Outcome measure used	No comment on functional outcome but stated that the neurological profile in HIV patients are related to their environment and CD4 count
Tipping et al	2007	Prospective cohort	South Africa-Groote Schuur Hospital	UCT- stroke register	n= 1089	<46 yrs of age included only. Mean age 33.4 yrs	Both male and female	HIV only	To report the nature of stroke in pts infected with HIV in a region with high HIV prevalence and to describe HIV associated vasculopathy	No specific function	mRankin scale	No significant results for outcome

Table 2.2: Primary Study Article Summaries												
											Page 2 of 2	
Name	**Year**	**Study design**	**Country**	**Setting**	**Sample**	**Age**	**Gender**	**HIV status**	**Primary and secondary outcomes**	**Functional assessed**	**Outcome measures**	**Findings**
Jowi et al	2007	Retrospective cohort	Kenya- Mairobi Hospital	Hospital based	n= 708 HIV+ pts, 150 neuro manifestations 12.7% stroke	Mean age 38.84 yrs	Both male and female	HIV only	To determine the profile of clinical and laboratory characteristics of hospitalized HIV positive pts with neurological complications	Commented on physical outcome	No measure	Mention that all patients were discharged home with 50% having motor deficits, 12.7% of these being stroke patients
Patel et al	2005	Cross-sectional	South Africa-Durban-Ihkosi Albat Luthuli Hospital	Hospital based	n= 594	n= 293 aged 15-44	Both male and female	Both HIV+ and HIV-	To determine whether HIV seropositivity confers a predisposition to stroke by comparing age-matched HIV+ and HIV- black African patients with cerebrovascular disease	No mention of outcome	No outcome measures	HIV+ and HIV- groups did not differ in cardiac nor serologic tests. An HIV+ test does not provide causal information or diagnosis
Kumwenda et al	2005	Prospective cohort	Malawi- Queen Elizabeth Central Hospital	Hospital based	n= 98 HIV+ = 47 HIV- = 51	Mean age- 37.5 yrs	Both male and female	Both HIV+ and HIV -	To study causes of stroke in areas with high HIV prevalence	Commented on initial physical findings	No outcome measures	On discharge- HIV+ : 7 of 47 patients were alive and not disabled; 33 of 47 alive and disabled; 6 of 47 died; 1 absconded HIV-: 8 of 51 alive and not disabled; 36 of 51 alive and disabled; 7 died
Mochan et al	2003	Prospective cohort	South Africa-Chris Hani Baragwanith Hospital	Hospital Based	n= 35	Mean age 32.1 yrs	Both male and female	HIV only	To analyze the association of stroke in HIV+ black population	Commented on initial clinical findings	No outcome measures	Clinical presentation: 28% Hemiparesis; 11% Hemiparesis and hemisensory loss; 20% hemiparesis, hemisensory loss and hemianopia; 17% hemiparesis, hemisensory loss and hemianopia aphasia; 6% ataxia
Hoffmann	2000	Retrospective case control	South Africa-Durban	Durban stroke data bank	n= 1298 (16% HIV+)	15-49 yrsMean age of white pts- 61 yrs, black (HIV+ pts) 31 yrs	Both male and female	HIV + only	To elucidate the mechanism of an ischemic stroke in HIV infected population	No specific function	mRankin scale, Canadian neurological scale	No significant results

2.4.3.1. The functional outcomes of HIV Positive Stroke Patients

Eight studies commented on the clinical presentation and functional outcome of patients (Heikiheimo et al., 2012; Mlay & Bakari, 2010; Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007; Kumwenda et al., 2005; Mochan et al., 2003; Hoffmann et al., 2000), but only three used functional outcome measures (Heikinheimo et al., 2012; Tipping et al., 2007; Hoffmann et al., 2000). These studies briefly described clinical presentation in terms of patients being aphasic or having hemiplegia. Later their outcome was discussed comparing only the HIV+ and HIV- stroke patients and it was reported that no statistical difference was seen in their functional outcome.

Mlay and Bakari (2010), Kumwenda et al. (2005) and Mochan et al. (2003) found no significant difference between HIV+ and HIV- patients in terms of baseline physical findings such as facial asymmetry and hemiplegia. In terms of cognitive impairment Hoffmann et al. (2000) found that HIV+ patients had more cognitive impairments, but no statistically significant differences were found.

Hoffmann et al. (2000) measured the neurological deficit with the CN scale (Bushnell et al., 2001; Cote et al., 1989) as well as the mRankin Scale (Bonita & Beaglehole, 1988; Rankin, 1957) to assess the degree of disability. Neither neurological deficit nor degree of disability was statistically significantly different between HIV+ and HIV- patients. Hoffman et al. (2000) did not adequately report on what was found using the outcome measures, hence it was not possible to compare their results with other studies. The mRankin Scale was also used by Tipping et al. (2007); the mean score for HIV- patients was 4.2 and the mean score for the HIV+ group was 4 and no statistical differences were found. This study failed to describe findings or compare results to other similar studies.

Heikinheimo et al. (2012) did a one-year follow up assessing patients' functional levels on admission, using the mRankin Scale and the NIHSS. The NIHSS was conducted only on admission. On admission, six to eight weeks, six months, and one-year follow-up only the mRankin Scale was used. A total of 19.7% of 147 patients were transferred to residential rehabilitation units; 6.1% received outpatient therapy. No significant results were obtained on admission ($p = 0.46$). A significant difference ($p = 0.0920$) was found for the NIHSS in favour of the HIV+ group on admission. The significance for the NIHSS was $p = 0.092$. The scores for the mRankin Scale at six to eight weeks showed a significance of $p = 0.015$ in favour of the HIV+ group, with no significant difference at six

months (p = 0.58) and at one year (p = 0.29). At one year 46.6% of the sample population scored 0 to 3 (good outcome); 53.4% scored 4 to 6 (poor outcome) and 22.4% had died. No significance in relation to HIV status was noted. Severity of stroke was seen to be related to older age and female gender (Heikinheimo et al., 2012). This study also had an average post stroke length of stay of 15.7 days with no significant differences between HIV- and HIV+ patients. This differed from Mlay and Bakari (2010) where the length of stay for HIV- patients was 7.3 days and HIV+ with 10.3 days which demonstrated a significant difference (p = 0.001). Thirteen patients had had another non-fatal stroke at the one-year follow-up (Mlay & Bakari, 2010). Mlay and Bakari (2010) did not comment on treatment received or if patients had ongoing therapy for the entire year. No information was given on patient prognosis, if they would be able to function independently in the community or if they would need ongoing care and assistance. No information was given on patients who were previously working and if they would be able to return to their previous function.

The outcome measures used in the studies of this scoping review were too global and of little use in conveying patient functional outcomes according to the ICF as reported by Scheepers et al. (2007), and as seen with the mRankin Scale which was often used but from which limited information could be gathered. The outcome measures used by the studies in this scoping review gave very little information or detail about patient function in terms of ADLs or participation restriction and whether or not HIV+ patients would need full time care post stroke.

2.4.3.2. Limitations of the Scoping Review

The limitations were that the seven studies were either hospital based or patients were selected from a database. These results therefore could not be applied to the population of South Africa or of other sub-Saharan countries. Three South African studies were hospital based (Modi et al., 2007; Patel et al., 2005; Mochan et al., 2003) and two studies (Tipping et al., 2007; Hoffman et al., 2000) recruited their patients from a database, but these databases had patients from a specific region or hospital. All four other sub-Saharan studies were hospital based (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Jowi et al., 2007; Kumwenda et al., 2005). There were significant differences with regard to demographics and risk factors between HIV+ and HIV- groups in four studies that compared these groups (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Kumwenda et al., 2005; Patel et al., 2005). These differences make it difficult to draw a conclusion on

whether or not there were significant differences between HIV+ and HIV- stroke patients. Due to the fact that nine of the studies included being observational cohorts (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Modi et al., 2007; Jowi et al., 2007; Tipping et al., 2007; Kumwenda et al., 2005; Patel et al., 2005; Mochan et al., 2003; Hoffmann, 2000), the researchers had no control over the sample size in each group, and hence the HIV+ groups were always significantly smaller, which also influenced interpretation and generalisation. No sample size was calculated and therefore one cannot generalise these results.

Ten of the studies were based on the black ethnic population (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Modi et al., 2008; Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007; Modi et al., 2006; Kumwenda et al., 2005; Patel et al., 2005; Mochan et al., 2003). The eleventh study, which compared the black and white populations, still had 96% of its HIV+ participants being black (Hoffmann, 2000). This makes it hard to apply the findings to the general population. Standardised outcome measures were used in only three studies and their findings, except for one study that was not detailed or well documented (Heikinheimo et al., 2012; Tipping et al., 2007; Hoffmann, 2000). Studies that reported on functional outcomes gave minimal information on the outcome measures used or how reliable or valid these measures were in determining the functional outcomes of patients. No therapeutic protocol for rehabilitation interventions used was described. None of the included studies described the patients' previous functions and whether or not they were able to return to these functions, whether activities of daily living or even work.

The four studies that compared HIV+ and HIV- people concluded that there was no statistical significance between the HIV+ and HIV- stroke patients in terms of functional outcome (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Kumwenda et al., 2005; Patel et al., 2005). However, these groups were not matched in terms of demographics such as age nor risk factors such as hypertension or opportunistic infections, hence a conclusion could not be drawn. Age may have a role in functional recovery. Spengos and Vemmas (2010) conducted a study of young adults with stroke in Athens. Their findings were compared to other studies and the general consensus was that young stroke patients tend to have a good functional outcome. However, in a study conducted in South Korea by Lee, Sung, Jung & Dae-Il. (2011), it was found that only a minority of young Korean stroke patients returned to work post-stroke. The five studies that looked only at the HIV+ stroke population were biased by small sample sizes and being hospital based,

therefore their findings could not be generalised to the general population (Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007; Mochan et al., 2003; Hoffmann, 2000).

2.5 Conclusion

Thus far, a conclusion could not be drawn on whether or not HIV+ and HIV- stroke populations differ in functional outcomes. First, the comparison between the two groups could not be made due to the significant difference in demographics and risk factors. The sample sizes of the five studies that included HIV+ groups were small and the participants in the studies were not representative of the entire population. The studies included in this review used global outcome measures that were not specific enough to adequately describe function as in the ICF. Only three studies used functional outcomes and gave only brief descriptions of their findings. The outcome measures used were global scales used to determine mortality and severity of stroke, but they were not specific enough in determining functional outcomes in terms of returning to previous ADL, work, and whether or not these patients, being as young as they are, will live productive lives, or if they will be an economic burden on society. Even though Spengos and Vemmas (2010) found the functional outcomes of young stroke patients who were HIV- to be better than their older counterparts, this was not the case for the patients seen in this review, as they showed no significant difference from the older stroke patients who tended to have a poorer outcome. However, this cannot be confirmed with the current literature, as their results do not reflect the sub-Saharan population, and the outcome measures used in studies within the scoping review were not detailed enough to describe patient outcomes.

Chapter 3: Methodology

This chapter presents the research question, study objectives, study structure, study population, sampling and instrumentation. The procedure, data analysis and ethical considerations are also described.

3.1 Research Question

The research question posed is “What are the functional outcomes of post stroke patients following inpatient rehabilitation who are HIV positive, -negative and -undiagnosed?”

3.2 Study Objectives

To describe the functional outcomes of stroke patients in terms of activity or activity limitations on admission versus discharge from inpatient rehabilitation focusing on the following specific outcomes:

1) HIV status (HIV+, HIV- and undiagnosed) and immune status (CD4 count if relevant);
2) Severity of stroke using the Modified Rankin Scale;
3) Function in activities of daily living using the Barthel Index;
4) Level of independence using the Barthel Index;
5) Wheelchair or other assistive devices issued on discharge;
6) Balance, safety and risk of falling using the Berg Balance Scale (BBS) and pressure mapping.

Secondary objectives

To describe:

7) Demographics of participants admitted for inpatient rehabilitation in terms of age, gender and race;
8) Documented risk factors of stroke, i.e. hypertension, diabetes, opportunistic infections, etc.;
9) Length of stay at rehabilitation facility (from date of admission to date of discharge, including suspension or days at home);
10) Patient perception of quality of life and function on discharge from inpatient rehabilitation (EQ5D).

3.3 Study Design

A descriptive study design was chosen. This study design is used to estimate prevalence and describe associations as was intended in the current project to highlight the prevalence and association with regard to HIV+ stroke patients (Kelly, Clark, Brown & Sitzia, 2003). It allows for the use of quantitative (observational data) and qualitative (interviews) data making the study more feasible and countenancing for patient perception (Hulley, Cummings, Browner, Grady & Newman, 2013). The disadvantage is that interpretation is often muddied due to confounding variables (Kelley et al., 2003). However, when reporting on findings is done in a transparent manner, the researcher can overcome these disadvantages (von Elm, Altman, Egger, Pocock, Gotzche & Vandenbroucke, 2008).

3.4 Study Setting

This study was based at the Western Cape Rehabilitation Center (WCRC) located in Cape Town. The WCRC has a catchment area that encompasses the entire Western Cape province as well as the surrounding provinces with some admissions from the Northern and Eastern Cape provinces. Some patients are also referred from neighbouring countries such as Lesotho, Zimbabwe and Namibia. The conditions seen at the WCRC range from spinal cord to traumatic brain injuries, stroke and amputations (WCRC, 2015). The WCRC is a specialised rehabilitation centre for people with physical disabilities which accepts appropriate referrals from all levels of healthcare (WCRC, 2015). Clients are also able to refer themselves to the outpatient department for assessment and management purposes (WCRC, 2015).

The WCRC has a total of 156 available beds for comprehensive inpatient rehabilitation. Patients are treated until they are able to return home safely, back either to their previous ADL or into the care of relatives. Most patients are referred to their nearest community health centre or day hospital for follow up management (Hartley, 2015).

3.5 Study Population

The study population consisted of all patients over the age of 18 years who had their first ever stroke and were admitted for inpatient rehabilitation at the WCRC between 1 July and 15 November 2016.

3.6 Study Sample

All patients at the WCRC fitting the inclusion criteria, who were admitted from 1 July to 15 November 2016 and consented to participate in the study, were recruited.

3.7 Inclusion Criteria

Patients over 18 years of age admitted to the WCRC with first ever stroke, that were able to respond to simple verbal cues or commands were eligible for inclusion in this study. Participants needed to understand basic English and/or Afrikaans and/or isiXhosa.

3.8 Exclusion Criteria

Patients with stroke who presented with documented cardiac problems i.e. recent myocardial infarction, severe angina, left ventricular failure, congestive heart failure; renal insufficiency; liver insufficiency or failure; systemic infection; severe psychiatric disorder and pre-existing disability were excluded from this study (Duncan, Jorgensen & Wade, 2000). Individuals who were unable to understand basic English, Afrikaans or isiXhosa were also excluded.

3.9 Instrumentation

A number of outcome measures were used in this study, which focused on severity of stroke, function, balance and health-related quality of life. More information on these specific measures is provided below.

Functional outcome measures that have been closely linked to the ICF were used to assess stroke patients in this study (Stucki et al., 2003). The functional outcome measures used were focused mainly on assessing a person's ability to perform activities of daily living which are related to activities and participation components of the ICF (Scheepers et al., 2007). Along with a socio-demographic data sheet and medical history (Appendix

D), the following functional outcome measures (OM) were used: Modified Rankin Scale (mRS), Barthel Index (BI), the Berg Balance Scale (BBS) (Appendices E through G). Pressure mapping was utilised along with the BBS as an objective measure for patients' static standing balance. For gathering the patients' perception of their health-related quality of life, the European Quality of Life Five Domain Three Language Health Questionnaire **(**EQ5D) (Appendices H through J) was used.

The justification for selection and psychometric properties of the selected functional outcome measures are discussed below.

3.9.1 Modified Rankin Scale (mRS)

The mRS is a frequently used scale to assess stroke severity and dependence. Patients are given a score of 1 to 6, 1 being little to no dependence and 6 being death (Bonita & Beaglehole, 1988; Rankin, 1957). (Refer to 2.4.2.6.).

3.9.2 Barthel Index (BI)

The BI is the most widely used outcome measure of functional disability in the stroke population and is often the gold standard criterion to assess the validity of other measures (Salter, Jutai, Teasell, Foley, Bitensky & Bayley, 2005). It is also one of the simplest outcome measures to assess ADL. The BI requires no training and has been developed in many forms (Salter, Campbell, Richardson… & Teasell, 2013). This study utilised the 10-item index BI as a self-reported measure. Each item is scored between 0 to 10. (Refer to 2.4.2.6).

The index indicates the need for assistance with each item. It yields a total score of 100 with a higher score indicating an increased level in functional independence. A score of less than 60 is seen as unfavourable, indicating maximal assistance required with ADLs, a score of more than 60 is seen as a pivotal point in which patients are transitioning from dependency to assisted dependence and a score of 90 to 100 indicates slight dependence to complete indepedence (Sulter et al, 1999).

3.9.3 Berg Balance Scale (BBS)

The BBS provides a quantitative assessment of balance in older adults as well as determining risk of falls (Berg, Wood-Dauphinee, Williams & Maki, 1989). The scale consists of 14 items used in everyday life. The assessment requires easily accessible objects namely: a ruler, stopwatch, chair and a wide room in which to do a 360° turn (Berg, Wood-Dauphine & Williams, 1995). Patients are required to complete movements of

varying difficulty and maintain various positions independently. The items receive a score of 0 to 4 where a score of 0 indicates inability to do an activity and 4 means ability to complete the activity. The maximum score is 56 and a score of 45 or less indicates balance impairment (Berg, Wood-Dauphinee, Williams & Maki, 1992). A score of 41 to 56 indicates a low risk of falling whereas a score of 21 to 40 indicates a medium risk of falling and a score of 0 to 20 indicates a high risk of falling (Berg et al., 1992). On average it takes 10 to 15 minutes to complete the BBS (Berg et al., 1995).

The BBS has good validity as an outcome measure for balance with excellent concurrent validity in relation to the balance subscale of the Fugl-Meyer test (r = 0.90-0.92), the Postural Assessment Scale for Stroke Patients (0.92-0.95) as well as a high correlation with the Timed Up and Go test (r = -0.76) (Mao, Hsueh, Tang, Sheu & Hsieh, 2002; Berg et al., 1992). Its predictive validity was high to moderate with a moderate prediction of length of stay (Juneja, Czyrny & Linn, 1998). The BBS has excellent validity and is a feasible tool as it requires no special training and relatively little space and equipment (Salter et al., 2013).

Berg et al. (1995) showed excellent internal consistency as well as excellent intra-rater and inter-rater reliability (k = 0.97, k = 0.98 and k = 0.92 respectively) when assessing stroke patients. Flansbjer, Blom & Brogardh (2012) also found the BBS test-retest reliability to be excellent (k = 0.88). Overall the BBS shows excellent reliability when assessing the stroke population (Salter et al., 2013).

In summary, it has been reported that both of these functional outcome measures, i.e. the BI and BBS, have excellent validity and reliability in stroke patients. Responsiveness of measures is also an important factor in the assessment of stroke patients and this was also well established for the BI as well as the BBS. These two outcome measures have been well researched and reported on and are effective in assessing mobility, balance and risk of falling, as well as the ADL of stroke patients in our study.

3.9.4 Pressure mapping (Matscan pressure measurement platform)

The pressure measurement platform is a validated pressure mapping system. Combined with Tekscan software, the mats are usable in various applications including evaluating balance. The device allows the practitioner to capture data in seconds knowing that the data captured are objective and quantifiable. The mat itself is easy to use and portable

(www.tekscan.com/medical). This measure was utilised along with the BBS as a more objective measure for static standing balance.

A common consequence of stroke is weight-bearing asymmetry (WBA) (Kamphuis, de Kam, Geurts & Weerdesteyn, 2013). During static standing a significant amount of WBA in favour of the non-hemiplegic leg is commonly observed (Aruin, Hanke, Chaudhuri, Harvey & Rao, 2000; Sackley, 1991; Mizrahi, Solzi, Ring & Nisell, 1989). On average 10% more weight is borne on the non-hemiplegic leg (Mansfield, Danells, Inness, Machizuki & Mcllroy, 2011; Barra, Oujamaa, Chauvineau, Rougier & Perennou, 2009; de Haart, Geurts, Huidekoper, Fasotti & van Limbeek, 2004).

During static standing, the central nervous system aims to keep the center of gravity within the base of support (Shumway-Cook & Woollacott, 2007). Therefore, the amount of movement of the center of gravity (postural sway) is considered an indicator of the integrity of the balance control system (Fearing, 1924). Pressure mapping can be used to offer reasonable approximations of postural sway through integration of shear forces recorded during static standing (Zatsiorsky & King, 1997). Furthermore, pressure mapping can directly measure the position of the centre of pressure (COP) underneath the feet; it is by changing the position of the COP that individuals control the position of the center of gravity in static standing (Winter, 1995).

WBA is the mean vertical force recorded by the pressure map under both limbs, expressed as a percentage of total body weight on either side or how evenly weight is distributed on each foot (Eng & Chu, 2002). Test–retest reliability using the pressure mapping system is high for weight-bearing asymmetry during static standing (ICC = 0.95 for the mean of two 30-second trials) and maximal loading (ICCs = 0.93–0.99 for the mean of five six-second trials) among individuals with chronic stroke (Eng & Chu, 2002).

Other variables include the anteroposterior (AP) and mediolateral (ML) COP displacement. Root mean square (RMS) of net AP and ML COP are measures of the variability of the COP displacement under both limbs combined; RMS of COP is calculated separately for the AP and ML directions (Kapteyn, Bles, Njiokiktjien, Kodde, Massen & Mol, 1983). The RMS of COP is a recommended measure of stability within clinical posturography (Kapteyn et al., 1983). As the position of the COP and centre of gravity are correlated, high RMS of COP suggests high postural sway (de Haart et al., 2004). Therefore, high RMS of COP can generally be interpreted as poor overall balance control.

There is some evidence that increased RMS of ML COP is related to increased risk of falling (Mansfield, Wong, McIlroy, Biasin Bruton, Bayley & Inness, 2015).

3.9.5 European Quality of Life Five Domain Three Language Health Questionnaire (EQ5D-3L)

Most post stroke assessments focus on the functional status of the patient which is done objectively, but many forget that patient perception of function and/or quality of life is vital, hence self-reported measures are considered essential in assessing physical and mental well-being (Hunger, Sabariego, Stollenwerk, Cieza, Leidl, 2012).

The EQ5D is a generic self-reported measurement tool used in various conditions including HIV/AIDS and stroke. It has been translated adhering strictly to the European Quality of Life Group's (Euroqol) protocol for translation and tested in the Afrikaans and isiXhosa speaking populations in South Africa and found to be a valid and reliable tool in these populations (Hunger et al., 2012). The only other measure that was found to have good validity and reliability in the South African population was the Short Form Health Survey-36 (SF36) (Hunger et al., 2012). However, the SF-36 is long and results are somewhat difficult to analyse without a weighting algorithm (Hunger et al., 2012). The EuroQol Group developed the EQ5D, a health related quality of life (HRQoL) questionnaire, which describes health state in terms of five domains namely mobility, self-care, usual activities, anxiety/depression and pain/discomfort (Hunger et al., 2012). In scoring, patients are asked to tick off the statement that best describes their current health status in each domain. Patients are also asked to score their health status using a Visual Analog Scale (VAS) rating 0 to 100; the score of 0 being worst imaginable health state and the score of 100 being best imaginable health state. This instrument has been validated in a wide range of settings, including Zimbabwe (Hunger et al., 2012). It has also been used specifically to examine HRQoL in subjects with HIV/AIDS in South Africa (Hunger et al., 2012).

When correlating the EQ5D with the Stroke Impact Scale (SIS), a quality of life scale using the Spearman Rank correlation coefficient, the criterion validity in each domain namely mobility ($r = 0.74$), self-care ($r = 0.65$), usual activities ($r = 0.61$), pain/discomfort and anxiety/depression ($r= 0.39$), the EQ5D showed a strong correlation with the SIS in all domains except for the pain and anxiety domain (Hunger et al., 2012). In terms of test-retest reliability the EQ5D was shown to have adequate test-retest reliability scores in all

domains (k = 0.62-0.7). Overall the EQ5D was shown to have reasonable validity and reliability in the stroke population (Hunger et al., 2012).

Although the EQ5D is seemingly a valid and reliable tool, it is also worth noting that one cannot measure the reliability and validity of the EQ5D appropriately as a self-reported quality of life (QoL) measurement tool because there is no gold standard. Permission was granted by the EuroQoL group to use the EQ5D for this study.

3.9.6 Self-developed data capture form for socio-demographic information and medical history

To obtain documented medical history for each patient included in this study, their medical records at the WCRC were reviewed. A self-developed checklist/data capture form was developed to facilitate the extraction of the following information from all participants' medical folders:

- Age;
- Dates of incident (of stroke), admission and discharge;
- Language (English, isiXhosa or Afrikaans);
- Gender;
- Race (black, mixed race, white, Indian and other);
- Type of stroke (hemorrhage or infarction);
- Area affected (right cerebrovascular accident, left cerebrovascular accident, cerebellar or brainstem);
- Special investigations (CT brain scan, MRI or other);
- Risk factors (hypertension, diabetes, cholesterol, smoker, obesity, substance abuse, atherosclerosis, opportunistic, not known and other);
- HIV-status (HIV positive, negative, undiagnosed);
- Assistive device received on admission and discharge.

3.10 Procedures for the Pretest and Main Study

3.10.1 Pretest

The pretest was conducted at the WCRC. Two patients were recruited based on inclusion criteria. The principal investigator (PI) obtained their written consent to participate in the pretest. The pretest assisted the PI by becoming familiar with the objective measures, alerting the PI to any adjustments of the procedures for logistical and practical time

management. At the facility, the following items were required to conduct the pretest: a 3X4m room, a height adjustable Bobath plinth, a step, two chairs with backrests (one with and one without arm support), a small table and an outlet for a laptop.

The pretest was conducted with two participants who met the inclusion criteria. The PI conducted all assessments, procedures and logistical issues were amended.

- Venues with sufficient space and equipment were booked.
- A patient booking system was established where clinicians identified potential participants who met the inclusion criteria and informed the therapy clerks who made the bookings.
- A second person was employed for testing to ensure the safety of patients during the assessments.
- A translator was employed for isiXhosa speaking patients.
- Datasheets were amended.
- A sequence for outcome measures of the assessments and documentation was established.

3.10.2 Main study

1) Recruitment of subjects

The WCRC healthcare practitioners and ward admission clerks were informed of the aim, objectives and inclusion criteria of the envisaged study. The clerks notified the PI of any new stroke patient admissions between June and November 2016. The PI screened the patients to see if they fitted the inclusion criteria, and gained their written consent to participate in the study.

2) Data collection for the main study

The PI explained the aims and study procedure to all participants once informed consent was obtained. All consent forms were available in English, Afrikaans and isiXhosa. For isiXhosa speaking participants who did not understand English or Afrikaans, an isiXhosa translator was employed. On admission the PI reviewed the medical records of eligible and recruited participants to capture their socio-demographic data and relevant medical history. The PI, having had experience using the outcome measures, then conducted the pretest in four stages. The first stage was the interview using the EQ5D and BI. The EQ5D was separated into three sections namely, prior to stroke (premorbid function), on admission (present function) and on discharge. Participants were asked the same six

questions (refer to Appendix F) regarding their function prior to stroke and on admission. The BI, also a self-reported measure, was reported on admission only. The second stage was the pressure mapping system. This was conducted on participants who were able to stand independently. The third stage was just the BBS. The MatScan (pressure mapping), which is also a balance assessment tool was done prior to this. During the second and third stage, the second person employed assisted with patient safety during the physical assessment, ensuring that the PI could appropriately observe each activity. Thereafter, in the final stage, the PI used the mRS to rate participant stroke severity. The PI conducted all assessments and was not blinded to participant HIV-status. All scores were documented and entered into an Excel spreadsheet. Once participants completed their rehabilitation (treated by the therapists at the WCRC) and were in their final week prior to discharge, the PI reassessed these same participants using the EQ5D, BI, pressure mapping and BBS as well as the mRS for participant discharge results. The specific procedures used during the data collection of the main study are described in Appendix I.

3) Data management

All the patients' relevant data, i.e. demographic information, medical history and outcome measure results were collected in the assessment form (see Appendices A and B). All the data findings were entered into an Excel spreadsheet, coded and the results were interpreted with the programme STATA. The patients' confidentiality was kept by a coding process whereby the patients' names on the assessment forms were substituted by a code. All raw data and data collection forms were locked in a secure cupboard housed in the Physiotherapy Division, Stellenbosch University. The records of the patients' names and corresponding codes were known to the PI and supervisors only.

4) Statistical analysis

All the data from the socio-demographic data sheet and outcome measures were entered into an Excel spreadsheet, coded and analysed. Continuous data including mRS, BI, BBS and pressure mapping were summarised using median and range. The EQ5D, which is the patients' perception of function, was categorical data so it had different analysis. Categorical data were represented as proportions and graphically displayed using a histogram. Statistical analysis was performed using STATA version 14.2 (Statacorp, 2015). Association between categorical variables was assessed using the chi-squared or Fisher's exact test. Differences distribution of continuous variables over different levels of a categorical variable were evaluated using the Kruskal-Wallis test, and where differences

were detected, the Dunn's test was used for pairwise comparisons. Relationships between patient characteristics and pain and anxiety were evaluated using ordinal logistic regression. The Kaplan-Meier curve was used to describe the length of stay. Statistical significance was assessed at five percent.

5) Ethical considerations

Approval for conducting the study was obtained from the Committee of Human Research (HREC) at Stellenbosch University. The study was conducted according to the internationally accepted ethical standards and guidelines as stipulated in the Declaration of Helsinki (2013) and the South African Guideline for Good Clinical Practice. Permission was also sought from the Western Cape Department of Health and management of the WCRC. All the procedures were explained to each participant and their written informed consent was obtained before proceeding with data collection. Once feedback was received from the Ethics Committee (HREC), the consent form was translated into Afrikaans and isiXhosa.

Participants were informed that they could withdraw from the study at any point without any repercussions. A code/number was allocated to each participant once the raw data were captured electronically and analysed to ensure their anonymity. All results were described at group level and no individual data were made known to parties other than the PI and supervisors. The results were shared with the participants and top management at the WCRC only.

There were minimal foreseeable risks involved in this study; they included a risk of falling and possible fatigue post assessment. Snacks and regular breaks were given during data collection to combat fatigue. Participants did not receive any remuneration for participating in the study. It is hoped that the information gained in this study will provide a better understanding of the functional outcomes of HIV+ stroke patients, which may lead to better future management strategies. This study will act as a springboard for much needed epidemiological and large cohort studies.

The results of the study will be disseminated via scientific publications and conference presentations. A bound copy and electronic version will be given to the WCRC Library and a presentation will be given to WCRC staff.

Chapter 4: Results

The results chapter describes the demographic information of participants and their functional outcome on admission and discharge. The differences between the HIV+, HIV- and HIV undiagnosed participant groups with regard to demographic data, baseline characteristics and the findings of outcome measurements are highlighted.

4.1 Participation Allocation and HIV-status Grouping

The recruitment of participants for this study, together with the number of participants in each group, are detailed in Figure 4.1. Of the initial 54 patients screened at the WCRC between June 2016 and November 2016, 49 met the inclusion criteria, provided informed consent and were subsequently recruited into the study. There were nine participants with a confirmed HIV+ diagnosis, 17 who were negative and 23 individuals who were undiagnosed. Overall, eight participants dropped out; reasons are provided in the following figure (see figure 4.1).

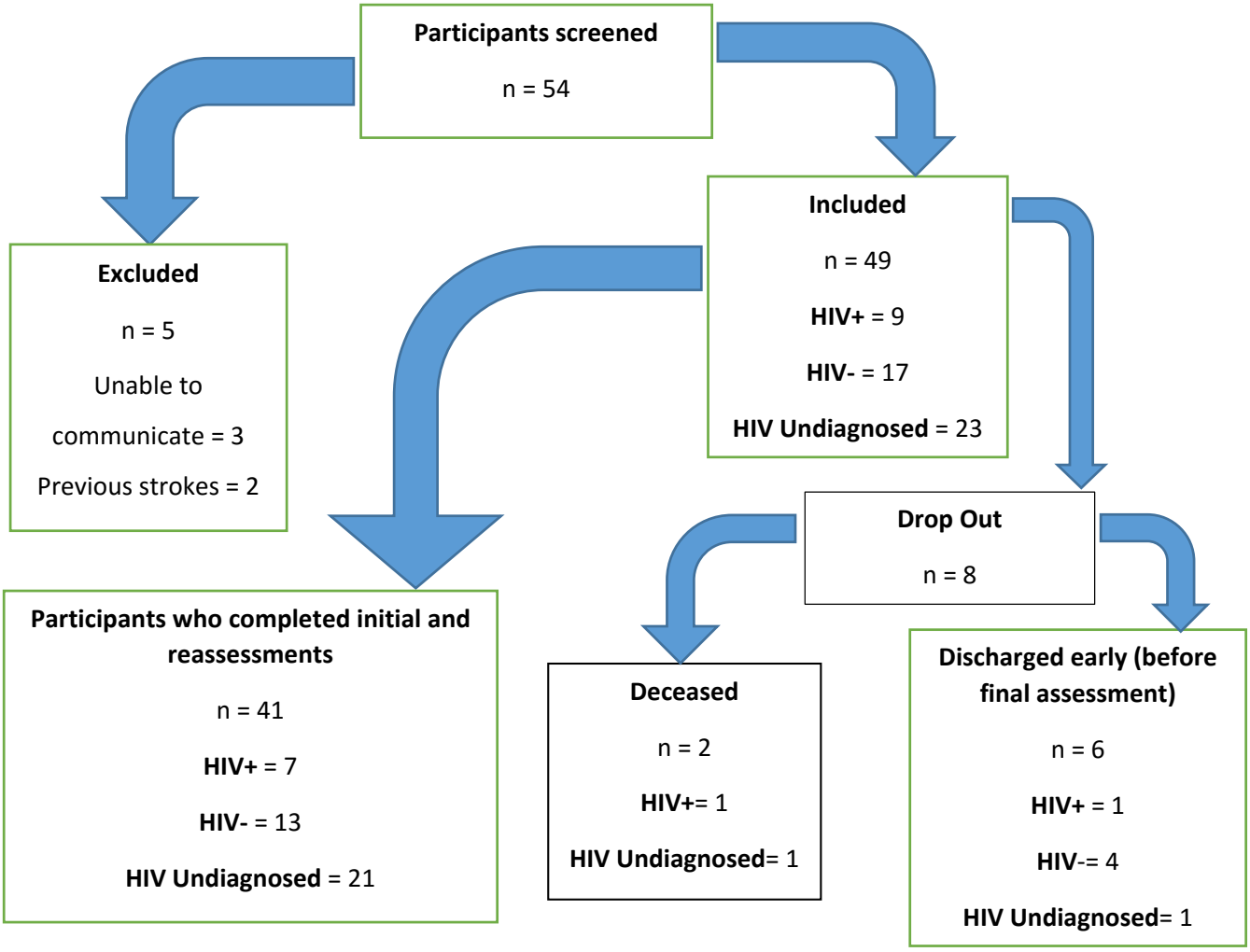


Figure 4.1: Study flow diagram detailing participant allocation

4.2 Demographic Characteristics of the Study Sample

The study sample's demographic characteristics were tabulated (Table 4.1) to illustrate the differences between the HIV+, HIV- and HIV undiagnosed participant groups.

Table 4.1: Demographic characteristics of each group and the combined study sample

Demographic Characteristics	HIV+	HIV-	HIV undiagnosed	Total
	n=9 (18.36%)	n=17 (34.69%)	n=23 (46.94%)	n=49 (100%)
Gender n (%)				
Female	6 (66.67)	8 (47.06)	11 (47.83)	25 (51.02)
Male	3 (33.33)	9 (52.94)	12 (52.17)	24 (48.98)
Race n (%)				
Black	6 (66.67)	4 (23.53)	7 (30.43)	17 (34.69)
Mixed Race	3 (33.33)	9 (52.94)	14 (60.87)	26 (53.06)
White	0 (0.00)	3 (17.65)	2 (8.7)	5 (10.20)
Indian	0 (0.00)	1 (5.88)	0 (0.00)	1 (2.04)
Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Age median (min-max)				
	30 (22-62)	50 (26-75)	51 (24-77)	48 (22-77)

Mdn- median; Min- minimum; Max- maximum

4.2.1 Gender

The male to female ratio for the entire study sample was closely matched, having one more female than males. Even though the HIV+ group was the only subgroup with more females than males, there was no statistical significance between male or female participants in either group or in the sample size as a whole (p = 0.607).

4.2.2 Race

More than half of the study sample was mixed race with 34.69% from the black racial category. The HIV+ participants had a majority of black participants (66.67%) with 33.33% mixed race; while the HIV- and undiagnosed groups had a majority of mixed race participants (52.94% and 60.87% respectively). Even though differences were shown in race distribution, there was no statistical significance between groups (p = 0.254) with regard to race.

4.2.3 Age

The age range of the study sample was similar to the HIV- and undiagnosed groups. There was, however, a difference between ages when comparing HIV status. There was no statistical significant difference between ages in the HIV- and undiagnosed groups (p = 0.3045) but the HIV+ group was significantly younger compared to the HIV- and undiagnosed groups (p = 0.0046).

4.3 Stroke Related Information

Stroke characteristics are presented in Table 4.2.

4.3.1 Type of stroke

The majority of the study sample (89.80%) suffered a cerebral infarct as cause of stroke. All HIV+ participants sustained cerebral infarcts; likewise, the majority of the HIV- and undiagnosed groups were also diagnosed as such (82.35% and 91.30% respectively). Haemorrhagic strokes occurred in the HIV- and undiagnosed groups. No statistical significance between groups was found (p = 0.569) in terms of stroke type.

4.3.2 Area affected by stroke

The area affected did not differ significantly in the sample. The same was seen for all groups having an almost equal ratio of left and right sided strokes with one participant in the HIV undiagnosed group suffering a cerebellar stroke. No statistical significance between groups was found (p = 0.967).

4.3.3 Special investigations following stroke

The majority of participants (87.71%) received computed tomographic scans of the brain (CTB), while others received Carotid Doppler Ultrasound imaging and unspecified diagnostic investigations (14.29%).

Table 4.2: Stroke characteristics of the study sample

Stroke Characteristics	HIV+	HIV-	HIV undiagnosed	Total
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
Type of stroke n (%)				
Haemorrhagic	0 (0.00)	3 (17.65)	2 (8.70)	5 (10.20)
Infarction	9 (100)	14 (82.35)	21 (91.30)	44 (89.80)
Affected area n (%)				
Right CVA (Left hemiplegia)	5 (55.56)	8 (47.06)	12 (52.17)	25 (51.02)
Left CVA (Right hemiplegia)	4 (44.44)	9 (52.94)	10 (43.48)	23 (46.94)
Cerebellar CVA (balance disorder)	0 (0.00)	0 (0.00)	1 (4.35)	1 (2.04)
Special investigations n (%)				
CT brain	9 (100)	15 (88.24)	18 (78.26)	42 (85.71)
MRI/ other	0 (0.00)	2 (11.76)	5 (21.74)	7 (14.29)

Mdn- median; Min- minimum; Max- maximum

4.4 Risk Factors Associated with Stroke

Stroke risk factors are presented in Tables 4.3 and 4.4.

Some of the typical risk factors for stroke were reported in our study (see Table 4.3). A few of these risk factors appeared more amongst the HIV+ group, for example, hypertension and diabetes along with substance abuse and opportunistic infections. There was no statistical significant difference between the HIV- and undiagnosed groups with regard to hypertension and diabetes. Compared to the HIV+ group, however, the HIV- and HIV undiagnosed groups showed greater statistical significant difference for hypertension and diabetes ($p = 0.001$ and $p = 0.042$ respectively). Cholesterol and smoking had no statistical significance between any of the groups ($p = 1.00$ and $p = 0.671$ respectively). Documented substance abuse in the HIV+ group was 22.22%, compared to 5.8% in the HIV- and 0% for the HIV undiagnosed groups. This difference was found to be significant ($p = 0.038$). There was no documented occurrence of atherosclerosis in this sample. In the HIV+ group there was 22.22% with no known risk factors. None of the HIV- or undiagnosed groups showed any documented risk of opportunistic infections while the HIV+ group had 33.33% of participants suffering from infections ranging from cryptococcol meningitis to cystic brain lesions ($p = 0.005$). The CD4 count of the HIV+ group ranged from 54 to 883 with the median of 130.

Table 4.3: Risk factors for/of each group and the combined study sample

Risk factors n (%)	HIV+	HIV-	HIV undiagnosed	Total
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
None	2 (22.22)	0 (0.00)	0 (0.00)	0 (0.00)
Hypertension	1 (11.11)	15 (88.24)	20 (86.96)	36 (73.47)
Diabetes	0 (0.00)	4 (23.53)	10 (43.48)	14 (28.57)
Cholesterol	1 (11.11)	2 (11.76)	3 (13.04)	6 (12.24)
Smoking	2 (22.22)	7 (41.18)	7 (30.43)	16 (32.65)
Substance abuse	2 (22.22)	1 (5.88)	0 (0.00)	3 (6.12)
Artherosclerosis	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Opportunistic infection	3 (33.33)	0 (0.00)	0 (0.00)	3 (6.12)

Mdn- median; Min- minimum; Max- maximum

The most common combination of risk factors seen in the sample were hypertension and smoking as well as hypertension and diabetes (n = 14; 28.57% and n =13; 26.3% respectively) (see Table 4.4). With regard to a combination of risk factors in each group the following was noted: the combination of risk factors in the HIV+ group (excluding HIV) was substance abuse and smoking, found in two (22.22%) participants one of whom also had high cholesterol. When including HIV as a risk factor 66.67% (n = 6) of the HIV+ group had a combination of risk factors, the majority being HIV and opportunistic infections. None of the other groups had opportunistic infections. Hypertension and cholesterol occurred only once in the HIV+ group unlike the HIV- and undiagnosed groups where these risk factors were most common.

Hypertension (n = 15; 88.24%) was the leading risk factor in the HIV- group, often combined with smoking (n = 7; 41.18%), diabetes (n = 4; 23.53%) and cholesterol (n = 2; 11.76%). The HIV undiagnosed group yielded similar results to the HIV- group with 86.96% (n = 20) of participants having hypertension often combined with diabetes (n = 9; 39.13%) followed by smoking (n = 7; 30.44%) (See Table 4.4). These are the more common lifestyle related non-communicable diseases placing individuals at risk for stroke.

Table 4.4: Distribution of multiple risk factors for each group and study sample

Risk factors n (%)	HIV+	HIV-	HIV undiagnosed	Total
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
Multiple risk factors excluding HIV	2 (22.22)	11 (64.7)	14 (56.2)	27 (55.1)
Two risk factors:				
- Hypertension and diabetes	0 (0.00)	4 (23.53)	9 (39.13)	13 (26.53)
- Hypertension and smoking	0 (0.00)	7 (41.18)	7 (30.44)	14 (28.57)
- Hypertension and cholesterol	0 (0.00)	2 (11.77)	2 (8.70)	4 (8.16)
- Substance abuse and smoking	2 (22.22)	1 (5.88)	0 (0.00)	3 (6.13)
Three risk factors:				
- Hypertension, diabetes and smoking	0 (0.00)	1 (5.88)	3 (13.04)	4 (8.16)
- Hypertension, diabetes and cholesterol	0 (0.00)	0 (0.00)	2 (8.70)	2 (4.08)
- Hypertension, smoking and high cholesterol	0 (0.00)	1 (5.88)	0 (0.00)	1 (2.04)
- Hypertension, smoking and substance abuse	0 (0.00)	1 (5.88)	0 (0.00)	1 (2.04)
- Smoking, high cholesterol and substance abuse	1 (11.11)	0 (0.00)	0 (0.00)	1 (2.04)
Multiple risk factors including HIV	6 (66.67)			6 (12.25)
Two risk factors (HIV and):				
- Opportunistic infection	3 (33.33)			3 (6.13)
- Hypertension	1 (11.11)			1 (2.04)
Three/ more risk factors (HIV and):				
- Smoking and substance abuse	2 (22.22)			2 (4.08)
- High cholesterol, smoking and substance abuse	1 (11.11)			1 (2.04)

Mdn- median; Min- minimum; Max- maximum

4.5 Duration of Stroke until Admission and Length of Stay

The HIV+ group had the shortest time from stroke incident until admission to rehabilitation (two weeks). There was one patient in the HIV- group, however, who had an extended period before admission to rehabilitation (218 days). This particular patient in the HIV- group had medical complications unrelated to the stroke, hence the delay to rehabilitation. These outlying data may have skewed the HIV- group's data with regard to median and range. Therefore, if the outlying data were removed, the HIV+ and HIV- groups may have been more similar in this regard. The HIV undiagnosed group had the longest period before admission (almost a month), even longer than the overall sample. Nonetheless, no statistical significance was found between groups with regard to time of stroke to admission ($p = 0.5293$).

The median time from stroke incident until admission for the entire sample was 53 days, ranging from one month to almost three months. The overall length of stay was similar between the HIV- and HIV undiagnosed groups who were admitted over a week later than the HIV+ group (Table 4.4). However, no statistical significance was seen between groups ($p = 0.0671$).

Table 4.5: Median time between stroke incident and admission (to rehabilitation) and length of stay during inpatient rehabilitation

Time period (Days)	HIV+	HIV-	HIV undiagnosed	Total
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
Median time between stroke incident and admission mdn (min-max)	14 (6 - 45)	18 (6 - 218)	23 (6 - 42)	21 (6 - 218)
Length of stay mdn (min-max)	45 (31- 64)	55 (42- 79)	53 (39- 74)	53 (31- 79)

Mdn- median; Min- minimum; Max- maximum

4.6 Level of Function

The following section focuses on the outcome measures used to describe patient function on initial assessment and discharge. The following function related outcome measures were used: Modified Rankin Scale, Barthel Index and the Berg Balance Scale (BSS). Pressure mapping was utilised along with the BBS as an objective measure for static standing balance. The assistive devices issued on the initial assessment and discharge are also described to give a better understanding of participants' function. The EQ5D was

used to describe patient perception of function, prior to stroke, on admission and discharge.

4.6.1 Describing the severity of stroke using the Modified Rankin Scale

As previously mentioned, the mRS measures the degree of disability or dependence in ADL (Bonita & Beaglehole, 1988; Rankin, 1957). A higher score is more indicative of disability.

The mRS has no established minimally clinically important difference (MCID) nor minimal detectable change (MDC) (de Haan et al., 1995). Overall, the majority of participants (63.27%, n = 31) were admitted with moderately severe disability. This was found to be similar for all groups with the HIV+ group having 66.67% (n = 6) of participants with moderately severe disability, the same was seen in 64.71% (n = 11) of the HIV- group and 60.87% (n = 14) of the HIV undiagnosed group. On discharge, 31.71% of the total group had no significant disability despite symptoms, and were able to carry out all usual duties and activities. In the HIV+ group two thirds (57.14, n = 4) had no significant disability, whereas a third of the HIV- group (30.77%, n= 4) and HIV undiagnosed groups (28.57%, n = 6) had no significant disability. Even though having a smaller sample size, the HIV+ group had a better mRS score on discharge than the other groups; however, no statistical significant difference was found (p = 0.748) among groups with the change in scores from admission to discharge. (Figures 4.2 and 4.3 display and compare the severity of stroke among the three groups (HIV+, HIV- and HIV undiagnosed) on admission and discharge.)

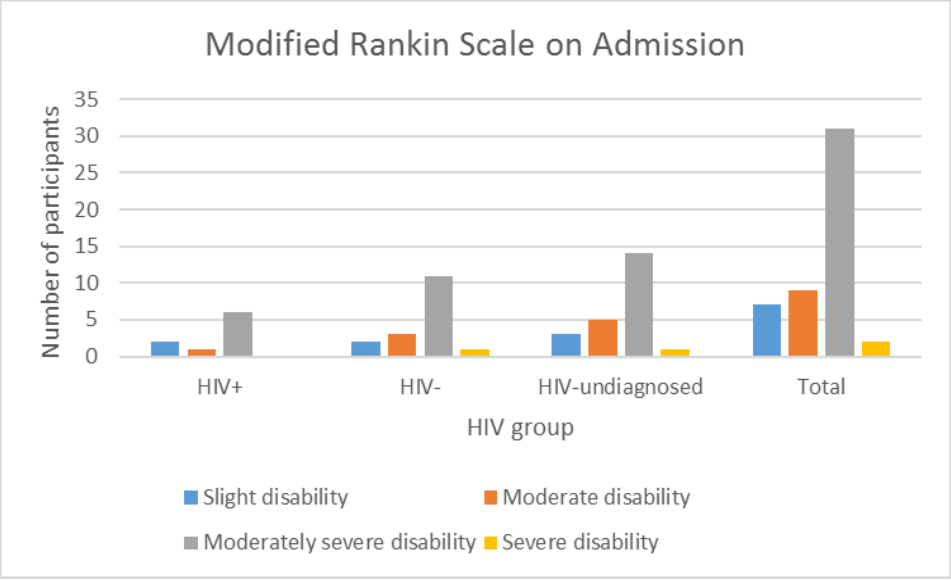


Figure 4.2: Modified Rankin Scale on admission

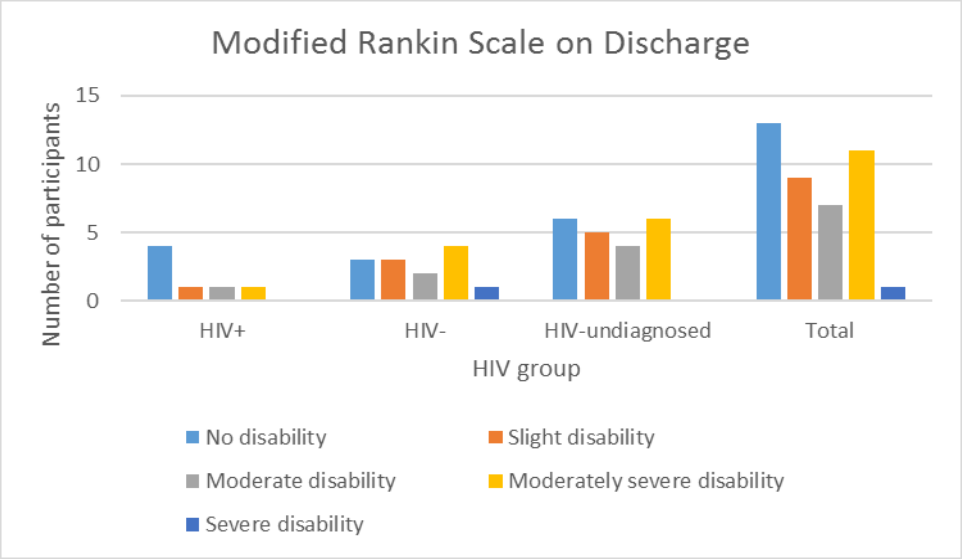


Figure 4.3: Modified Rankin Scale on discharge

4.6.2 Function and level of independence in activities of daily living using the Barthel Index

The Barthel Index BI is a 10-item index that measures the degree to which somebody can function independently in their ADL. A score of 0 indicates complete dependence in performing a task and therefore a higher score is indicative of more independence. The highest total score is 100. Table 4.6 describes the median and range of scores each group received on admission and discharge. It also shows the median difference between admission and discharge scores. Overall, the median BI score for admission was 55 (Table 4.6), indicating assistance required with ADLs.

The median admission and discharge scores were similar for all groups (Table 4.6). The MDC for the BI is an increase or decrease of 4.02 points (Hsieh, Wang, Wu, Chen, Shen & Hsieh, 2007). The median MDC for the HIV+ group was 10, HIV- was 25 and the undiagnosed group 35. Even though the difference between admission and discharge scores was smaller for the HIV+ group, no statistical significant difference was found among groups (0.886).

Table 4.6: Barthel Index scores for the groups displaying median and range scores

Barthel Index (Total scores)	**HIV+** mdn (min-max)	**HIV-** mdn (min-max)	**HIV undiagnosed** mdn (min-max)	**Total** mdn (min-max)
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
Admission	50 (30-95)	55 (15-100)	55 (25-95)	55 (15-100)
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.2%)	n= 41 (100%)
Discharge	95 (50-100)	95 (50-100)	90 (45-100)	90 (45-100)
Difference (between admission and discharge scores)	10 (5-65)	25 (-10-50)	35 (0-60)	35 (-10-65)

Mdn- median; Min- minimum; Max- maximum

Table 4.7 displays frequency and percentage for individual items on the Barthel Index.

A total of 20.41% (n = 10) of the study sample were independent in feeding, 32.65% (n = 16) independent in bathing, 26.53% (n = 13) in dressing and only 12.25% (n = 6) independent in mobility (Table 4.7). The rest required assistance or were dependent in the above-mentioned ADLs. Upon discharge, 80.49% (n = 33) of the participants who participated in the assessment prior to discharge were independent in feeding, 85.36% (n = 35) independent in bathing, 73.17% (n = 30) in dressing and 43.9% (n = 18) in mobility. One participant, however, displayed deterioration on reassessment prior to discharge and this is reflected in the negative score in the range within the HIV- group (Table 4.7).

Table 4.7: Barthel Index scores displaying frequency and percentage for individual teams

Barthel Index		HIV+		HIV-		HIV undiagnosed		Total	
Item	Score	Admission	Discharge	Admision	Discharge	Admission	Discharge	Admission	Discharge
		n= 9 (18.37%)	n= 7 (17.07%)	n= 17 (34.69%)	n= 13 (31.71%)	n= 23 (46.94%)	n= 21 (51.21%)	n= 49 (100%)	n= 41 (100%)
Feeding	0	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	5	7 (77.78)	1 (14.29)	14 (82.35)	2 (15.38)	18 (78.26)	5 (23.81)	39 (79.59)	8 (16.33)
	10	2 (22.22)	6 (85.71)	3 (17.65)	11 (84.62)	5 (21.74)	16 (76.19)	10 (20.41)	33 (67.35)
Bathing	0	4 (44.44)	1 (14.29)	12 (70.59)	3 (23.08)	17 (73.91)	2 (9.52)	33(67.35)	6 (12.24)
	5	5 (55.56)	6 (85.71)	5 (29.41)	10 (76.92)	6 (26.09)	19 (90.48)	16 (32.65)	35 (71.43)
Grooming	0	5 (55.56)	3 (42.86)	7 (41.18)	3 (23.08)	11 (47.83)	1 (4.76)	23 (46.94)	7 (14.29)
	5	4 (44.44)	4 (57.14)	10 (58.82)	10 (76.92)	12 (52.17)	20 (95.24)	26 (53.06)	34 (69.39)
Dressing	0	2 (22.22)	0 (0.00)	2 (11.76)	0 (0.00)	4 (17.39)	0 (0.00)	8 (16.33)	0 (0.00)
	5	6 (66.67)	1 (14.29)	8 (47.06)	5 (38.46)	14 (60.87)	5 (23.81)	28 (57.14)	11 (22.45)
	10	1 (11.11)	6 (85.71)	7 (41.18)	8 (61.54)	5 (21.74)	16 (76.19)	13 (26.53)	30 (61.22)
Bowels	0	2 (22.22)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (4.08)	0 (0.00)
	5	0 (0.00)	0 (0.00)	3 (17.65)	0 (0.00)	2 (8.70)	1 (4.76)	5 (10.20)	1 (2.04)
	10	7 (77.78)	7 (100,00)	14 (82.35)	13 (100.00)	21 (91.30)	20 (95.24)	42 (85.71)	40 (81.63)
Bladder	0	2 (22.22)	0 (0.00)	1 (5.88)	1 (7.69)	0 (0.00)	0 (0.00)	3 (6.12)	1 (2.04)
	5	0 (0.00)	0 (0.00)	4 (23.53)	2 (15.38)	2 (8.70)	1 (4.76)	6 (12.24)	3 (6.12)
	10	7 (77.78)	7 (100.00)	12 (70.59)	10 (76.92)	21 (91.30)	20 (95.24)	40 (81.63)	37 (75.51)
Toilet use	0	0 (0.00)	0 (0.00)	2 (11.76)	0 (0.00)	1 (4.35)	0 (0.00)	3 (6.12)	0 (0.00)
	5	5 (55.56)	1 (14.29)	6 (35.29)	3 (23.08)	11 (47.83)	2 (9.52)	22 (44.90)	6 (12.24)
	10	4 (44.44)	6 (85.71)	9 (52.94)	10 (76.92)	11 (47.83)	19 (90.48)	24 (48.98)	35 (71.43)
Transfers	0	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	1 (4.35)	0 (0.00)	2 (4.08)	0 (0.00)
	5	1 (11.11)	0 (0.00)	0 (0.00)	0 (0.00)	8 (34.78)	2 (9.52)	9 (18.37)	2 (4.08)
	10	5 (55.56)	1 (14.29)	9 (52.94)	3 (23.03)	7 (30.43)	2 (9.52)	21 (42.86)	6 (12.24)
	15	3 (33.33)	6 (85.71)	7 (41.18)	10 (76.92)	7 (30.43)	17 (80.95)	17 (34.69)	33 (67.35)
Mobility	0	4 (44.44)	1 (14.29)	8 (47.06)	2 (15.38)	11 (47.83)	1 (4.76)	23 (46.94)	4 (8.16)
	5	2 (22.22)	0 (0.00)	4 (23.53)	3 (23.08)	7 (30.43)	8 (38.10)	13 (26.53)	11 (22.45)
	10	0 (0.00)	1 (14.29)	2 (11.76)	2 (15.38)	5 (21.74)	5 (23.81)	7 (14.29)	8 (16.33)
	15	3 (33.33)	5 (71.43)	3 (17.65)	6 (46.15)	0 (0,00)	7 (33.33)	6 (12.24)	18 (36.73)
Stairs	0	6 (66.67)	2 (28.57)	12 (70.59)	4 (30.77)	18 (78.26)	8 (38.10)	36 (73.47)	14 (24.57)
	5	1 (11.11)	0 (0.00)	1 (5.88)	3 (23.08)	3 (13.04)	4 (19.05)	5 (10.20)	7 (14.29)
	10	2 (22.22)	5 (71.43)	4 (23.53)	6 (46.15)	2 (8.70)	9 (42.86)	8 (16.33)	20 (40.82)

4.6.3 Assistive devices issued on discharge

The assistive device issued on discharge is a good indicator of function as it relays how dependent participants are in terms of mobility. Table 4.8 below describes how many participants in each group required assistive devices on admission and discharge.

On admission the majority of the study sample required wheelchairs as they were not safe to mobilise independently; this was seen for the individual groups, with a larger majority occurring in the HIV undiagnosed group. No statistical significance was found among groups (p = 0.102.).

Overall equal numbers of patients required wheelchairs and were independent in mobilising on discharge. Looking at the individual groups, more than half of the HIV+ group did not require assistive devices and were able to mobilise unaided, whereas in the HIV- group, 41.67% (n = 5) required a walking stick and 33.33% (n = 4) required a wheelchair. In the HIV undiagnosed group, 40% (n = 8) required a wheelchair, while 30% (n = 6) were able to mobilise unaided. Even though the HIV+ group had a larger majority of participants mobilising unaided, no statistical significance was found among groups (p = 0.722).

Table 4.8: Assistive devices issued on admission and discharge

Assistive Devices	HIV+	HIV-	HIV undiagnosed	Total
Assistive device on admission n (%)	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
1- no aid required	3 (33.33)	5 (29.41)	1 (4.35)	9 (18.37)
2- walking stick	0 (0.00)	0 (0.00)	1 (4.35)	1 (2.04)
3- crutches	0 (0.00)	0 (0.00)	1 (4.35)	1 (2.04)
4- walking frame	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
5- wheelchair	6 (66.67)	12 (70.59)	20 (86.96)	38 (77.55)
Assistive device on discharge n (%)	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (46.94%)	n= 41 (100%)
1- no aid required	4 (57.14)	3 (25.00)	6 (30.00)	13 (33.33)
2- walking stick	2 (28.57)	5 (41.67)	5 (25.00)	12 (30.77)
3- crutches	0 (0.00)	0 (0.00)	1 (5.00)	1 (2.56)
4- walking frame	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
5- wheelchair	1 (14.29)	4 (33.33)	8 (40.00)	13 (33.33)

Mdn- median; Min- minimum; Max- maximum

4.6.4 Balance, safety and risk of falling described using the Berg Balance Scale (BBS) and pressure mapping

4.6.4.1 Berg Balance Scale (BBS)

The BBS provides a quantitative assessment of balance in older adults as well as determining risk of falls. The scale consists of 14 items performed in everyday life. (See Tables 4.9 and 4.10 displaying frequency and percentage scores for individual items on the BBS for items 1 to 7 and 8 to 14 respectively). The items receive a score of 0 to 4 where a score of 0 indicates inability to do an activity and 4 means ability to complete the activity. The maximum score is 56 (Berg et al., 1992).

Overall, the median result for the admission scores for the study sample indicated a medium risk of falling (Table 4.11). On discharge the median score indicated a low risk of falling for the entire sample. Looking at the individual items on the BBS, specifically the independent standing balance which required participants to stand unaided for two minutes, only 36.73% (n = 18) were able to stand independently. This improved to 61.22% (n = 30) of the sample who participated in the re-assessment prior to discharge (Table 4.9). The MDC is 6.9 points and no MCID has been established for the BBS (Hiengkaew, Jitaree & Chaiyawat, 2012). Even though the median MDC score for the HIV- and undiagnosed groups were double the HIV+ MCD score (Table 4.11), no statistical significance was found among groups (p = 0.4170).

Table 4.9: Berg Balance Scale displaying frequency and percentage scores for individual items 1 to 7

Berg balance scale		HIV+		HIV-		HIV undiagnosed		Total	
Item	Score	Admission	Discharge	Admission	Discharge	Admission	Discharge	Admission	Discharge
		n= 9 (18.37%)	n= 7 (17.07%)	n= 17 (34.69%)	n= 13 (31.71%)	n= 23 (46.94%)	n= 21 (51.21%)	n= 49 (100%)	n= 41 (100%)
Sitting to standing	0	0 (0.00)	0 (0.00)	3 (17.65)	1 (7.69)	5 (21.74)	1 (4.76)	8 (16.33)	2 (4.08)
	1	2 (22.22)	1 (14.29)	2 (11.76)	0 (0.00)	4 (17.39)	1 (4,67)	8 (16.33)	2 (4.08)
	2	0 (0.00)	0 (0.00)	2 (11.76)	0 (0.00)	2 (8.70)	0 (0.00)	4 (8.16)	0 (0.00)
	3	3 (33.33)	0 (0.00)	5 (29.41)	5 (38.46)	8 (34.78)	5 (23.81)	16 (32.65)	10 (20.41)
	4	4 (44.44)	6 (85.71)	5 (29.41)	7 (53.85)	4 (17.39)	14 (66.67)	13 (26.53)	27 (55.10)
Standing unsupported	0	3 (33.33)	1 (14.29)	4 (23.53)	1 (7.69)	8 (34.78)	2 (9.52)	15 (30.61)	4 (8.16)
	1	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	2	1 (11.11)	0 (0.00)	1 (5.88)	0 (0.00)	0 (0.00)	1 (4.76)	2 (4.08)	1 (2.04)
	3	1 (11.11)	0 (0.00)	5 (29.41)	4 (30.77)	8 (34.78)	2 (9.52)	14 (28.57)	6 (12.24)
	4	4 (44.44)	6 (85.71)	7 (41.18)	8 (61.54)	7 (30.43)	16 (76.19)	18 (36.73)	30 (61.22)
Sitting unsupported	0	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)	0 (0.00)
	1	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)	0 (0.00)
	2	1 (11.11)	0 (0.00)	0 (0.00)	1 (7.69)	0 (0.00)	0 (0.00)	1 (2.04)	1 (2.04)
	3	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	3 (13.04)	0 (0.00)	4 (8.16)	0 (0.00)
	4	8 (88.89)	7 (100.00)	14 (82.35)	12 (92.31)	20 (86.96)	21 (100.00)	42 (85.71)	40 (81.63)
Standing to sitting	0	0 (0.00)	0 (0.00)	1 (5.88)	1 (7.69)	3 (13.04)	1 (4.76)	4 (8.16)	2 (4.08)
	1	2 (22.22)	1 (14.29)	3 (17.65)	0 (0.00)	3 (13.04)	0 (0.00)	8 (16.33)	1 (2.04)
	2	1 (11.11)	0 (0.00)	3 (17.65)	0 (0.00)	4 (17.39)	1 (4.76)	8 (16.33)	1 (2.04)
	3	2 (22.22)	0 (0.00)	4 (23.53)	4 (30.77)	9 (39.13)	4 (19.05)	15 (30.61)	8 (16.33)
	4	4 (44.44)	6 (85.71)	6 (35.29)	8 (61.54)	4 (17.39)	15 (71.43)	14 (28.57)	29 (59.18)
Transfers	0	0 (0.00)	1 (14.29)	2 (11.76)	0 (0.00)	1 (4.35)	1 (4.76)	3 (6.12)	1 (2.04)
	1	3 (33.33)	0 (0.00)	2 (11.76)	1 (7.69)	6 (26.09)	0 (0.00)	11 (22.45)	2 (4.08)
	2	1 (11.11)	0 (0.00)	3 (17.65)	1 (7.69)	6 (26.09)	2 (9.52)	10 (20.41)	3 (6.12)
	3	1 (11.11)	0 (0.00)	5 (29.41)	2 (15.38)	4 (17.39)	3 (14.29)	10 (20.41)	5 (10.20)
	4	4 (44.44)	6 (85.71)	5 (29.41)	9 (69.23)	6 (26.09)	15 (71.43)	15 (30.61)	30 (61.22)
Standing with eyes closed	0	3 (33.33)	1 (14.29)	5 (29.41)	1 (7.69)	8 (34.78)	2 (9.52)	16 (32.65)	4 (8.16)
	1	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	2	0 (0.00)	0 (0.00)	0 (0.00)	2 (15.38)	0 (0.00)	0 (0.00)	0 (0.00)	2 (4.08)
	3	3 (33.33)	1 (14.29)	8 (47.06)	2 (15.38)	10 (43.48)	6 (28.57)	21 (42.86)	8 (16.33)
	4	3 (33.33)	5 (71.43)	4 (23.53)	8 (61.54)	5 (21.74)	13 (61.90)	12 (24.49)	27 (55.10)
Standing with feet together	0	4 (44.44)	1 (14.29)	5 (29.41)	1 (7.69)	9 (39.13)	3 (14.29)	18 (36.73)	5 (10.20)
	1	1 (11.11)	0 (0.00)	1 (5.88)	0 (0.00)	1 (4.35)	0 (0.00)	3 (6.12)	0 (0.00)
	2	0 (0.00)	0 (0.00)	2 (11.76)	0 (0.00)	1 (4.35)	1 (4.76)	3 (6.12)	1 (2.04)
	3	1 (11.11)	1 (14.29)	6 (35.29)	5 (38.46)	6 (26.09)	5 (23.81)	13 (26.53)	11 (22.45)
	4	3 (33.33)	5 (71.43)	3 (17.65)	7 (53.85)	6 (26.09)	12 (57.14)	12 (24.49)	24 (48.98)

Table 4.10: Berg Balance Scale displaying frequency and percentage scores for individual items 8 to 14

Berg balance scale		HIV+		HIV-		HIV undiagnosed		Total	
Item	Score	Admission	Discharge	Admission	Discharge	Admission	Discharge	Admission	Discharge
		n= 9 (18.37%)	n= 7 (17.07%)	n= 17 (34.69%)	n= 13 (31.71%)	n= 23 (46.94%)	n= 21 (51.21%)	n= 49 (100%)	n= 41 (100%)
Reaching forward	0	3 (33.33)	1 (14.29)	5 (29.41)	1 (7.69)	8 (34.78)	3 (14.29)	16 (32.65)	5 (10.20)
	1	1 (11.11)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)	0 (0.00)
	2	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	3	0 (0.00)	0 (0.00)	2 (11.76)	1 (7.69)	4 (17.39)	3 (14.29)	6 (12.24)	4 (8.16)
	4	5 (55.56)	6 (85.71)	10 (58.82)	11 (84.62)	11 (47.83)	15 (71.43)	26 (53.06)	32 (65.31)
Retrieving object	0	5 (55.56)	1 (14.29)	6 (35.29)	2 (15.38)	11 (47.83)	4 (19.05)	22 (44.90)	6 (12.24)
	1	0 (0.00)	0 (0.00)	1 (5.88)	2 (15.38)	0 (0.00)	0 (0.00)	1 (2.04)	2 (4.08)
	2	0 (0.00)	0 (0.00)	0 (0.00)	1 (7.69)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)
	3	0 (0.00)	1 (14.29)	5 (29.41)	1 (7.69)	9 (39.13)	6 (28.57)	14 (28.57)	9 (18.37)
	4	4 (44.44)	5 (71.43)	5 (29.41)	7 (53.85)	3 (13.04)	11 (52.38)	12 (24.49)	23 (46.94)
Turning to look behind	0	3 (33.33)	1 (14.29)	5 (29.41)	1 (7.69)	8 (34.78)	3 (14.29)	16 (32.65)	5 (10.20)
	1	1 (11.11)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)	0 (0.00)
	2	0 (0.00)	0 (0.00)	1 (5.88)	0 (0.00)	1 (4.35)	0 (0.00)	2 (4.08)	0 (0.00)
	3	1 (11.11)	1 (14.29)	5 (29.41)	5 (38.46)	9 (39.13)	3 (14.29)	15 (30.61)	9 (18.37)
	4	4 (44.44)	5 (71.43)	6 (35.29)	7 (53.85)	5 (21.74)	15 (71.43)	15 (30.61)	27 (55.10)
Turning 360	0	5 (55.56)	1 (14.29)	10 (58.82)	4 (30.77)	13 (56.52)	6 (28.57)	28 (57.14)	11 (22.45)
	1	0 (0.00)	1 (14.29)	1 (5.88)	1 (7.69)	1 (4.35)	0 (0.00)	2 (4.08)	2 (4.08)
	2	1 (11.11)	0 (0.00)	1 (5.88)	1 (7.69)	4 (17.39)	5 (23.81)	6 (12.24)	6 (12.24)
	3	1 (11.11)	0 (0.00)	1 (5.88)	2 (15.38)	2 (8.70)	1 (4.76)	4 (8.16)	3 (6.12)
	4	2 (22.22)	5 (71.43)	4 (23.53)	5 (38.46)	3 (13.04)	9 (42.86)	9 (18.37)	19 (38.78)
Placing alternate foot	0	5 (55.56)	2 (28.57)	10 (58.82)	4 (30.77)	15 (65.22)	9 (42.86)	30 (61.22)	15 (30.61)
	1	0 (0.00)	0 (0.00)	2 (11.76)	1 (7.69)	0 (0.00)	0 (0.00)	2 (4.08)	1 (2.04)
	2	0 (0.00)	0 (0.00)	0 (0.00)	2 (15.38)	0 (0.00)	1 (4.76)	0 (0.00)	3 (6.12)
	3	2 (22.22)	0 (0.00)	1 (5.88)	0 (0.00)	3 (13.04)	3 (14.29)	6 (12.24)	3 (6.12)
	4	2 (22.22)	5 (71.43)	4 (23.53)	6 (46.15)	5 (21.74)	8 (38.10)	11 (22.45)	19 (38.78)
Standing with feet together	0	6 (66.67)	2 (28.57)	8 (47.06)	5 (38.46)	14 (60.87)	10 (47.62)	28 (57.14)	18 (36.73)
	1	1 (11.11)	0 (0.00)	4 (23.53)	2 (15.38)	3 (13.04)	1 (4.76)	8 (16.33)	3 (6.12)
	2	0 (0.00)	1 (14.29)	1 (5.88)	0 (0.00)	1 (4.35)	1 (4.76)	2 (4.08)	2 (4.08)
	3	0 (0.00)	0 (0.00)	3 (17.65)	3 (23.08)	4 (17.39)	3 (14.29)	7 (14.29)	6 (12.14)
	4	2 (22.22)	4 (57.14)	1 (5.88)	3 (23.08)	1 (4.35)	5 (23.81)	4 (8.16)	12 (24.49)
Standing on one foot	0	6 (66.67)	2 (28.57)	9 (52.94)	3 (23,08)	13 (56.52)	7 (33.33)	28 (57.14)	12 (24.49)
	1	1 (11.11)	1 (14.29)	2 (11.76)	0 (0.00)	2 (8.70)	3 (14.29)	5 (10.20)	4 (8.16)
	2	0 (0.00)	0 (0.00)	0 (0.00)	3 (23.08)	1 (4.35)	1 (4.76)	1 (2.04)	4 (8.16)
	3	0 (0.00)	1 (14.29)	2 (11.76)	3 (23.08)	4 (17.39)	5 (23.81)	6 (12.24)	9 (18.37)
	4	2 (22.22)	3 (42.86)	4 (23.53)	4 (30.77)	3 (13.04)	5 (23.81)	9 (18.37)	12 (24.49)

Table 4.11: Berg Balance Scale displaying median and range scores for balance

Berg Balance Scale	HIV+ mdn (min-max)	HIV- mdn (min-max)	HIV undiagnosed mdn (min-max)	Total mdn (min-max)
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
Admission	27 (7-56)	33 (0-56)	28 (7-56)	29 (0-56)
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.21%)	n= 41 (100%)
Discharge	54 (7-56)	54 (3-56)	45 (4-56)	47 (3-56)
Difference (between admission and discharge scores)	8 (0-31)	16 (3-27)	15 (0-52)	15 (0-52)

Mdn- median; Min- minimum; Max- maximum

4.6.4.2 MatScan

The MatScan is a pressure measurement platform. Combined with Tekscan software, the mat is able to record and evaluate balance using different variables and gives the assessor an output for each variable in order to ascertain any impairment and describe balance more comprehensively (www.tekscan.com/medical). The variables assessed in this study were (i) asymmetry in static standing looking at the difference in percentage weight bearing between each lower limb, (ii) center of pressure (COP) velocity, and (iii) distance COP travelled in anterior-posterior and mediolateral directions denoted as sway (Table 4.12). A few participants, however, displayed deterioration on reassessment prior to discharge and this is reflected in the negative scores in the range within the median difference between admission and discharge scores (Table 4.12). Normal ranges for the following variables have not yet been established (Kumar, Omar, Htwe, Joseph, Krishnan, Esfehani & Min, 2014).

(i) Weight bearing asymmetry

The overall results for the weight bearing difference between affected and less affected lower limbs seemed to have regressed when looking at the median as it showed that the weight bearing difference had increased by 2% on discharge. However, the range (minimum to maximum values) shows a great improvement, with the maximum difference in asymmetry decreasing by 44%. The difference between asymmetry in weight bearing for the total study sample when comparing admission and discharge results was 2%. The HIV+ group was 4% more than other groups but showed no statistical significant difference among groups ($p = 0.3834$).

(ii) COP Velocity

Overall, the study sample improved by 0.01 m/s in static standing velocity, i.e. COP moving slower indicative of increased stability. The individual groups displayed similar results. There was no statistically significant difference found for admission and discharge results for COP velocity ($p = 0.6330$).

(iii) Anterior-posterior and mediolateral sway of COP

Overall, the anterior-posterior sway improved by 0.62cm and the mediolateral sway improved by 0.6cm. A decrease in the distance is indicative of increased stability. Looking at the difference between admission and discharge scores, the HIV+ group improved more than the other groups in the anterior-posterior sway and regressed more in the mediolateral sway. However, no statistical significance was found for the difference between admission and discharge results for anterior-posterior nor medio-lateral sway ($p = 0.9045$ and $p = 0.7931$ respectively).

Table 4.12: MatScan results for weight bearing symmetry and centre of pressure measurements

Variables	HIV+ mdn (min-max)	HIV- mdn (min-max)	HIV undiagnosed mdn (min-max)	Total mdn (min-max)	P-value
Asymmetry (%)					
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)	
Admission	25 (4 - 52)	14 (2 - 68)	14 (0 - 22)	14 (0 - 68)	
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.2%)	n= 41 (100%)	
Discharge	9 (4 - 20)	17 (0 - 100)	18 (0 - 28)	16 (0 - 24)	
Median difference between admission and discharge	6 (-2 - 42)	2 (-8 - 44)	2 (-14 - 20)	2 (-14 -44)	0.3834
Velocity (m/s)					
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)	
Admission	0.03 (0.02 - 3.23)	0.03 (0.02 - 0.14)	0.02 (0.01 – 0.05)	0.03 (0.01 – 3.23)	
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.2%)	n= 41 (100%)	
Discharge	0.02 (0.02 - 0.03)	0.02 (0.02 - 0.04)	0.02 (0.01 – 1.00)	0.02 (0.01 – 1.00)	
Median difference between admission and discharge	0.001(-0.001 - 3.21)	0.01 (-0.01 - 0.13)	0.001 (-0.11 – 0.02)	0.01 (-0.11 – 3.21)	0.6330
AP sway (cm)					
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)	
Admission	2.92 (0.95 - 6.05)	2.94 (1.40 – 8.25)	3.18 (1.67 – 9.13)	3.05 (0.95 – 9.13)	
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.2%)	n= 41 (100%)	
Discharge	1.64 (1.06 - 2.41)	2.26 (1.53 – 5.41)	2.56 (1.75 – 5.56)	2.43 (1.06 – 5.56)	
Median difference between admission and discharge	0.75 (-0.23 - 2.37)	0.50 (-0.73– 6.48)	0.45 (-0.08 – 3.57)	0.54 (-0.86 – 6.48)	0.9045
ML sway (cm)					
	n= 9 (18.36%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)	
Admission	2.81 (0.52 - 8.97)	3.66 (0.99 – 9.72)	2.56 (0.06 – 15.59)	3.04 (0.06 – 15.59)	
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.21%)	n= 41 (100%)	
Discharge	1.65 (0.66 - 4.83)	2.70 (0.72 – 5.99)	2.58 (0.82 – 4.68)	2.44 (0.66 – 5.99)	
Median difference between admission and discharge	0.36 (-1.00 - 4.99)	0.35 (-0.81– 8.20)	0.94 (-1.60 – 12.94)	0.62 (-1.60 – 12.94)	0.7931

WB= Weight bearing; AP= Anterior Posterior; ML= Mediolateral; Mdn- median; Min- minimum; Max- maximum

4.6.5 Patient perception of functional outcome using the EQ5D

The EQ5D is a self-reported measurement tool used in various conditions including HIV/AIDS and stroke (Hunger et al., 2012). In scoring, patients were asked to tick off the statement/level (1 to 3) that best described their current health status in each domain. Level 1 being the best option and level 3 being the worst. Patients were also asked to score their health status using a Visual Analog Scale (VAS) rating 0 to 100; the score of 0 being worst and 100 the best. The results are presented below.

4.6.5.1 Perception of best imaginable health state

As expected, the overall scores were high for all participants prior to stroke with the maximum score of 100 as the median (Table 4.13). The majority of participants reported independence in ADLs as well as being pain free and having lower levels of anxiety. These overall scores dropped by half, as would be expected on admission to rehabilitation after a stroke. The scores improved significantly with a median of 30 points on discharge, showing great improvement. One participant however displayed deterioration on reassessment prior to discharge and this is reflected in the negative score in the range within the HIV- group. With regard to the Best Imaginable Health State Scale on comparing the difference between 'prior to stroke', admission and discharge scores, no statistical significant difference was found among groups (p = 0.8048).

Table 4.13: Best imaginable Health State Scale as measured by VAS and EQ5D

Best Imaginable Health state scale	**HIV+** mdn (min- max)	**HIV-** mdn (min- max)	**HIV undiagnosed** mdn (min- max)	**Total** mdn (min- max)
	n= 9 (18.37%)	n= 17 (34.69%)	n= 23 (46.94%)	n= 49 (100%)
Prior to stroke	100 (80-100)	100 (50-100)	100 (70-100)	100 (50-100)
Admission	50 (20-65)	50 (20-100)	50 (10-90)	50 (10-100)
	n= 7 (17.07%)	n= 13 (31.71%)	n= 21 (51.21%)	n= 41 (100%)
Discharge	75 (60-100)	80 (59-90)	85 (50-100)	80 (50-100)
Median difference (between admission and discharge scores)	30 (15-40)	30 (-30- 70)	30 (5-75)	30 (-30- 75)

Mdn- median; Min- minimum; Max- maximum

4.6.5.2. Perception of function, pain and anxiety

On admission, scores dropped with 85.71% (n = 42) of participants reporting problems with walking and self-care, nearly half (n = 24; 48.98%) reported some problems with usual activities and 44.90% (n = 22) reported an inability to perform usual activities (Table

4.14). Participants who reported moderate pain and discomfort doubled on admission and those who experienced anxiety or depression increased by 22.45% (n = 11).

Great improvement in perception of function, pain and discomfort as well as anxiety and depression were noted on discharge. The mobility scores on discharge improved significantly with 51.22% (n = 21) participants reporting no problems with walking compared to 6.12% (n = 3) on admission. The odds of attaining a better perceived outcome for mobility on discharge was 48% (p = 0.001), 36% better outcome on self-care (p = 0.001) and 41% better chance of attaining a better perceived score on discharge for usual activities (p = 0.001). No significant differences were found for these items among groups.

When comparing prior and admission scores for items, pain and discomfort as well as anxiety and depression showed a significant decrease (p = 0.022 and p = 0.001 respectively). When comparing prior and discharge scores, no significant difference was noted for items pain and discomfort nor anxiety and depression (p = 0.279 and p = 0.101 respectively). This showed that discharge scores improved from admission scores and most patients returned to their perceived baseline level. No significant differences were noted among groups.

Table 4.14: Patient perception of function according to EQ5D questionnaire

EQ5D Admission Scores		HIV- status											
EQ5D Items			HIV +			HIV -			HIV Undiagnosed			Total	
		Prior	Admission	Discharge	Prior	Admission	Discharge	Prior	Admission	Discharge	Prior	Admission	Discharge
		n= 9 (18.37%)	n= 9 (18.37%)	n= 7 (17.07%)	n= 17 (34.69%)	n= 17 (34.69%)	n= 13 (31.71%)	n= 23 (46.94%)	n= 23 (46.94%)	n= 21 (51.21%)	n= 49 (100%)	n= 49 (100%)	n= 41 (100%)
Mobility	Level 1	9 (100.00)	1 (11.11)	5 (71.43)	17 (100.00)	1 (5.88)	8 (61.54)	22 (95.65)	1 (4.35)	8 (38.10)	48 (97.96)	3 (6.12)	21 (51.22)
	Level 2	0 (0.00)	7 (77.78)	2 (28.57)	0 (0.00)	16 (94.12)	4 (30.77)	1 (4.35)	19 (82.61)	13 (61.90)	1 (2.04)	42 (85.71)	19 (46.34)
	Level 3	0 (0.00)	1 (11.11)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (13.04)	0 (0.00)	0 (0.00)	4 (8.16)	0 (0.00)
Self-care	Level 1	9 (100.00)	1 (11.11)	6 (85.71)	17 (100.00)	3 (17.65)	10 (76.92)	23 (100.00)	2 (8.70)	16 (76.19)	49 (100.00)	6 (12.24)	32 (78.05)
	Level 2	0 (0.00)	8 (88.89)	1 (14.29)	0 (0.00)	14 (82.35)	3 (23.08)	0 (0.00)	20 (86.96)	5 (23.81)	0 (0.00)	42 (85.71)	9 (21.95)
	Level 3	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (4.35)	0 (0.00)	0 (0.00)	1 (2.04)	0 (0.00)
Usual Activities	Level 1	9 (100.00)	0 (0.00)	5 (71.43)	17 (100.00)	2 (11.76)	5 (38.46)	22 (65.65)	1 (4.35)	14 (66.67)	48 (0.00)	3 (6.12)	24 (58.54)
	Level 2	0 (0.00)	5 (55.56)	2 (28.57)	0 (0.00)	9 (52.94)	8 (61.54)	1 (4.35)	10 (43.48)	6 (28.57)	1 (2.04)	24 (48.98)	16 (39.02)
	Level 3	0 (0.00)	4 (44.44)	0 (0.00)	0 (0.00)	6 (35.29)	0 (0.00)	0 (0.00)	12 (52.17)	1 (4.76)	0 (0.00)	22 (44.90)	1 (2.44)
Pain/ discomfort	Level 1	7 (77.78)	4 (44.44)	5 (71.43)	16 (94.12)	13 (76.47)	11 (84.62)	15 (65.22)	11 (47.83)	12 (57.14)	38 (77.55)	28 (57.14)	28 (68.29)
	Level 2	1 (11.11)	4 (44.44)	1 (14.29)	1 (5.88)	4 (23.53)	2 (15.38)	8 (34.78)	12 (52.17)	9 (42.86)	10 (20.41)	20 (40.82)	12 (29.27)
	Level 3	1 (11.11)	1 (11.11)	1 (14.29)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)	1 (2.04)	1 (2.44)
Anxiety/ depression	Level 1	7 (77.78)	6 (66.67)	5 (71.42)	16 (94.12)	10 (58.82)	10 (76.92)	20 (86.96)	16 (69.57)	17 (80.95)	43 (87.76)	32 (65.31)	32 (78.05)
	Level 2	1 (11.11)	3 (33.33)	2 (28.57)	1 (5.88)	4 (23.53)	2 (15.38)	3 (13.04)	7 (30.43)	4 (19.05)	5 (10.20)	14 (28.57)	8 (19.51)
	Level 3	1 (11.11)	0 (0.00)	0 (0.00)	0 (0.00)	3 (17.65)	1 (7.69)	0 (0.00)	0 (0.00)	0 (0.00)	1 (2.04)	3 (6.12)	1 (2.44)

Mobility, self-care and usual activities: Level 1= independent in activity; Level 2= assistance needed with activity; Level 3= inability to do activity
Pain/discomfort and anxiety /depression: Level 1= does not experience symptoms; Level 2= experience moderate symptoms; Level 3= experiences severe symptom

4.7 Summary

The aim of the study was to describe the functional outcomes of stroke patients post inpatient rehabilitation with regard to their HIV status. This chapter described the demographic, stroke-related information, clinical presentation as well as function of participants, highlighting differences among the respective groups. Even though some differences between demographics and functional scores were seen, the sample size as well as the distribution of participants among groups was too small to conclude statistically significant differences. The next chapter will discuss the findings in detail, comparing current results with local and international literature.

Chapter 5: Discussion

5.1 Introduction

This chapter discusses the results obtained and how they compare to other local and international studies. The results are discussed under various headings, such as demographics and clinical presentation of people with stroke, functional outcomes on admission and discharge, and patient perception of function.

5.2 Demographics of Sample

5.2.1 Gender

The male to female ratio was closely matched in our study. Even though the HIV+ group was the only group with more females, no significant difference was found among groups. In sub-Saharan Africa more females than males are diagnosed with HIV. According to UNAIDS (2016) 56% of the newly infected HIV population in sub-Saharan Africa were female. Seven of the 11 studies in the scoping review (see Chapter 2) had more females than males but none of them showed this difference to be significant (Heikinheimo, 2012; Mlay & Bakari, 2010; Tipping et al., 2007; Modi et al., 2007; Kumwenda et al., 2005; Patel et al., 2005; Mochan et al., 2003). All of these studies had a small HIV+ stroke population. This may have been due to not all paients being tested for HIV and seen in the undiagnosed group of the current study. Majority of the primary studies were based at one hospital so this is not a true reflection of the wider HIV+ stroke population. Being that these patients are young, some may have recovered well in hospital and are referred home or to their local CHC or day hospital. Some who are in their late stages of HIV may even be referred to palliative care as their prognosis was poor. Larger samples are needed to consider whether gender has a significant impact on the prevalence of HIV+ stroke patients.

5.2.2 Race

Overall, mixed race was the largest ethnic group in our study. With regard to race, the majority of the HIV+ group were of black ethnicity and the majority of the HIV- and undiagnosed groups were mixed race. The differences between groups were not significant although, admittedly the sample was small. A study done by Hoffman et al. (2000) in Durban (KwaZulu Natal, South Africa) which focused on the black-white racial difference in stroke distribution, found that in addition to being significantly younger, the black racial category had a majority of HIV+ participants. Three other studies conducted in South Africa, which

focused only on HIV+ stroke participants, also based their studies solely on the black racial category as a larger percentage of HIV+ people are considered to be of black ethnicity (Modi et al., 2007; Patel et al., 2005; Hoffman et al., 2000). According to UNAIDS (2016), more than half of the global HIV+ population reside in Southern Africa. The majority of sub-Saharan African people are of black ethnicity; this may be why these studies were focused on one particular race.

5.2.3 Age

What seemed to be a common thread through literature is the significant age difference between HIV+ and HIV- stroke patients. According to UNAIDS (2016) 34% of the young HIV+ population who are aged between 15 and 24 years reside in sub-Saharan Africa, whereas globally 22% of the HIV+ population are aged between 15 and 24 years. This was seen in the current study with the HIV- and HIV undiagnosed groups having a median age of 51 and 53 respectively and the HIV+ group with the median age of 30. A prospective cohort study done by Tipping et al. (2007) reported that 91% of the HIV+ stroke sample were less than 46 years of age. The HIV+ group had a mean age of 33.4 years and 64 years for their control group who were HIV negative. Similar results were yielded by three other African studies (Heikinheimo et al., 2012; Malay & Bakari, 2010; Kumwenda et al., 2005). Other studies in our scoping review which looked only at the HIV+ stroke patients found that the majority of participants were aged younger than 50 years (Jowi et al., Modi et al., 2007; 2007; Mochan et al., 2003).

5.3 Clinical Presentation of Stroke

5.3.1 Side of stroke

In terms of the presentation in left and right stroke patients, symptoms originate from a lesion in the contralateral side of the brain i.e. a right sided brain lesion/stroke would give rise to symptoms on the left side of the body and vice versa (Kottorp, Ekstan & Lie, 2013). Both left and right strokes may experience symptoms of hemianopia, hemianaesthesia and hemiplegia (Kottorp et al., 2013). Problems such as understanding speech or word finding issues occur mainly in left sided brain lesions/stroke, while both left and right lesions could have difficulty speaking clearly due to vocal cord control being affected (Kottorp et al., 2013; Hart, 1990;). Hemineglect as well as lack of insight and difficulties with visual and spatial skills occur mainly in right sided brain lesions/stroke (Kottorp et al., 2013). Hemiplegia refers

to the decrease in strength or paralyses, but is used often as a term that encompasses all impairments that are expected with left or right sided brain lesions (Hart, 1990).

A Swiss study which looked at the difference of awareness between left and right sided hemiplegia, found that of 183 participants 42.63% had left sided brain lesions and 57.38% had right sided brain lesions (Kottorp et al., 2013). This Swiss study found no significant difference between groups in terms of functional status and ability to perform ADLs. Similarly, of the overall sample in our current study, 51.02% of participants had left hemiplegia and 46.94% had right hemiplegia. This distribution was similar in all three groups, with one participant in the HIV undiagnosed group having a cerebellar stroke. Similar to Kottorp et al. (2013) no significant differences were seen in functional outcome between left and right hemiplegic participants of the current study.

5.3.2 Risk factors for stroke

The most common risk factors or combination of risk factors for stroke are hypertension and type 2 diabetes (Hu, Sarti, Jousilahti, Peltonen, Qiao, Antikainen & Tuomilehto, 2005). The current study displayed similar results with the most common risk factor being hypertension in both HIV- and undiagnosed groups. The most common combination in the HIV- group was hypertension and smoking, and in the HIV undiagnosed group hypertension and diabetes. This differed significantly to the HIV+ group with regard to hypertension and diabetes. This was reiterated in the scoping review with the usual risk factors, such as diabetes and hypertension, being uncommon in the HIV+ groups (; Heikinheimo et al., 2012; Tipping et al., 2007; Hoffman et al., 2000). Heikinheimo et al. (2012) suggested that this may be due to hypertension and diabetes type 2 being strongly correlated with age.

A study conducted by Tipping et al. (2007) found similar results and suggested that HIV could be a risk factor for stroke as participants were significantly younger with no other risk factors. Having HIV could be considered a risk factor for stroke. The current study showed 22.22% of the HIV+ group without a known risk factor for stroke which was not seen in the HIV- and undiagnosed groups. Similarly, of the HIV+ participants in a study conducted by Hoffman et al. (2000), 85% fell into the unknown stroke cause category. Patel et al. (2005) who conducted a study to determine whether HIV seropositivity confers a predisposition to stroke by comparing age-matched HIV+ and HIV- black African patients with cerebrovascular disease reported an odds ratio of 2.3, indicating that individuals who were HIV+ were twice as likely to have a stroke. Patel et al. (2005) also stated that until studies

on larger cohorts are done, an HIV+ test should not preclude further investigations to rule out other causes for stroke.

The current study found opportunistic infections to be the most common reported risk factor of stroke in the HIV+ group. Five studies in the scoping review had similar findings (Tipping et al., 2007; Kumwenda et al., 2005; Patel et al., 2005; Mochan et al., 2003; Hoffman et al., 2000). These studies suggested that there is a strong correlation between HIV-related stroke and opportunistic infection. These studies also suggested that opportunistic infection was more prevalent than the conventional risk factors such as hypertension, diabetes, smoking and substance abuse amongst the HIV+ stroke group. In the current study, HIV+ participants still presented with some conventional risk factors, e.g. both smoking and substance abuse occurred in 22% of participants and hypertension and cholesterol in 11% respectively. This varied significantly from the HIV- and undiagnosed groups.

A low CD4 count has also been considered to be a risk factor for stroke in HIV+ populations. Five studies in the scoping review showed that a CD4 count of less than 200 was seen in most HIV+ stroke patients (Heikinheimo et al., 2012; Mlay & Bakari, 2010; Jowi et al., 2007; Modi et al., 2007; Tipping et al., 2007;). Similarly, the current study had a median CD4 of 130 (range 54-883). Mlay and Bakari (2010) also suggested that stroke or severe neurological manifestations may be an indication of late stage HIV. Other common risk factors for HIV-related stroke were vascular manifestations such as vasculitis, coagulopathy, cardiac embolisms and atherosclerosis (Heikinheimo et al., 2012; Tipping et al., 2005; Mochan et al., 2003). None of these was documented as risk factors in patient folders and none of the diagnostic tools used to diagnose these vascular conditions was evident in our sample.

As 100% of the HIV+ group in the current study were diagnosed with infarction type strokes, one could hypothesize vascular involvement since few of these participants had the more common risk factors for stroke, such as hypertension. None of the HIV+ participants suffered haemorrhagic strokes, but this type of stroke was evident in a small percentage of the HIV- group and HIV undiagnosed groups. This could be due to the high percentage of participants with hypertension in these groups in our sample.

5.3.3 Type of stroke

The type of stroke may affect functional recovery and a poorer functional outcome may contribute to the burden of disease. (Krishnamurthi, Feign, Forouzanfar... Murray, 2013; Scheepers, Ketelaar, Visser-Meily, de Groot, Twisk & Lindeman, 2008). The WHO describes

Disability Adjusted Life Year (DALY) as one year of a healthy life lost and the sum of these can be calculated for a particular population to estimate the burden of disease (www.who.int). A global burden of disease study was conducted, focusing on the global and regional distribution of ischaemic and haemorrhagic strokes (Krishnamurthi et al., 2013). In 2010, it was estimated that the global incidence of ischaemic strokes was more than double the amount of haemorrhagic strokes (Krishnamurthi et al., 2013). Even though significantly fewer people had haemorrhagic strokes, the DALYs for haemorrhagic strokes were significantly higher, being almost double the amount of ischaemic strokes, indicating a greater decrease in functional abilities of the haemorrhagic strokes (Krishnamurthi et al., 2013).

Scheepers et al. (2008) found similar results after conducting a longitudinal study to compare the difference in recovery between ischaemic and haemorrhagic strokes at four Dutch rehabilitation centres. They found that ischaemic strokes made a faster recovery and continued to recover over a longer period of time compared to haemorrhagic strokes (Scheepers et al., 2008). Similarly, the current study showed that the BI scores on both admission and discharge were lower for the haemorrhagic group with a median score of 45 on admission compared to the ischaemic strokes with a score of 55. The discharge scores for the haemorrhagic strokes were also indicative of these strokes being less functionally independent, with a median score of 60 indicating moderate dependence with ADLs, whereas ischaemic strokes were slightly dependent with a median score of 92.5. No significant age differences were seen between these stroke types. However, the haemorrhagic group had a significantly smaller sample size, making statistical analysis problematic.

5.3.4 Severity of stroke (mRS)

On admission, all groups in the current study displayed similar stroke severity with the majority in each group admitted with moderately severe disability (grade 4). This indicated the inability either to walk or to attend to own bodily needs without assistance. None of the HIV+ group were severely disabled (grade 5) on admission, whereas a small percentage of the HIV- and undiagnosed groups were severely disabled, requiring constant nursing care, and were both bedridden and incontinent. This was possibly due to some of these participants being 75 years and older, having multiple risk factors and one of whom having had a haemorrhagic stroke which is known for having a poorer outcome.

On discharge the HIV+ group seemed to be more independent than other groups. More than half of the HIV+ group had no significant disability despite symptoms (grade 1) and were able to carry out all previous activities, whereas less than a third of the HIV- and undiagnosed groups had slight disability. A majority of the lower functioning strokes was seen in the HIV- and undiagnosed groups. The HIV+ group had one participant with moderately severe disability. This participant was 62 years of age, 28 years older than the median age and had multiple risk factors, which could be the reason for poor functional recovery. The HIV+ group also had better admission scores; hence they may have had better discharge scores. Even though the HIV+ group showed a better functional recovery according to the mRS scores, no statistical significance was shown among groups.

Rouillard, de Weerdt, De Wit & Jelsma (2012) conducted a longitudinal descriptive study on the functional recovery of participants post first ever stroke. Having the same mean age and mRS scores to the current study's HIV- group, their sample also had fewer participants with slight to no disability while the majority had moderate disability when compared to the current study's HIV+ group. Again, this may be due to age and multiple risk factors. Rouillard et al. (2012) did not exclude HIV+ participants in their total sample and 11.76% (n = 6) of participants were known to be HIV+. The author conceded that the subgroup was too small to permit a comparative statistical analysis in terms of functional outcome (Rouillard et al., 2012).

Studies that compared HIV+ and HIV- groups using the mRS, such as Tipping et al. (2007) and Hoffman et al. (2000), showed no significant difference between groups but also had significantly smaller HIV+ samples. Heikinhemo et al. (2012) did a prospective one year follow up study and found a significant difference at six to eight weeks ($p = 0.015$), with the HIV+ group having a better score, but no significant difference at six-month to one year follow up. Again, their HIV+ group had a significantly smaller sample size not permitting a comparative statistical analysis for functional outcome.

5.4 Function Post Stroke

5.4.1 The role of age on functional recovery

Functional recovery is dependent on neural plasticity, which is the ability of the brain to learn and relearn function by adapting neurons and re-circuiting neural synapses, which expand the amount of cortex involved in controlling function or movement (Kleim, 2011). Neurorehabilitation done by physiotherapists and occupational therapists uses techniques

which utilise neural plasticity (Kleim, 2011). As we age, the capacity of neural plasticity decreases, hence older patients may have a poorer functional outcome (Park & Bischof, 2013). Hence, the HIV+ group of the current study may be expected to have a better functional outcome due to these participants being significantly younger.

5.4.2 Impact of stroke on activities of daily living (Individual Barthel items)

On discharge the majority of participants were independent in self-care ADLs such as eating, bathing, grooming, dressing, toileting and transfers (in and out of the wheelchair), indicating that they may require minimal assistance from caregivers. Concerning mobility and stair climbing, admission scores were similar in all groups for participants who were immobile and unable to climb stairs. On discharge, the HIV+ group had a greater percentage of participants being independent in mobility and stair climbing compared to other groups. In both items 71.43% (n = 5) the HIV+ group was independent in mobility (able to walk > 50 yards independently) and stair climbing, while the HIV- and undiagnosed groups had less than half of their sample being independent in these activities. This may indicate a larger percentage of the HIV+ group being able to participate independently in usual activities, being introduced back into the community and possibly returning to work. Because the BI is based mostly on being independent in self-care ADLs, it is hard to say whether these participants were reintegrated into the community and returned to work. Other outcome measures such as the Nottingham extended activities of daily living (NEADL) scale could be used in future studies to give a better understanding on reintegration and other ADLs which include housework (Rouillard et al., 2012).

5.4.3 Level of dependence post stroke (Total Barthel Index scores)

In our study, there were no significant functional differences seen among groups on admission. On discharge overall 17.07% (n = 7) of the entire sample was categorised as severely dependent (a score of 21 to 60) requiring maximal assistance with self-care and mobility on the BI. These participants were older than the median age of the total sample and had multiple risk factors impacting recovery. With a score of 40 or less on discharge, they may require assistance with ADLs throughout their life span (Sulter et al,1999).

It has been advocated that using a combination of outcome measures to assess levels of independence is more effective in describing participant function (Sulter et al., 1999). The mRS and BI are commonly used in combination to describe stroke populations (Cioncoloni et al, 2012; Huybrechts & Caro, 2007; Sulter et al., 1999). Sulter et al. (1999) suggested that a mRS score <3 and BI score <60 most likely resulted in an unfavourable outcome as these

participants struggled with mobility and were dependent in most ADLs. A score of 60 is the pivotal point at which participants go from dependency to assisted independence (Sulter et al., 1999). The majority of the HIV undiagnosed group (52.38%, n = 11) in our study had participants with moderate dependence (a score of 61 to 90) transitioning from dependence to assisted independence, indicating that assistance was still needed with self-care and mobility. Conversely, the majority of the HIV+ group (71.43%, n = 5) and the HIV- group (53.85%, n = 7) showed slight dependence (a score of 91 to 99) and complete independence (a score of 100) in ADLs needing minimal to no assistance with ADLs and mobility (Sulter et al., 1999).

The majority of the HIV+ and HIV- groups seemed to have a better functional recovery. Since the majority of all groups, including the HIV undiagnosed group, were at the pivotal stage in regaining independence (i.e. mRS> 3 and BI> 60), however, continued rehabilitation may assist in these participants improving functionally six months to a year post incident. This could mean that some of the current non-ambulant participants in our study may continue to improve and be walking with further rehabilitation (Heikinheimo et al., 2012; Sulter et al., 1999).

Similar to the current study, another study done at the WCRC by Rouillard et al. (2012) had HIV+ participants who were all aged under 40 years while the HIV- participants had a mean age of 51.9 years. Although this particular subgroup in Rouillard et al (2012) was not used for comparative statistical analysis (small group size), the researcher found that the HIV+ group had a good functional recovery and had a premorbid BI function of 100, except for one participant who reported poor function prior to stroke. On six-month follow up, all HIV+ participants were doing well except for the one participant (with low premorbid function) who was discharged to palliative care (Hospice) possibly due to late stage HIV (S. Rouillard, 2017, personal correspondence, 24 May 2017). Another study looking at the functional outcomes of early rehabilitation post stroke had a BI mean score of 73.1 at two months from admission (Laufer, Sivan, Schwarzwann & Sprechter, 2003). This score is significantly less that the current study overall median on discharge possibly due to these participants being older and having a larger percentage of participants with multiple risk factors (Laufer et al., 2003). On the contrary other studies with significantly older stroke participants having multiple risk factors had similar BI scores to the current study (Rasmussen, Kjaer, Skerris, Skou, Christoffersen, Seest, Paulsen, Ronholt & Overgaard, 2016; Rhoda, Smith, Putman, Mpofu, De Weerdt and De Wit, 2014).

Rhoda et al. (2014) did a comparative study on functional recovery post stroke in developed versus developing countries. The two independent studies done in Germany and South Africa then compared the functional outcomes of their respective stroke samples. The mean age was similar between groups, with the German mean age at 63.9 and 63.4 for South Africans. Using the BI, at six months follow up the German sample had a median score of 95, similar to the current study and the South African sample had a median score of 85 ($p = 0.003$). The findings in Rasmussen et al. (2016) and Rhoda et al. (2014) suggested that strokes in developed countries may have a better outcome than in developing countries as participants in developed countries who are significantly older improve at the same rate as younger strokes do in developing countries. Rhoda et al. (2014) speculated that this may be due to lack of resources, manpower and facilities in South Africa. Stroke patients in developed countries are reported to receive more rigorous rehabilitation, hence the difference in functional recovery (Rhoda et al., 2014). No known studies have been conducted using the BI to assess functional recovery of stroke patients who are HIV+. Hence a comparison with current literature could not be made for this group alone.

Even though the HIV+ group in the current study had a smaller change in median score on discharge compared to other groups, this was not seen as significant as all groups had similar change in median scores. The HIV- group was the only group to receive a negative score in the range for the BI change in score, indicating a decrease in function. As the BI was used as a self-reported measure on discharge, this particular participant felt that they had regressed in function but this finding was not consistent with the objective measures as they had improved in BBS and mRS scores. In addition, the improvements the patient made was to impairment and not function. Since the BI is a functional outcome measure it is not sensitive enough to pick up this difference. The BBS even though a measure of the risk of falling was able to pick up this discrepancy because there was an improvement in the balance impairment.

5.4.4 Assistive devices issued on admission and discharge

Immobility is common after an acute stroke due to impairments such as upper and lower limb weakness, balance, proprioceptive and visual neglect disorders and other than rehabilitation, it is often remedied with assistive devices (Kenzie, Semrau, Findlater, Herter, Hill, Scott & Dukelow, 2014; Hollands, Pelton, Tyson, Hollands & van Vliet, 2012; Jutai, Coulson, Teasell, Bayley, Garland, Mayo, Wood-Dauphinee 2007; Tyson, Hanley, Chillala, Selley & Tallis, 2006; Lawrence, Coshall, Dundas, Stewart, Rudd, Howard & Wolfe, 2001). This was seen in the current study, where on admission the majority of participants in each

group required a wheelchair as the attending clinicians considered them unsafe to mobilise independently. This was also reflected by low scores on the mRS and BI on admission, where the majority of participants were categorised as moderately severe in disability and being immobile.

On discharge, the overall sample showed that a majority of participants were mobile with the HIV+ group having the largest percentage (85.71%, n = 6) of ambulant participants. More than half of the HIV+ group did not require assistive devices such as walking sticks, whereas a third of the HIV- and undiagnosed groups were able to mobilise without a device. One participant (14.29%) of the HIV+ group required a wheelchair, whereas a third and more of the HIV- and undiagnosed groups required wheelchairs. This was also reflected in the mRS and BI scores where a greater percentage of the HIV+ group had no significant disability despite impairments and were independent in mobility compared to the HIV- and undiagnosed groups. The HIV+ group may have done better due to age difference and having fewer risk factors and better baseline scores. However, a prospective study conducted in the United Kingdom had an older sample than the HIV- and undiagnosed groups of the current study and showed fewer participants needing wheelchairs (9.81%) as their primary aid, fewer participants requiring walking aids (32.91%) and more than half of the sample not requiring assistive devices (Jutai et al., 2007). This showed similar results to the younger HIV+ group of the current study. As stated before, developed countries seem to have a better outcome which could be ascribed to better resources, more manpower, and more intensive rehabilitation done more frequently (Rhoda et al., 2014). Even though a larger percentage of the HIV+ group was ambulant and fewer of the HIV+ group required assistive devices compared to the other groups, there was no significance seen with the use of assistive devices, as the majority of participants in each group were ambulant and showed less dependency in mobility and ADLs.

Mobility still remains a functional problem for some stroke participants in the current study. Verma et al. (2012) stated that most stroke patients regain some ability to walk, but 40% require assistance and 60% are restricted in community ambulation. Patients with stroke may be independent indoors but lack the capabilities to negotiate rough terrain outdoors (Verma et al., 2012). It is also important to note that even though participants may not have required an ambulatory assistive device, 80.77% of the current study who were ambulant did require an ankle foot orthosis (AFO). This showed that participants still needed ankle support possibly due to muscle weakness and sensory impairments which impact balance and risk of falling, making community ambulation unsafe (Gorst, Lyddon, Marsden, Paton,

Morrison, Cramp & Freeman, 2016). Further investigation into community ambulation was not assessed in the current study but is suggested for future studies.

5.5 Impact of Stroke on Balance

5.5.1 Balance dysfunction

Balance impairments were seen in the majority of participants in the current study. Balance recovery is seen as a determinant for both ADL and community ambulation (Braun, Marks, Thiel, Zietz, Zutter & Gruneberg, 2016; Gorst et al., 2016; Schmid, van Puymbroeck, Altenburger, Dierks, Miller, Damush & Williams, 2012; Michael, Allen & Marcko, 2005). The inability to sit during early recovery is closely linked to poor prognosis and independence in ADLs as well as mobility (Tyson, Hanley, Chillala, Selley & Tallis, 2006). This was evident in the current study with five participants of the entire sample not being able to sit independently on admission, three of whom were moderately severe to severely disabled on discharge. One of these participants from the HIV undiagnosed group, as mentioned before, regressed in BI score but this reflects the patient's self-reported perception of their abilities. Looking at the BBS and mRS scores, this participant made slight improvements even though still moderately severe in disability; no regression was observed. The slight improvement may also be due the BBS not being sensitive enough to detect change in stroke patients at the lower end of functioning. The BBS has only one applicable item (independent sitting) to record function for this lower level of functioning (Salter et al., 2013). One participant in the HIV+ group who was unable to sit on admission was sent home two weeks into rehabilitation when the MDT concluded that the participant had a poor prognosis. The exact reason for this decision was not clear in the medical records, but may be related to HIV stage. The majority of participants in our study who were unable to sit on admission were older than the overall median age and had multiple risk factors. Only one of the participants (of the HIV- group) who was unable to sit on admission made a significant recovery with no significant disability despite symptoms on discharge. This may have been attributed to age as this participant was significantly younger having a greater capacity for neural plasticity and had fewer risk factors for stroke pre-morbidly.

Other studies also found sitting balance as well as standing balance to be strong predictors of walking ability (Kwakkel & Kollen, 2013; Tyson et al., 2006; Kollen, van de Port, Lindeman, Twisk, Kwakkel, 2005). This was seen in the current study where the majority of participants of the entire sample (30.61%; n = 15) who were unable to stand on admission, had a poorer outcome than the rest of the sample. The majority of these participants (10/15) were

categorised as moderately severe in disability (mRS grade 4) meaning they were unable to walk and unable to attend to own bodily needs without assistance. Again, the majority of these participants were older than 50 years and had multiple risk factors. Even though the HIV undiagnosed group had fewer participants with a full score for standing independently than other groups on admission, this changed on discharge with the HIV- group having the smallest percentage of independent standing participants on discharge. This change may be attributed to the dropout rate in each group as more of the HIV- group were discharged earlier than expected than any other group, meaning that they were not able to perform the second assessment prior to discharge (see Table 4.9).

Overall improvements were noted in all groups, specifically in the standing unsupported, sitting unsupported and transfer items with the HIV+ group having a larger percentage of participants being independent in these items (see Table 4.9). This indicates improvement in function and these improvements in balance are indicative of greater strength, improved sensation and decreased hemineglect (Tyson et al., 2006). One may conclude that as the majority of participants were able to sit and stand independently on admission, this sample may have a good prognosis, being more functionally independent in ADLs and possibly mobility (as seen in BI scores), together with a decreased risk of falling (Braun et al., 2016; Gorst et al., 2016; Schmid et al., 2012; Michael et al., 2005).

5.5.2 Risk of falling

Overall all groups showed a medium risk of falling according to the BBS on admission, meaning they were unsafe to mobilise independently which affects their ability to perform ADLs (see Table 4.7), with the HIV- group having the highest median score (see Table 4.11) for BBS. On discharge the HIV+ and HIV- groups had the lowest risk of falling score followed by the HIV undiagnosed group indicating that a majority of participants were able to mobilise independently or with minimal assistance, potentially being independent in community ambulation (Tyson et al., 2006).

No statistical significant differences were seen among groups even though the HIV+ group seemed to have a higher percentage of full scores for more of the individual items of the BBS (see Table 4.9). This percentage was similar to the results seen with assistive devices where a greater percentage of HIV+ participants required no assistive devices compared to other groups, which could mean that the HIV+ group may have better balance and less of a risk of falling than the HIV- group. The MCD for the HIV+ group was half that of the HIV- and undiagnosed groups but they required fewer assistive devices than any other group (see

Table 4.11). The smaller change in score for the HIV+ group may be due to the smaller sample size and a greater percentage of participants with high scores on admission to begin with (see Table 4.11). It could also be due possibly to the BBS not being as sensitive to change in higher functioning stroke patients (Salter et al., 2013). It is important to note that there is no common interpretation of BBS results that exists, nor its relation to patient mobility and mobility aides, but only risk of falling (Salter et al., 2013). Therefore, the BI and recording of assistive devices issued was also described to enhance understanding of the sample's functioning. The combination of outcome measures used gave us a good indication of safety and mobility indoors. It is necessary for future studies comparing HIV+ and HIV- strokes to include outcome measures that assess independence once participants are re-integrated into their community and whether or not they are able to return to work or premorbid function.

Studies with stroke populations with a mean age over 60 years had similar admission scores falling within the range of medium risk of falling (23.8 to 28.3 points) as well as on discharge scores within the low risk of falling range (40.6 to 49.9 points) which were similar to the HIV undiagnosed group of our study (Chen, Chou, Yu, Chen, Shih & Hsieh, 2015; Garland, Ivaniva & Mochizuki, 2007; Garland, Willems, Ivanova, Miller, 2003). Garland et al. (2007) divided their stroke groups into mild and severe in disability. The authors found that severely disabled strokes were significantly older and had poorer BBS scores than their younger counterparts (mean age: 64.9 vs 52.8 and BBS mean: 49.9 vs 55.8 respectively). The overall BBS score of the current study was similar to that of the mildly disabled strokes in Garland et al. (2007) (see Table 4.11). This may be due to the samples being similar in age, hence having a greater capacity for neural plasticity (Park & Bischof, 2013; Salzman, 2010). There was no significance, however, regarding BBS scores found in the current study even though the HIV+ group was significantly younger.

5.5.3 Static standing balance measurement by pressure mapping (MatScan)

Kollen et al. (2005) state that improvement in control in standing balance is more pertinent than leg strength for attaining better walking balance. Most stroke survivors are able to stand independently but may have multiple impairments which affect balance, such as lateral deviation of the trunk towards the unaffected side, greater postural sway (i.e. COP velocity and distance), decreased leg strength on the affected side and weight bearing asymmetry (WBA) (Boukadida, Piotee, Dehail & Nadeau, 2015; Tysonet al., 2006). Asymmetry in weight bearing is due to less weight being taken on the affected leg because of the above mentioned impairments which cause smaller excursions when weight shifting to the affected

side. This could increase the risk of falling and is seen in all aspects of balance even in high functioning stroke patients (Pereira, Botelho & Martins, 2010; Tyson et al., 2006).

The MatScan was used to assess static standing balance specifically assessing WBA, COP velocity and distance. Excessive postural sway is shown in COP velocity and distance. The faster and further the COP sways, the more the participant struggles to maintain postural stability (Kamphuis et al, 2013; Adegoke et al, 2012). A systematic review done by Kamphuis et al (2013) shows that the greater the WBA, the greater the postural sway. To get a better idea of what the normal range would be for WBA, we compared the results of WBA distribution between limbs to a study done on non-disabled participants. Kumar et al. (2014) conducted a cross-sectional study on 33 non-disabled participants with the mean age of 59.24 years. Using the Symmetry Index (SI), a mathematical model utilised in the measurement of asymmetry which gives a score equivalent to the percentage of weight bearing asymmetry (PWBA). The PWBA was calculated and they found that the mean PWBA for nondisabled participants was 9.02 % (Kumar et al., 2014). The median PWBA in the current study are displayed in Table 4.12. The only group that had a similar PWBA on discharge was the HIV+ group (9%) and therefore considered to be more normal in their PWBA. The HIV- and undiagnosed groups had double the PWBA score of the HIV+ group meaning an increased level of asymmetry (17% and 18% respectively). Even though the HIV+ group had a higher median difference between admission and discharge scores (6% compared to 2% in the HIV- and undiagnosed groups), this was not seen as significant ($p = 0.3834$). A Nigerian study conducted on stroke patients' PWBA had similar findings to the HIV- and undiagnosed groups (Adegoke, Olaniyi & Akosile, 2012), with a mean age of 58.87 years and the mean time period after stroke was 13.58 months. The investigators found the mean PWBA to be 20.8% (SD = 14.7%), again double the percentage of the HIV+ groups more than a year post stroke (Adegoke et al., 2012). This could be due to the HIV+ participants having a lower mean age hence having better balance, having a larger percentage of participants being in the low fall risk category and not requiring assistive devices on discharge.

The velocity of sway of the centre of pressure (COP) was another factor assessed in the current study. According to a systematic review done by Ruhe, Fejer & Walker (2011), the mean COP velocity in healthy participants (mean age range: 13.8- 63 years) ranges from 0.003m/s to 0.016m/s. The HIV- group had the biggest change in score of 0.01m/s for the median difference between admission and discharge. The HIV+ and undiagnosed group had a median difference of 0.001m/s. The discharge scores for median velocity were similar

to a post-acute stroke study conducted by de Haart et al. (2004) of 37 stroke inpatients in the Netherlands. The median velocity for lateral and AP sway at 12 weeks (final assessment) was 0.013 m/s (range 0.01-0.016m/s) and 0.02 (range 0.015-0.024m/s) respectively. The current study sample showed similar results on discharge with a median of 0.02m/s (0.01-1.00) for overall velocity. The distance of sway, as measured in centimetres (cm), was assessed in both AP and lateral directions. In both these directions no significant difference was seen among groups of the current study. The negative values seen in all MatScan measures may be due to over compensation to reduce weight-bearing differences between limbs as participants were purposefully trying to improve on their previous scores. Their performance prior to being discharged could be affected by a number of factors, e.g. regression in sway of one participant in the HIV undiagnosed group could be ascribed to feeling unwell on the day of testing prior to discharge.

Overall, the majority of participants still struggled with WBA and COP sway on reassessment prior to discharge. This represents poorer standing balance that could be due to postural instability. It is reported that postural stability facilitates weight shifting and if affected hinders functional activities in ADL as well as mobility (Chengetanai, Tadyanemhandu, Chibhabha & Kaseke, 2016). Most participants of the current study may benefit from continued rehabilitation to address impairments causing instability in standing and walking, such as somatosensory deficits, weakness, poor muscle tone as well as spatial cognitive awareness deficits (Genthon, Rougier, Gissot, Froger, Pelissier & Perennou, 2008).

5.6 Participation Perception of Function, Pain and Anxiety

The general perception of function prior to stroke was good with the majority of participants being independent in all items and few experienced pain and anxiety/depression prior to having their stroke. On admission all participants experienced a decline in function, and a higher percentage of participants experienced pain/discomfort as well as anxiety/ depression. This change was seen to be statistically significant for all groups but no big difference was seen among groups. On discharge a definite improvement in all items was seen which was shown to be significantly better than the admission scores. These score were less than the “prior” scores, however, showing that participants did not feel they were as functionally capable as they were prior to having their stroke. Participants experienced more pain/discomfort and anxiety than they did prior to stroke. No significant differences were seen among groups.

Rouillard et al. (2012) also utilised the EQ5D to acquire patient perception of their health related quality of life post stroke. A total of 52% reported having problems with mobility. The least problematic domain was self-care with 30% reporting that they required assistance, whereas 61% required assistance with usual activities as seen in the HIV- group of the current study. The overall sample of the current study showed a better functional recovery on discharge than Rouillard et al. (2012). A significant age difference may have been the hindering factor in their functional recovery as the sample included in Rouillard et al. (2012) were older patients who could have a reduced capacity for neural plasticity.

The VAS scores of the current study indicated that the majority of participants had a good pre-morbid function (VAS = 100) and dropped by half on admission (VAS = 50). On discharge all participants made a significant improvement with a median difference between admission and discharge of 30 points with the exception of one participant. This particular participant felt that they had regressed despite improvements in the BI and BBS. The HIV+ group reported slightly lower VAS scores than the other groups even though functionally, they did well. Again, this may be due to age as they may have been more functionally able prior to stroke than their older counterparts.

In a health related quality of life study based in Cape Town, focusing on people living with HIV/AIDS (PLWA), differences were found in perceived health compared to the general community who were age matched (Hughes et al., 2004). A significant difference was found between both groups for most domains with the PLWA group experiencing more difficulties in each domain ($p<0.001$) besides the anxiety/ depression domain, which even though the PLWA had a higher percentage of those experiencing anxiety, the difference between groups was not significant ($p = 0.123$) (Hughes et al., 2004).

HIV itself could cause problems with function as seen in Hughes et al. (2004), with the added effect of functionally impairing conditions such as stroke, to which PLWA are prone. Subsequently, their quality of life would also be lowered. Due to these patients being younger, this not only puts an increased burden on society, as some of these patients would not be able to return to work, but may cause mental health conditions as the current and other studies show. They are therefore more at risk for anxiety and depression (Hughes et al., 2004; Breuer, Myer, Struthers & Joska, 2011). As suggested by Hughes et al. (2004), not only medical management but rehabilitation and mental health services are needed to decrease the impact these conditions may have on the quality of life of PLWA.

5.7 Rehabilitation Post Stroke

In-patient rehabilitation impacts functional outcome of stroke patients and is often delivered by a team of healthcare professionals. The multidisciplinary team may include physiotherapy, occupational and speech therapy, along with others such as, dieticians and social workers (Miller, Murray, Richards, Zorowitz, Bakas, Clark & Billinger, 2010; Keith 1991). Physiotherapy utilises a variety of techniques including strengthening exercises, balance retraining, facilitation of selective movement training and gait training (Rhoda et al., 2014; Miller et al., 2010). Occupational therapy (OT) often focuses on task retraining, such as activities of daily living (Smallfield & Karges, 2009). Cognitive deficits may be jointly addressed by OT as well as speech therapy (Smallfield & Karges, 2009). Speech language and hearing therapy tend to focus on regaining speech and language skills (Rhoda et al. 2014; Miller, et al., 2010). The exact type, content and duration of individual therapies received by participants in our sample were not the main focus of our study. Therapy is patient specific, hence each participant would have received a tailor-made rehabilitation programme dependent on their functional limitations and socioeconomic context (www.wcrc.co.za). However, the general outcome of participants in the current study was good, with the majority of these patients scoring in the higher percentiles for a number of the outcome measures, i.e. the mRS, BI and BBS at the end of their period of rehabilitation.

5.8 Length of inpatient therapy and time between stroke onset to admission for rehabilitation

Studies conducted in sub-Saharan Africa that compare the length of stay (LOS) of HIV+ and HIV- participants were medical studies which focused on LOS in an acute hospital setting specifically (Heikinheimo et al., 2012; Mlay & Bakari, 2010). Heikinheimo et al. (2012) showed no significant difference in LOS between HIV+ and HIV- strokes and had a mean LOS of 15.7 days. This differed from Mlay & Bakari (2010) who found a significant difference between the two groups in favour of the HIV- group (7.3 days and HIV+ group 10.3 days) ($p = 0.001$). This significant difference may be due to the stage of HIV, hence needing more medical treatment. Stroke is often a presentation of late stage HIV (Jowi et al., 2007). Once patients were medically stable their LOS may have differed.

With regard to the current samples' median time between stroke onset and admission to rehabilitation, differences were noted among groups but these were not seen as statistically significant. Unlike the study done by Mlay & Bakari (2010), the HIV+ group of the current study had the shortest stay with a median of two weeks, followed by the HIV- group (18

days) and the HIV undiagnosed group who were hospitalised for almost a month (see Table 4.5 in the previous chapter). The HIV+ and HIV- groups of the current study showed a similar median time between stroke onset and admission to the study done by Heikinheimo et al. (2012) which also showed no significant difference between the HIV+ and HIV- groups. However, there was one patient in the current study from the HIV- group who had medical complications unrelated to the stroke, which meant an extended acute hospital stay (218 days). The HIV- group may have had a shorter median for the time between stroke onset and admission to rehabilitation if these outlying data were removed as it may have skewed the HIV- group's data.

As Table 4.5 in the Results chapter indicates, the median length of stay (LOS) between groups did not show a significant difference even though the HIV+ group had a shorter stay of up to 10 days compared to other groups ($p = 0.0671$). This may be due to the significant age difference as younger patients have a greater capacity for neural plasticity (Park & Bischof, 2013). The HIV+ group also had a larger percentage of participants who had a low risk of falling and not requiring assistive devices on discharge, possibly indicative of milder strokes. The HIV+ group also had a high percentage of participants who were able to sit and stand independently on admission according to the BBS, which is a strong predictor for a good prognosis (Kwakkel & Kollen, 2013; Tyson et al., 2006; Kollen et al., 2005).

International studies conducted on stroke patients reported a mean LOS in inpatient rehabilitation ranging from 29 to 59.8 days (Bindawas, Mawajdeh, Vennu & Alhajdary, 2016; Grant, Goldsmith & Anton, 2014; Ozyemisci-Taskiran, Gunendi, Aknar, Karatas & Sepici, 2011; Tan, Heng, Chua & Chan, 2009). The current study median LOS days fell within this range. Rouillard et al. (2012) had a mean LOS of 62 days, nine days longer than the median current study sample, and more than two weeks longer than the HIV+ group. This may be due to the current sample being younger than that of Rouillard et al. (2012). As suggested by Spengos & Vemmas (2010), young strokes generally have a good functional recovery. All groups within the current study fell within the LOS ranges of international studies. It is also important to note that LOS may differ globally as different countries, particularly developed and developing countries, have different treatment protocols as well as available resources, giving a possible explanation for the broad range in LOS (Rhoda et al., 2014).

Once HIV+ patients who have suffered a stroke are medically stable, they seem to have a fast recovery, quicker than the other groups, which is expected of a younger population (Meintjies et al., 2014, Spemmos & Vengos, 2010). They often present with fewer risk factors due to younger age. Since a majority of HIV+ patients who suffered a stroke is diagnosed

only after the stroke incident, many of them are not on medical treatment, such as antiretroviral therapy (ART). Once patients at the WCRC are first diagnosed at the primary care level they may be required to start ARTs to become medically stable in order to participate effectively in rehabilitation. This could be an added reason that they recover faster (Meintjies et al., 2014; Tipping et al., 2007; Hoffmann et al., 2000). Since the effect of ARTs on functional recovery was not the focus of this study, this cannot be certain for the current study sample.

The current study achieved its objectives of adequately describing the study sample, its functional outcomes on discharge, participant perception of function as well as LOS. The only major differences seen among groups was age with the HIV+ group being significantly younger, and substance abuse as well as opportunistic infections being the main risk factors in the HIV+ group compared to the older HIV- and undiagnosed groups with lifestyle related non-communicable diseases. Having a younger stroke population may suggest that HIV could be a risk factor for stroke. The overall sample showed a majority of participants scoring in the higher percentiles for the outcome measures, indicating mild disability, independence in ADLs, low risk of falling and an improved functional perception on discharge. Even though the HIV+ group had a larger percentage of participants scoring in the higher percentiles, there were no significant differences among groups with regard to functional outcome. Recovery could be affected by a number of variables, in this sample, HIV-status did not seem to negatively affect functional outcome.

Chapter 6: Conclusion and Recommendations

This chapter gives an overall conclusion to the current study. This chapter also discusses the limitations of the current study, recommendations for future studies and the clinical relevance of the findings.

6.1 Overview of the Scope of the Thesis

The initial research question posed was “What are the functional outcomes of post stroke patients following inpatient rehabilitation who are HIV positive, -negative and -undiagnosed?” To answer this question, an introduction and scoping review containing current literature pertaining to the rise and relevance of HIV+ stroke patients and the functional outcome of these patients was presented. After evaluating the methodology used by these studies, the aims, objectives and methodology of the current study was developed. All of the aims and objectives were completed, presented in the results chapter and the implications of these results were further discussed in Chapter 5.

6.2 Objectives

The primary and secondary objectives are discussed below:

6.2.1 Primary objectives

The HIV and immune status (CD4 count if relevant) and the functional outcomes of stroke patients in terms of activity or activity limitations on admission versus discharge from inpatient rehabilitation were described successfully. HIV status (HIV+, HIV- and undiagnosed) and immune status (CD4 count if relevant) were described as patients were grouped accordingly. The HIV+ group was the smallest in sample size, hence not as prevalent as originally envisaged during the conceptual phase of the study. The documented CD4 count of the HIV+ group (median CD4 count: 130) was found to be similar to the literature described in the scoping review, where patients with a CD4 count of less than 200 were at risk of having a stroke.

The objective outcome measures used were deemed appropriate and effective in describing the function of the study sample of stroke patients, as motivated in the methods chapter. The baseline admission scores were similar in all groups showing no statistically significant differences. On discharge, a higher percentage of the HIV+ group were less severe in stroke severity (mRS scores, see Figures 2 & 3), were independent in ADLs (BI, see Table 4.6)

and had better balance and decreased risk of falling (BBS and MatScan, see Tables 4.11 and 4.12) compared to the HIV- and undiagnosed groups. The median change in score for the BI and BBS also indicates that a higher percentage of the HIV+ group had better baseline scores compared to the other two groups as they had a smaller change in score but better or similar overall outcome. This trend was also seen in the use of assistive devices where a higher percentage of the HIV+ group were ambulant and did not require an assistive device, compared to the HIV- and undiagnosed groups. Nonetheless, no statistical significance was seen among groups with regard to functional outcome or use of assistive devices issued. The majority of patients in the entire sample needed little to no assistance with ADLs or mobility and had a good prognosis.

6.2.2 Secondary objectives

After describing the demographics and risk factors of the study sample, it was clear to see that these were similar to other studies described in the scoping review. No significant differences among groups were seen concerning gender or race. The only significant difference between groups regarding demographics was age, with the HIV+ group being significantly younger, as seen in previous studies.

In line with previous literature, the current study showed a significant difference with regard to risk factors. Hypertension and diabetes were most prevalent in the HIV- and undiagnosed group compared to the HIV+ group. On the other hand, the HIV+ group had a higher prevalence of substance abuse and opportunistic infections compared to the HIV- and undiagnosed groups which was also statistically significant. This finding is supported by previous literature and indicates that HIV may be a risk factor for stroke.

The median time between stroke onset and admission to rehabilitation showed that the HIV+ and HIV- groups had similar time periods before admission, while the HIV undiagnosed group was the only group to have a lengthy pre-admission time period. Even so, no statistical significant difference was seen among groups. The length of stay in rehabilitation (prior to discharge) yielded no significant results even though the HIV+ group had an eight to ten day shorter stay in rehabilitation. This may indicate that if patients are medically stable, HIV-status has no bearing on stroke recovery.

With regard to the EQ5D, a patient perception of health related quality of life scale, it was noted that the HIV+ group scored themselves lower on the VAS scale than the other groups. This may have been attributed to their age as they were younger and possibly more functionally abled than their older counterparts. Even so, no significant differences were

found among groups, indicating that HIV- status may have no bearing on patient perception of functional outcome post stroke.

Even though the HIV+ group was significantly younger, had fewer risk factors, had better baseline scores as well as a larger percentage of participants who were more functionally abled compared to the HIV- and HIV undiagnosed groups, it was not statistically significant. This may indicate that HIV status may have had no bearing on functional outcome in this sample. However, this outcome could have been influenced by many unknown factors. Limitations to this outcome are discussed below.

6.3 Limitations

The overall sample size and the disproportionate amount of participants in each group, specifically the small number of HIV+ participants were the biggest limitations. The small sample size in the HIV+ group also had insufficient power when performing statistical analysis among groups, yielding no statistical significance for functional outcomes and other results. Due to the study being conducted only at one site, although having a big catchment area, not all Western Cape stroke patients would be admitted to the WCRC as they have admission criteria and limited bed capacity. Stroke patients may be placed at other facilities or be referred for outpatient treatment at their nearest day hospital or clinic. The WCRC is a government facility where the majority of patients admitted have low socioeconomic status. Therefore, not all patients within the respective stroke population would have an equal and mutually exclusive chance of being selected for the study. The dropout rate in such a small sample also introduced bias as this could have deviated results, specifically with regard to the data of functional outcome measures. The heterogeneity among groups may also impact a fair comparison being made, as the HIV+ group had a significant age difference together with different risk factors. The HIV+ group was also the only group not having haemorrhagic type strokes. As haemorrhagic strokes usually have a poorer outcome in the early stages post stroke, this may have also affected the heterogeneity of results. All of these factors combined makes it difficult to generalise the results to all stroke patients.

Other factors that were limiting to the study include the time and financial constraints that limited the data collection period to six months, which resulted in the small sample size. The PI was not blinded to HIV-status so a potential observer bias was introduced. No fixed time intervals for assessment could impact functional outcome as the study only had admission and discharge intervals. The time of admission and discharge since time of incident varied drastically from participant to participant, and being in different physiological stages of

healing also impacts recovery as three to six months' post incident is seen as the time in which stroke patients often reach a plateau in their recovery (Kwakkel & Kollen, 2012). The outcome measures selected for this study were able to describe activity limitations in stroke patients and even though participants scored high for the BI and BBS specifically, they may still need assistance with ADLs and mobility. Therefore, additional rehabilitation, perhaps on an outpatient basis, will facilitate further recovery.

6.4 Recommendations

6.4.1 Clinical relevance

Due to the above-mentioned limitations, no statistically significant difference was seen among groups for functional outcomes. However, other clinically relevant outcomes for the sample were seen. Patients who had poor baseline scores i.e. mRS < 3 and BI< 60, and who were unable to sit independently on admission (BBS< 4), generally had a poorer outcome. Those with higher scores and who were able to sit and stand independently on admission had a better outcome, meaning they were less dependent and more mobile. Since the majority of participants fell into the mid-range of the BBS, it is a good tool to use to gauge improvement, in combination with other balance outcome measures for those patients who are more advanced. The MatScan may not be as inexpensive as the BBS but this tool may be more effective in measuring static standing balance impairments as it gives objective results. The participants were also more aware of their asymmetry when using the MatScan so this outcome may also be encouraging to patients to correct the asymmetry and offer potential therapeutic exercise input. Clinicians could use these outcome measures to tailor their patient specific programmes on admission and set realistic goals for in-patient rehabilitation.

6.4.2 Future studies

Future studies comparing HIV+ stroke patients to general strokes, could look at larger cohorts with similar sample sizes for comparative groups and use multiple sites with longer data collection periods to ascertain generalisable results. The HIV+ groups could also have age-matched HIV- groups to give a better comparison in functional outcome as it has been reported that younger strokes have a better functional outcome (Spengos & Vemmos, 2010). The type of strokes entered into future studies should initially be based on ischaemic strokes only, as the majority of HIV+ strokes most likely would be ischaemic due to the pathophysiology, as explained in the scoping review. Moreover, haemorrhagic type strokes are more common in HIV- strokes and are reported to have a poorer outcome overall.

In order to expand on how exactly HIV-related stroke affects individuals, future studies should include outcome measures such as the Nottingham extended activities of daily living (NEADL) scale which describes more aspects of function, such as instrumental activities of daily living, including all levels of mobility. These outcome measures should be context-specific and culturally appropriate to be able to ascertain the impact of HIV-related stroke on daily life for African individuals from all walks of life, i.e. urban and rural. Furthermore, future studies should look at the impact of the stage of HIV and the use of ARTs in the functional outcome of the HIV+ group, which may also impact a person's recovery.

The current study was envisioned as a springboard for larger cohort studies. Duplicating the study and amending its limitations may result in a better understanding of the HIV-related stroke population and produce more meaningful results to understand their unique functional outcomes. Other than highlighting the need for larger epidemiological studies, the results may also impact future treatment of HIV-related strokes and highlight the socioeconomic impact that HIV-related disability has globally and more specifically its impact in the sub-Saharan region.

References

Ackerman, A. L., & Cresswell, P. (2004). Cellular mechanisms governing cross-presentation of exogenous antigens. *Nature Immunology, 25*(7), 678–84.

Adegoke, B. O. A., Olaniyi, O., & Akosile, C. O. (2012). Weight bearing asymmetry and functional ambulation performance in stroke survivors. *Global Journal of Health Science, 4*(2), 87–94.

Albright, A. V., Soldan, S. S., & Gonzalez-Scarano. (2003). Pathogenesis of human immunodeficiency virus-induced neurological disease. *Journal of NeuroVirology, 9*, 222–227.

Aruin, A. S., Hanke, T., Chaudhuri, G., Harvey, R., & Rao, N. (2000). Compelled weight-bearing in persons with hemiparesis following stroke: The effect of a lift insert and goal-directed balance exercise. *Journal of Rehabilitation Research & Development, (37)*1, 65–72.

Barra, J., Oujamaa, L., Chauvineau, V., Rougier, P., & Pérennou, D. (2009). Asymmetric standing posture after stroke is related to a biased egocentric coordinate system. *Neurology, 72*(18), 1582–1587.

Bartlett, J.G. (2002). *The 2002 Abbreviated guide to the Medical management of HIV infection.* PG John Hopkins University Press: Baltimore, America.

Benjamin, L. A., Bryer, A., Emsley H. C. A., Khoo, S., Solomon, T., Connor, M. D. (2012). HIV infection and stroke: Current perspectives and future directions. *Lancet Neurology, 11*(10): 878–90.

Berg, K.O., Wood-Dauphinee, S., Williams, J. L., & Maki, B. (1989). Measuring balance in the elderly: Validation of an instrument. *Physiotherapy Canada*, *41*(6), 304–311.

Berg, K., O., Wood-Dauphinee, S. L., Williams, J. I., & Maki, B. E. (1992). Measuring balance in the elderly: Validation of an instrument. *Canadian Journal of Public Health*, *83*(S2), S7–S11.

Berg, K., O., Wood-Dauphinee, S. L., & Williams, J. I. (1995). The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. *Scandinavian Journal of Rehabilitation Medicine, 27*(1), 27–36.

Bindawas, S. M, Mawajdeh, H., Vennu, V., Alhaidary, H., & Schaller, B. (2016). A retrospective observational study of functional outcomes, length of stay, and discharge disposition after an inpatient stroke rehabilitation program in Saudi Arabia. *Medicine*, *95*(31): e4427.

Bonita, R., & Beaglehole, R. (1988). Modified Randkin Scale: Recovery of motor function after stroke. *Stroke, 19*(12), 1497–1500.

Boukadida, A., Piotte, F., Dehail, P., & Nadeau, S. (2015). Determinants of sit-to-stand tasks in individuals with hemiparesis post stroke: A review. *Annals of Physical and Rehabilitation Medicine*, *58*, 167–172.

Braun, T., Marks, D., Thiel, C., Zietz, D., Zutter, D., & Grüneberg, C. (2016). Effects of additional, dynamic supported standing practice on functional recovery in patients with sub-acute stroke: A randomized pilot and feasibility trial. *Clinical Rehabilitation, 30*(4) 374–382.

Brew, B. J., Pemberton, L., Cunningham, P., & Law, M. G. (1997) Levels of human immunodeficiency virus type 1 RNA in cerebrospinal fluid correlated with AIDS dementia stage. *The Journal of Infectious Diseases, 175*, 963–966.

Breuer, E., Myer, L., Struthers, H., & Joska, J. A. (2011). HIV/AIDS and mental health research in sub-Saharan Africa: A systematic review. *African Journal of AIDS Research*, *10*(2), 101–122.

Brown, T. T., Cole, S. R., Li, X., Kingsley, L. A., Palella, F. J., Riddler, S. A., Visscher, B. R., Margolick, J. B. & Dobs, A. S. (2005). Antiretroviral therapy and the prevalence and incidence of diabetes mellitus in the multi-centre AIDS cohort study. *Archives of Internal Medicine*,165(10):1179–1184.

Bushnell, C. D., Johnston, D. C. C., & Goldstein, L. B. (2001) Retrospective Assessment of Initial Stroke Severity. Comparison of the NIH Stroke Scale and the Canadian Neurological Scale. *Stroke, 32*(3), 656.

Cioncoloni, D., Piu, P., Tassi, R., Acampa, M., Guideri, F., Taddei, S., Bielli, S., Martini, G., & Mazzocchio, R. (2012). Relationship between the modified Rankin Scale and the Barthel Index in the process of functional recovery after stroke. *NeuroRehabilitation*, *30*(4), 315–322.

Chen, K., Chou, Y., Yu, W., Chen, C., Shih, C., & Hsieh, C. (2015). A prospective study of responsiveness of the original and the short form Berg Balance Scale in people with stroke. *Clinical Rehabilitation, (29)*5, 468–476.

Chengetenais, S., Tadyanemhandu, C., Chibhabha, F., & Kaseke, F. (2016). The relationship between weight bearing asymmetry after stroke and functional standing balance. *International Journal of Science and Research Publications, 6*(11), 52–59.

Chin, J. H. (2012). Stroke in sub-Saharan Africa: an urgent call for prevention. *Neurology*, *78*(13), 1007–1008.

Collin, C., Wade, D. T., Davies, S., Horne, V. (1988). The Barthel ADL Index: A reliability study. *International Disabilities Studies, 10*(2), 61–63.

Connor, M. D., Thorogood, M., Casserly, B., Dobson, C.,& Warlow, C. P. (2004). Prevalence of stroke survivors in rural South Africa: Results from the Southern Africa Stroke Prevention Initiative (SASPI) Agincourt field site. *Stroke, 35*(3):627–32.

Cote, R., Battista, R., Wolfson, C., Boucher, J., Adam, J., & Hachinski, V. (1989). The Canadian Neurological Scale: Validation and reliability assessment. *Neurology*, *39*, 638–643.

de Haan, R. J., Limburg, M., Bossuyt, P., van der Meulen, J., & Aaronson, N. (1995). The clinical meaning of Rankin 'handicap' grades after stroke. *Stroke, 26*(11), 2027 2030.

de Haart, M., Geurts, A. C., Huidekoper, S. C., Fasotti, L., & van Limbeek, J. (2004). Recovery of standing balance in postacute stroke patients: A Rehabilitation Cohort Study. *Archives of Physical Medicine and Rehabilitation, 85*(6), 886–895.

Duncan, P., W., Jorgensen, H., S., & Wade., D., T. (2000). Outcome Measures in Acute Stroke trials: A systematic review and Some Recommendations to Improve Practice. *Stroke, 31*(6),1429–1438.

Dudgeon, W., Phillips, K. D., Carson, J. A., Brewer, R. B., Durstein, J. L., & Hand, G. A. (2006). Counteracting muscle wasting in HIV-infected individuals. *HIV Medicine*. *7*(5):299–310.

Ellis, R. J., Calero, P., & Stockin, M. D. (2009). HIV infection and the CNS: A primer. *Neuropsychology Review, 19*(2), 144–151.

Eng, J. J., & Chu, K. S. (2002). Reliability and comparison of weight-bearing ability during standing tasks for individuals with chronic stroke. *Archives of Physical Medicine and Rehabilitation*, *83*(8), 1138–1144.

Fearing, F. S. (1924). The factors influencing static equilibrium. An experimental study of the effects of practice upon amount and direction of sway. *Journal of Comparative Psychology, 4*(2), 163–183.

Feigin, V. L., Forouzantor, M. H., Krishnamurthi, R., Mensah, G. A., Conner, M., Bennett, D. A., Moran, A. E., Sacco, R. L., Anderson, L., Truelsen, T., O'Donnell, M., Venketasubranian, N., Barker-Collo, S., Lawes, C. M., Wang, W., Shinohara, Y., Witt,

E., Ezzati, M., Naghavi, M., & Murray, C. (2014). Global and regional burden of stroke during 1990–2010: Findings from Global Burden of Disease study. *Lancet*, *383*, 245–255.

Finch, E., Brooks, D., Stratford, P. W., & Mayo, N. E. (2002). *Physical rehabilitation outcome measures: a guide to enhanced clinical decision making*. (2nd edition). Lippincott, Williams and Wilkins, Philadelphia.

Flansbjer, U-B., Blom, J., & Brogardh, C. (2012). The reproducibility of Berg Balance Scale and the Single-Leg Stance in chronic stroke and the relationship between the two tests. *Physical Medicine & Rehabilitation*, *4*(3), 165–170.

Garland, J. S., Ivanova, T. D., & Mochizuki, G. (2007). Recovery of standing balance and health-related quality of life after mild or moderately severe stroke. *Archives of Physical Medicine and Rehabilitation, 88*, 218–227.

Garlands, J. S., Willems, D. A., Ivanova, D., Miller, K. J. (2003). Recovery of standing balance and functional mobility after stroke. *Archives of Physical Medicine and Rehabilitation, 84*(12), 1753–1759.

Gartner S.I., & Liu Y. (2002) Insights into the role of immune activation in HIV neuropathogenesis. *J Neurovirol*, 8(2):69–75.

Genthon, N., Rougier, P., Gissot, A. S., Froger, J., Pélissier, J., & Pérennou, D. (2008). Contribution of each lower limb to upright standing in stroke patients. *Stroke*, *39*(6), 1793–1799.

Gorst, T., Lyddon, A., Marsden, J., Paton, J., Morrison, S. C., Cramp, M., & Freeman, J. (2016). Foot and ankle impairments affect balance and mobility in stroke (FAiMiS): The views and experiences of people with stroke. *Disability and Rehabilitation, 38*(6), 589–596.

Grant, C., Goldsmith, C. H., & Anton, H. A. (2014). Inpatient stroke rehabilitation lengths of stay in Canada derived from the national rehabilitation reporting system, 2008 and 2009. *Archives of Physical Medicine and Rehabilitation, 95*(1), 74–78.

Hart, G. (1990). Strokes causing left vs. right hemiplegia: Different Effects and Nursing Implications. *Geriatric Nursing Class, 11*(2), 67–70.

Hartley, T. Personal Interview. 25 August 2015, Western Cape Rehabilitation Centre.

Hiengkaew V., Jitaree K., & Chaiyawat P. (2012). Minimal detectable changes of the berg balance scale, fugl-meyer assessment scale, timed “up & go” test, gait speeds, and 2-minute walk test in individuals with chronic stroke with different degrees of ankle plantarflexor tone. *Archives of Physical Medicine and Rehabilitation*, *93*(7), 1201–1208.

Heikinheimo, T., Chimbayo, D., Kumwenda, J. J., Kampondeni, S., & Allain, T. J. (2012). Stroke outcomes in Malawi, a country with high prevalence of HIV: A prospective follow-up. *PLOS*, *7*(3): e33765.

Hoffmann, M., Berger, J. R., Nath, A., & Rayens, M. (2000). Cerebrovascular disease in young HIV-infected black Africans in the KwaZulu Natal Province of South Africa. *Journal of NeuroVirology, 6*(3), 229–236.

Hollands, K. L., Pelton, T. A., Tyson, S. F., Hollands, M. A., & van Vliet, P. M. (2012). Interventions for coordination of walking following stroke: Systematic review. *Gait & Posture*, *35*(3), 349–359.

Hoshino, T., Mizuni, S., Shimizu, S., & Uchiyama, S. (2013). Clinical Features and Functional Outcome of Stroke After Transient Ischemic Attack. *Journal of Stroke and Cerebral Diseases*, *2* (3), 260–266.

Hsieh, Y. W., Wang, C. H., Wu, S. U., Chen, P. C., Shen, C. F. & Hsieh, C. L. (2007). Establishing the minimal clinically important difference of the Barthel Index in stroke patients. *Neurorehabilitation Neural Repair, 21*(3), 233–238.

Hsueh, I. P., Lee, M. M. & Hsieh, C. L. (2001). Psychometric characteristics of the Barthel Activities of Daily Living index in stroke patients. *Journal of the Formosan Medical Association*, 100(8), 526–532.

Hsueh, I. P., Lin, J. H., Jeng, J. S., & Hsieh, C. L. (2002). Comparison of the psychometric characteristics of the functional independence measure, 5 item Barthel index, and 10 item Barthel index in patients with stroke. *Journal of Neurology, Neurosurgery & Psychiatry, 73*(2), 188–190.

Hu, G., Sarti, C., Jousilahti, P., Peltonen, M., Qiao, Q., Antikainen, R., & Tuomilehto, J. (2005). The Impact of History of Hypertension and Type 2 Diabetes at Baseline on the Incidence of Stroke and Stroke Mortality. *Stroke*, *36*, 2538–2543.

Hughes, J., Jelsma, J., Maclean, E., Darder, M., & Tinise, X. (2004). The health-related quality of life of people living HIV/AIDS. *Disability & Rehabilitation*, *26*(6), 371–376.

Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D. G., & Newman, T. B. (2013). *Designing Clinical Research Fourth Edition*. Philadelphia. Wolters Kluwer Health/Lippincott Williams & Wilkins.

Hunger, M., Sabariego, C., Stollenwerk, B., Cieza, A., & Leidl, R. (2012). Validity, reliability and responsiveness of the EQ5D in German stroke patients undergoing rehabilitation. *Quality of Life Research*, *21*(7): 1205–1216.

Huybrechts, K. F. & Caro, J. J. (2007). The Barthel Index and the modified Rankin Scale as prognostic tools for long-term outcomes after stroke: A qualitative review of literature. *Current Medical Research and Opinion*, 23(7), 1627-1636.

Johnson, L. F., Mossong, J., Dorrington, R. E., Schomaker, M., Hoffmann, C. J., Keiser, O., Fox, M. P., Wood, R., Prokzesky, H., Giddy, J., Garone, D. B., Cornell, M., Egger, M., & Boulle, A. (2013). International Epidemiologic Databases to Evaluate AIDS Southern Africa Collaboration. Life expectancies of South African adults starting

antiretroviral treatment: Collaborative analysis of cohort studies. *PLoS Med*, *10*(4): e1001418.

Jowi, J. O., Mativo, P. M., & Musoke, S. S. (2007). Cinical and laboratory characteristics of hospitalized patients with neurological manifestation of HIV/AIDS at the Nairobi Hospital*. East African Medical Journal*, *84*(2), 67–76.

Jowi, J. O., & Musoke, S. S. (2004). Cerebral venous sinus thrombosis: a complication of HIV/ AIDS: Report of three cases. *Health Line, 8*, 57–62.

Jutai, J., Coulson, S., Teasell, R., Bayley, M., Garland, J., Mayo, N., & Wood-Dauphinee, S. (2007). Mobility Assistive Device Utilization in a Prospective Study of Patients with First-Ever Stroke. *Archives of Physical Medicine and Rehabilitation, 88*(10), 1268–1275.

Juneja, J., Czyrny, J. J., & Linn, R. T. (1998). Admission balance and outcomes of patients admitted for acute inpatient rehabilitation. *American Journal of Respiratory and Critical Care Medicine, 77*(5), 388–393.

Kamphuis, J. F., de Kam, D., Geurts, A.C., & Weerdesteyn, V. (2013). Is weight-bearing asymmetry associated with postural instability after stroke? A systematic review. *Stroke Research and Treatment*, *2013*: 692137.

Kapteyn, T. S., Bles, W., Njiokiktjien, C. J., Kodde, L., Massen, C. H., & Mol, J. M. F. (1983) Standardization in Platform Stabilometry being a Part of Posturography. *Agressologie, 24*(7), 321–326.

Kasner, S. E. (2006). Clinical interpretation and use of stroke scales. *The Lancet. Neurology, 5*(7), 603–612.

Keith, R. A. (1991). The comprehensive treatment team in rehabilitation. *Archives of Physical Medicine and Rehabilitation, 72*, 269–274.

Kenzie, J. M., Semaru, J. A., Findlater, S. E., Herter, T. M., Hill, M. D., Scott, S. H., & Dukelow, S. P. (2014). Anatomical correlates of proprioceptive impairments following acute stroke: A case series. *Journal of the Neurological Science*, *342*, 52–61.

Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care 2003, 15*(3), 261–6.

Kitzman, P., Hudson, K., Sylvia, V., Feltner, F., & Lovins, J. (2017). Care Coordination for Community Transitions for Individuals Post-stroke Returning to Low-Resource Rural Communities. *Journal of Community Health, 42*(3), 565–572.

Kleim, J. A. (2011). Neural plasticity and neurorehabilitation: Teaching the new brain old tricks. *Journal of Communiction Disorders, 44*(5), 521–528.

Kollen, B., van de Port, I., Lindeman, E., Twisk, J., & Kwakkel, G. (2005). Predicting improvement in gait after stroke a longitudinal prospective study. *Stroke, 36*(12), 2676–2680.

Kottorp, A., Ekstam, L., & Lie, P. I. (2013). Differences in awareness between persons with left and right hemispheric stroke. *Scandinavian Journal of Occupational Therapy, 20*(1), 37–44.

Krishnamurthi, R. V., Feigin, V. L., Forouzanfar, M. H., Mensah, G. A., Connor, M., Bennett, D. A., Moran, A. E., Sacco, R. L., Anderson, L. M., Truelsen, T., O'Donnell, M., Venketasubramanian, N., Barker-Collo, S., Lawes, C. M. M., Wang, W., Shinohara, Y., Witt, E., Ezzati, M., Naghavi, M., & Murray, C. (2013). Global and regional burden of first-ever ischaemic and haemorrhagic stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. *The Lancet Global Health*, *1*(5), e259–81.

Kumar, S. N. S., Omar, B., Htwe, O., Joseph, L. H., Krishnan, J., Esfehani, A. J., & Min, L. L. (2014). Reliability, agreement, and validity of digital weighing scale with MatScan in limb load measurement. *JRRD, 51*(4), 591–598.

Kumwenda, J. J., Mateyu, G., Kampondeni, S., van Dam, A. P., van Lieshout, L., & Zijlstra, E. E. (2005). Differential diagnosis of stroke in a setting of high HIV prevalence in Blantyre, Malawi. *Stroke, 36*(5), 960–964.

Kwakkel, G., & Kollen, B. J. (2013). Predicting activities after stroke: what is clinically relevant? *International Journal of Stroke, 8*, 25–32.

Langhorne, P., Bernhardt, J., Kwakkel, G. (2011). Stroke rehabilitation. *Lancet*, *377*, 1693–702.

Laufer, Y., Sivan, D., Schwarzmann, R., & Sprecher, E. (2003). Standing Balance and Functional Recovery of Patients with Right and Left Hemiparesis in the Early stages of Rehabilitation. *Neurorehabilitation and Neural Repair, 17*(4), 207–213.

Lawrence, E. S., Coshall, C., Dundas, R., Stewart, J., Rudd, A. G., Howard, R., & Wolfe, C. D. A. (2001). Estimates of the Prevalence of Acute Stroke Impairments and Disability in a Multiethnic Population. *Stroke, 32*(6), 1279–1284.

Lee, D., Sung, H. H., Jung, H. K., & Dae-Il, C. (2011). Stroke subtypes and risk factors of ischemic stroke in young Korean adults. Neurology Asia, 16(4), 281–289.

Li, W., Gailey, D., Mattson, M. P., & Nath, A. (2005). Molecular and cellular mechanisms of neuronal cell death in HIV dementia. *Neurotoxicity Research*, *8*, 119–134.

Loewen, S. C., Anderson, B. A. (1990). Predictors of stroke outcome using objective measurement scales. *Stroke*, *21*(1), 78–81.

Mansfield, A., Danells, C. J., Inness, E., Machizuki, G., & McIlroy, W. E. (2011). Between-limb synchronization for control of standing balance in individuals with stroke. *Clinical Biomechanics, 26* (3), 312–317.

Mansfield, A., Wong, J. S., McIlroy, W. E., Biasin, L., Bruton, K., Bayley, M., & Inness, E. L. (2015). Do measures of reactive balance control predict falls in people with stroke returning to the community? *Physiotherapy*, *101*(4), 373–380.

Mao, H. F., Hsueh, I. P., Tang, P. F., Sheu, C. F., Hsieh, C. L. (2002). Analysis and comparison of the psychometric properties of three balance measures for stroke patients. *Stroke*, *33*(4), 1022.

Markus, H. (2012). Stroke: causes and clinical features. *Medicine*, *40*(9), 484–489.

Meintjes, G., Black, J., Conradie, F., Cox, V., Dlamini, S., Fabian, J., Maartens, G., Manzini, T., Mathe, M., Menezes, C., Moorhouse, M., Moosa, Y., Nash, Y., Orrell, C., Pakade, Y., Venter, F., & Wilson, D. (2014). Adult antiretroviral therapy guidelines 2014 By the Southern African HIV Clinicians Society. *Southern African Journal of HIV Medicine, 15*(4), 121–143.

Meyer, B. C., & Lyden, P. D. (2009). The modified National Institutes of Health Stroke Scale: its time has come. *International Journal of Stroke, 4*(4):267–73.

Michael, K. M., Allen, J. K., & Macko, R. F. (2005). Reduced Ambulatory Activity After Stroke: The Role of Balance, Gait, and Cardiovascular Fitness. *Archives of Physical Medicine and Rehabilitation, 86*(8), 1552–1556.

Miller, E. L., Murray, L., Richards, L., Zorowitz, R. D., Bakas, T., Clark, P., Sandra A., & Billinger, S. A. (2010). Comprehensive overview of nursing and interdisciplinary rehabilitation care of the stroke patient. *Stroke. 2010, 41*(10), 2402–2448.

Mizrahi, J., Solzi, P., Ring, H., & Nisell, R. (1989). Postural stability in stroke patients: vectorial expression of asymmetry, sway activity and relative sequence of reactive forces. *Medical and Biological Engineering and Computing, 27*(2), 181–190.

Mlay, M., & Bakari, M. (2012). The prevalence of HIV among patients admitted with stroke at the Muhimbili National Hospital, Dar es Salaam, Tanzania. *Tanzanian Journal of Health Research*, *12*(2), 1–12.

Mochan, A., Modi, M., & Modi, G. (2003). Stroke in Black South African HIV positive patients. A prospective analysis. *Stroke*, *34*(1), 10–15.

Mochan, A., Modi, M., & Modi, G. (2005). Protein S deficiency in HIV associated ischemic stroke: an epiphenomenon of HIV infection. *Journal of Neurology, Neurosurgery and Psychiatry*, *76*, 1455–1456.

Modi, G., Hair, K., Modi, M., & Mochan, A. (2007). The frequency and profile of neurology in black South African HIV infected (Clade C) patients- A hospital-based prospective audit. *Journal of the Neurological Sciences*, *254*, 60–64.

Modi, G., Modi, M., & Mochan, A. (2006). Stroke and HIV-causal or coincidental co-occurrence? *South African Medical Journal, 96*(12): 1247–1248.

Modi, G., Modi, M., & Mochan, A. (2008). Is stroke a HIV-related neurological Manifestation? *Expert Review of Neurotherapeutics, 8*(8), 1247–1253.

Moore, D. J., Letendre, S. L., Morris, S., Umlof, A., Deutsch, R., Smith, D. M., Little, S., Rooney, A., Franklin, D. R., Gouaux, B., LeBlanc, S., Rosario, D., Fennema-Notestine, C., Heaton, R. K., Ellis, R. J., Hampton Atkinson, J., & Grant, I. 2011. Neurocognitive functioning in acute or early HIV infection. *Journal of NeuroVirology*, *17*(1): 50–57.

Murray, P., & Wynn, T. (2011) Protective and Pathogenic Functions of Macrophages Subsets. *Nature Reviews Immunology, 11*, 723–737.

Ozyemisci-Taskiran, O., Gunendi, Z., Aknar, O., Karatas, G. K., & Sepici, V. (2011). Revisiting length of stay in stroke rehabilitation in Turkey. *Archives of Physical Medicine and Rehabilitation, 92*(2), 257–264.

Park, D. C., & Bischof, G. N. The aging mind: neuroplasticity in response to cognitive training. *Dialogues in Clinical Neuroscience*, *15*(1), 109–119.

Patel, V. B., Sancoor, Z., Francis, P., Bill, P. L. A., Bhigjee, A. I., & Connolly, C. (2005). Ischemic stroke in young HIV-positive patients in KwaZulu Natal, South Africa. *Neurology*, *65*, 759–761.

Pereira, L. C., Botelho, A. C., & Martins, E. F. (2010) Relationships between body symmetry during weight-bearing and functional reach among chronic hemiparetic patients. *Revista Brasileira De Fisioterapia, 14*(3), 259–66.

Persidsky, Y., Stins, M., Way, D., Witte, M. H., Weinand, M., Kim, K. S., Bock, P., Gendelman, H. E., Fiala, M. A. (1997). A model for monocyte migration through the blood-brain barrier during HIV-1 encephalitis. *Journal of Immunological Methods, 158*(7):3499–3510.

Rankin, J. (1957). Cerebral vascular accident in patients over the age of 60. *Scottish Medical Journal, 2*(5), 200–215.

Rasmussen, R. S., Ostergaard, A., Kjaer, P., Skerris, A., Skou, C., Christoffersen, J., Seest, L. S., Poulsen, M. B., Ronholt, F., & Overgaard, K. (2016). Stroke rehabilitation at home before and after discharge reduced disability and improved quality of life: A randomised controlled trial. *Clinical Rehabilitation*, *30*(3), 225–36.

Rhoda, A., Smith, M., Putman, K., Mpofu, R., De Weerdt, W., & De Wit, L. (2014). Motor and functional recovery after stroke: a comparison between rehabilitation settings in a developed versus a developing country. *BMC Health Services Research, 14*(82), 1–7.

Robinson-Papp, J., Byrd, D., Mindt, M. R., Oden, N. L., Simpson, D. M., & Morgello, S. 2008. Motor function and human immunodeficiency virus-associated cognitive impairment in a highly active antiretroviral therapy-era cohort. *Archives of Neurology*, *65*(8), 1096–1101.

Rossier, P., & Wade, D. T. (2001). Validity and reliability comparison of 4 mobility measures in patients presenting with neurologic impairment. *Archives of Physical Medicine and Rehabilitation, 82*(1), 9–13.

Rouillard, S., De Weerdt, W., De Wit, L., Jelsma, J. (2012). Functioning at 6 months post stroke following discharge from inpatient rehabilitation. *South African Medical Journal*, *102*(6): 545–548.

Ruhe, A., Fejer, R., & Walker, B. (2011). Center of pressure excursion as a measure of balance performance in patients with non-specific lower back pain compared to healthy controls: A systematic review of the literature. *European Spine Journal*, *20*(3), 358–368.

Sackley, C. M. (1991). Falls, sway, and symmetry of weight-bearing after stroke. *International Disability Studies, 13*(1), 1–4, 1991.

Salter, K., Jutai, J., W., Teasell, R., Foley, N., C., Bitensky, J., & Bayley, M. (2005). Issues for selection of outcome measures in stroke rehabilitation: ICF activity. *Disability and Rehabilitation*, *27*(6): 315–340.

Salter, K., Campbell, N., Richardson, M., Mehta, S., Jutai, J., Zettler, L., Moses, M., McClure, A., Mays, R., Foley, N., & Teasell, R. (2013). Outcome measures in stroke rehabilitation. *Evidence-Based Review of Stroke Rehabilitation, 10*(1). 1–144.

Salzman, B. (2010). Gait and balance disorders in older adults. *American Family Physician, 82*(1), 61–68.

Scheepers, V. P. M., Ketelaar, M., Van de Port, I. G. L., Visser-Meily, J. M. A., & Lindeman, E. (2007). Comparing contents of functional outcome measures in stroke rehabilitation using the International Classification of Functioning, Disability and Health. *Disability and rehabilitation*, *29*(3), 221–230.

Scheepers, V. P. M., Ketelaar, M., Visser-Meily, A. J. M., de Groot, V., Twisk, J. W. R., & Lindeman, E. (2008). Funtional recovery differs between ischaemic and haemorrhagic stroke patients. *Journal of Rehabilitation Medicine, 40*(6),487–489.

Schmid, A. A., Van Puymbroeck, M., Altenburger, P. A., Dierks, T. A., Miller, K. K., Damush, T. M., & Williams, L. S. (2012). Balance and balance self-efficacy are associated with activity and participation after stroke: A cross-sectional study in people with chronic stroke. *Archives of Physical Medicine and Rehabilitation, 93*(6), 1101–1107.

Şenocak, E., Oğuz, K. K., Özgen, B., Kurne, A., Özkaya, G., Ünal, S., & Cila, A. (2010). Imaging features of CNS involvement in AIDS. *Diagnostic and Interventional Radiology, 16*(3), 193–200.

Shah, S., Cooper, B., & Maas, F. (1992). The Barthel Index and ADL evaluation in stroke rehabilitation in Australia, Japan, the US and the USA. *The Australian Occupational Therapy Journal*, *39*, 5–13.

Shumway-Cook, A., & Woollacott, M. H. (2007). *Motor control: Translating research into clinical practice (6th edition)*. Philadelphia: Lippincott Williams & Wilkins.

Smallfield, S., & Karges, J. (2009). Classification of occupational therapy intervention for inpatient stroke rehabilitation. *American Journal of Occupational Therapy*, *63*(4), 408–413.

Spengos, K., & Vemmos, K. (2010). Risk factors, etiology, and outcome of first-ever ischaemic stroke in young adults aged 15 to 45 – the Athens young stroke registry. *European Journal of Neurology*,*17*, 1358–1364.

StataCorp (2015). Statistical Software: Release 14. College Station, TX: StataCorp LP.

Stavem, K., Lossius, M., & Ronning, O.M. (2003). Reliability and Validity of the Canadian Neurological Scale in Retrospective Assessment of Initial Stroke Severity. *Journal of Stroke and Cerebrovascular Diseases, 16*(3), 286–291.

Stollberger, C., & Fimstrer, J. (2002). Role of infectious and immune factors in coronary and cerebrovascular atherosclerosis. *Clinical and Diagnostic laboratory Immunology, 9*(2), 207–215.

Stucki, G., Ewert, T., & Cieza, A. (2003). Value and application of the ICF in rehabilitation medicine. *Disability and Rehabilitation*, *25*(11–12): 628–634.

Sulter, G., Steen, C., & De Keyser, J. (1999). Use of the Barthel index and modified Rankin scale in acute stroke trials. *Stroke, 30*(8), 1538–1541.

Tan, W. S., Heng, B. H., Chua, K. S., & Chan, K. F. (2009). Factors predicting inpatient rehabilitation length of stay of acute stroke patients in Singapore. *Archives of Physical Medicine and Rehabilitation*, 90(7), 1202–1207.

Tipping, B., de Villiers, L., Wainwright, H., Candy, S., & Bryer, A. (2007). *Journal Neurology, Neurosurgery, and Psychiatry, 78*(12), 1320–1324.

Tyson, S. T, Hanley, M., Chillala, J., Selley, A. B., & Tallis, R. C. (2006). Balance Disability After Stroke. *Physical Therapy Journal, 86*(1), 30–38.

Tyson, S. T, Hanley, M., Chillala, J., Selley, A. B., & Tallis, R. C. (2007). The Relationship Between Balance, Disability, and Recovery After Stroke: Predictive Validity of the Brunel Balance Assessment. *The American Society of Neurorehabilitation, 21*(4), 341–346.

UNAIDS (2016). AIDS by the numbers.

van der Putten, J. J. M. F., Hobart, J. C., Freeman, J. A., & Thompson, A. J. (1999). Measuring change in disability after inpatient rehabilitation: comparison of the responsiveness of the Barthel Index and the Functional Independence Measure. *Journal of Neurological, Neurosurgery & Psychiatry, 66*(4), 480–484.

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gotzsche, P. C., & Vandenbroucke, J. P. (2008). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Journal of Clinical Epidemiology, 61*(4), 334–339.

Verma, R., Arya, K. N., Sharma, P., & Garg, R. K. (2012). Understanding gait control in post-stroke: Implications for management. *Journal of Bodywork and Movement Therapies*, *16*(1), 14–21.

Wade, D.T. (1992). Measurement in neurological rehabilitation. *Current Opinion in Neurology and Neurosurgery, 5*(5), 682–6.

Winter, D. A. (1995). Human balance and posture control during standing and walking. *Gait & Posture*, 3(4), 193–214.

Wolfe, C. D. A., Taub, N. A., Woodrow, E. J., & Burney, P. G. J. (1991). Assessment of scales of disability and handicap for stroke patients. *Stroke, 22*(10), 1242–1244.

Woods, S. P., Moore, D. J., Weber, E., & Grant, I. 2009. Cognitive neuropsychology of HIV-associated neurocognitive disorders. *Neuropsychology Review*, *19*(2), 152–168.

World Health Organization. The World Health Report: 2002. Reducing risks, promoting healthy life. 2002., *World Health Organization*.

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

World Medical Association (2013). World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA, 310*(20), 2191–2194.

www.wcrc.co.za about_us.htm [accessed July 30, 2015].

www.who.int/topics/hiv_aids/en/ [accessed July 30, 2015].

https://www.tekscan.com/product-group/test-measurement/pressure-mapping?tab=products-solutions [accessed February 20, 2016].

http:// http://www.heartfoundation.co.za/search/node/stroke [accessed July 30, 2015].

Yusuf, S., Hawken, S., Ounpuu, S., Dans, T., Avezum, A., Lanas, F., McQueen, M., Budaj, A., Pais, P., Varigos, J., & Linsheng, L. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet, 364* (9438), 937–952.

Zatsiorsky, V. M., & King, D. L. (1997). An algorithm for determining gravity line location from posturographic recordings. *Journal of Biomechanics, 31*(2), 161–164.

Zimba, S., Ntanda, P. M., Lakhi, S., & Atadzhanov, M. (2017). HIV infection, hypercoagulability and ischaemic stroke in adults at the University Teaching Hospital in Zambia: a case control study, *BMC Infectious Diseases, 17*(1), 354.

List of Appendices

Appendix A: English Consent Form

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT:

The functional outcomes of stroke patients who are HIV positive, HIV negative and HIV undiagnosed, following inpatient rehabilitation: A descriptive study

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: Tasneem Hartley

ADDRESS: Physiotherapy Division
Medical School; Stellenbosch University
Francie Van Zijl Drive
Tygerberg
7505
Cape Town
South Africa

CONTACT NUMBER: 079 474 8468

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or physiotherapist any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Health Research Ethics Committee at Stellenbosch University and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- The study will be conducted at the Western Cape Rehabilitation Centre.
- The aim of this study is to understand what affects functional outcome in people post stroke. Functional outcome entails one's ability to go back to their daily activities as they did before their stroke. There is a lack of research in South Africa regarding functional outcome in stroke in terms of its associated risk

factors and this is concerning since South Africa is a country with a rapidly growing stroke population.

- Once you have consented to the study, you will complete function tests as you would normally do during a physiotherapy assessment and this will be repeated once you have completed your rehabilitation. The physiotherapist (researcher) will ask you to do certain activities such as moving in bed, balance and standing. You will also be asked a few questions regarding your thoughts on these activities. The assessment may take more or less an hour and you should expect some fatigue (tiredness) after the assessment but nothing detrimental (that will harm you) to your health. You may take breaks during the physical assessment and snacks will be provided.
- The information gathered about you is completely confidential and will be coded so that no one besides the researcher is able to know that information belongs to you.

Why have you been invited to participate?

- You fit the criteria of the patients we would like to assess namely: You have suffered your first-ever stroke are older than 18 years.

What will your responsibilities be?

- Your responsibility will only be to partake in the physical assessment (function tests).

Will you benefit from taking part in this research?

- The information given will assist in the research of stroke, its risk factors and functional outcome in the South African population. Future patients may benefit from this as this study will add to current literature to better develop our health care system as well as give us more insight or understanding as to how illnesses such as HIV may impact ones function once you have had a stroke.

Are there risks involved in your taking part in this research?

- There are minor risks involved in this study which may include fatigue during the physical assessment as well as the risk of falling. These assessments are clinical tests and standard precautions will be applied at all times of testing to ensure your safety.

If you do not agree to take part, what alternatives do you have?

- If you do not wish to take part in this study or feel the need to withdraw there will be no negative consequences, your participation is completely voluntary.

Who will have access to your medical records?

- The information collected will be treated as confidential and protected. If it is used in a publication or thesis, your identity will remain anonymous. Only the researcher and the healthcare staff who already have access to your medical records are able to see your medical records.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

- In the unlikely event of an injury, participants will be treated by the nursing staff or Doctors at WCRC.

Will you be paid to take part in this study and are there any costs involved?

- Participants will be compensated with a snack pack.

Is there anything else that you should know or do?

- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study researcher.
- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I ……..…… agree to take part in a research study entitled *(*
The functional outcomes of stroke patients who are HIV positive, HIV negative and HIV undiagnosed, following inpatient rehabilitation: A descriptive study*)*.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....…….…….. on (*date*) ……...…….. 2016.

Signature of participant Signature of witness

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If a interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....…..…….. on (*date*) ……...…….. 2016.

Signature of investigator Signature of witness

Declaration by interpreter

I *(name)* ……..…… declare that:

- I assisted the investigator (*name*) ……. to explain the information in this document to (*name of participant*) ……..…….. using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) .....…..…….. on (*date*) ……...……..

Signature of interpreter Signature of witness

Appendix B: Afrikaans Consent Form

DEELNEMERINLIGTINGSBLAD EN -TOESTEMMINGSVORM

TITEL VAN DIE NAVORSINGSPROJEK:

Die funksionele uitkomste van MIV-positiewe, MIV-negatiewe en MIV onbekende status van mense post beroerte nadat hulle binne pasiënt rehabilitasie ontvang het: 'n beskrywende navorsings studie.

VERWYSINGSNOMMER:

HOOFNAVORSER: Tasneem Hartley

ADRES: Fisioterapie Afdeling
Stellenbosch Universiteit
Francie Van Zijl Rylaan
Tygerberg
7505
Suid Afrika

KONTAKNOMMER: 079 474 8468

U word genooi om deel te neem aan ’n navorsingsprojek. Lees asseblief hierdie inligtingsblad op u tyd deur aangesien die detail van die navorsingsprojek daarin verduidelik word. Indien daar enige deel van die navorsingsprojek is wat u nie ten volle verstaan nie, is u welkom om die navorsingspersoneel of fisioterapeut daaroor uit te vra. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsingsprojek behels en hoe u daarby betrokke kan wees. U deelname is ook **volkome vrywillig** en dit staan u vry om deelname te weier. U sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om deel te neem nie. U mag ook te eniger tyd aan die navorsingsprojek onttrek, selfs al het u ingestem om deel te neem.

Hierdie navorsingsprojek is deur die Gesondheids Navorsings Etiek Komitee (GNEK) van die Universiteit Stellenbosch goedgekeur en sal uitgevoer word volgens die etiese riglyne en beginsels van die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsing van die Mediese Navorsingsraad (MNR).

Wat behels hierdie navorsingsprojek?

- Die studie sal uitgevoer word by die Wes-Kaapse Rehabilitasiesentrum.
- Die doel van die studie is om te verstaan wat die funksionele uitkomste van mense post beroerte kan affekteer. Funksionele uitkomste behels 'n mens se vermoë om terug te gaan na hul daaglikse aktiwiteite soos voor hulle beroerte. Daar is 'n gebrek aan navorsing in Suid-Afrika met betrekking tot funksionele uitkomste in persone wat 'n beroerte gehad het, asook in terme van verwante risikofaktore. Navorsing hieroor is belangrik, aangesien Suid-Afrika 'n land is met 'n vinnig groeiende beroerte populasie.

- Indien jy instem om aan die navorsings studie deel te neem sal jy funksionele toetse te voltooi soos jy normaalweg sou doen tydens 'n fisioterapie evaluering en sodra jy jou rehabilitasie voltooi het, sal die funksionele toetse herhaal word. Die fisioterapeut (navorser) sal jou vra om sekere aktiwiteite te doen soos om op en af te skuif in die bed, balans aktiwiteite en staan aktiwiteite. Jy sal ook gevra word om 'n paar vrae te beantwoord oor hoe u voel tydens die uitvoer van die funksionele aktiwiteite. Die evaluering kan min of meer as 'n uur duur en jy kan verwag dat jy moeg sal voel na die evaluering, maar dit sal nie nadelig vir jou gesondheid wees nie. Jy kan rusperiodes neem tydens die evaluering en versnaperinge sal voorsien word.
- Die inligting wat verkry word, is heeltemal vertroulik en sal gekodeer word (kodes sal gegee word) sodat niemand behalwe die navorser sal weet dat die inligting aan jou behoort nie.

Waarom is u genooi om deel te neem?

- Jy voldoen aan die kriteria van die pasiënte wat ons wil insluit in ons studie: Naamlik jy het jou heel eerste beroerte gehad en is ouer as 18 jaar.

Wat sal u verantwoordelikhede wees?

- Jou verantwoordelikheid sal slegs wees om deel te neem aan die fisiese evaluering (funksionele toetse).

Sal u voordeel trek deur deel te neem aan hierdie navorsingsprojek?

- Die inligting sal help om te bepaal wat die risikofaktore en funksionele uitkomste is in die Suid-Afrikaanse bevolking wat 'n beroerte gehad het. Toekomstige pasiënte kan baat vind by inligting wat deur die studie ingesamel word, aangesien dit sal bydra tot die huidige literatuur om ons gesondheidsorg stelsel te help ontwikkel, asook om ons meer insig of begrip te gee oor hoe siektes soos MIV funksie kan beïnvloed van iemand wat 'n beroerte gehad het.

Is daar enige risiko's verbonde aan u deelname aan hierdie navorsingsprojek?

- Daar is geringe risiko’s betrokke by hierdie studie wat moontlik die volgende kan insluit: moegheid gedurende die fisiese evaluering, sowel as die risiko om te val. Tydens die evaluering sal voorsorgmaatreëls ten alle tye toegepas word op jou veiligheid te verseker.

Watter alternatiewe is daar indien u nie instem om deel te neem nie?

- As jy nie wil deelneem aan hierdie studie of die behoefte het om te onttrek, sal daar geen negatiewe gevolge wees nie. Jou deelname is heeltemal vrywillig.

Wie sal toegang hê tot u mediese rekords?

- Die inligting wat ingesamel word, sal as vertroulik hanteer en beskerm word. As dit gebruik word in 'n publikasie of verhandeling (tesis), sal jou identiteit anoniem bly. Slegs die navorser en die gesondheidsorg personeel wat reeds toegang tot jou mediese rekords het, sal in staat wees om jou mediese rekords te sien.

Wat sal gebeur in die onwaarskynlike geval van ’n besering wat mag voorkom as gevolg van u deelname aan hierdie navorsingsprojek?

- In die onwaarskynlike geval van 'n besering, sal deelnemers behandel word deur die verpleegpersoneel of Dokters by WKRS.

Sal u betaal word vir deelname aan die navorsingsprojek en is daar enige koste verbonde aan deelname?

- Deelnemers sal vergoed word met 'n versnapering vir hulle tyd.

Is daar enigiets anders wat u moet weet of doen?

- U kan die **Gesondheidsnavorsingsetiek administrasie** kontak by 021-938 9207 indien u enige bekommernis of klagte het wat nie bevredigend deur u studie navorser hanteer is nie.
- U sal ’n afskrif van hierdie inligtings- en toestemmingsvorm ontvang vir u eie rekords.

Verklaring deur deelnemer

Met die ondertekening van hierdie dokument onderneem ek, ……..……..……..……., om deel te neem aan ’n navorsingsprojek getiteld (*Titel van navorsingsprojek)*.

Ek verklaar dat:

- Ek hierdie inligtings- en toestemmingsvorm gelees het of aan my laat voorlees het en dat dit in ’n taal geskryf is waarin ek vaardig en gemaklik mee is.
- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwoord is.
- Ek verstaan dat deelname aan hierdie navorsingsprojek **vrywillig** is en dat daar geen druk op my geplaas is om deel te neem nie.
- Ek te eniger tyd aan die navorsingsprojek mag onttrek en dat ek nie op enige wyse daardeur benadeel sal word nie.
- Ek gevra mag word om van die navorsingsprojek te onttrek voordat dit afgehandel is indien die studiedokter of navorser van oordeel is dat dit in my beste belang is, of indien ek nie die ooreengekome navorsingsplan volg nie.

Geteken te *(plek*) ……..…….. op *(datum*) ……..…….. 2016.

.....	.....
Handtekening van deelnemer	**Handtekening van getuie**

Verklaring deur navorser

Ek *(naam)* ……..…… verklaar dat:

- Ek die inligting in hierdie dokument verduidelik het aan

  …….……..

- Ek hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek tevrede is dat hy/sy al die aspekte van die navorsingsprojek soos hierbo bespreek, voldoende verstaan.
- Ek 'n tolk gebruik het/nie 'n tolk gebruik het nie. (*Indien 'n tolk gebruik is, moet die tolk die onderstaande verklaring teken.)*

Geteken te *(plek*) .....…….. op *(datum*) ……..…….. 2016.

..... **.....**

Handtekening van navorder **Handtekening van getuie**

Verklaring deur tolk

Ek *(naam)* ……..…… verklaar dat:

- Ek die navorser *(naam*) …….....……. bygestaan het om die inligting in hierdie dokument in Afrikaans/Xhosa aan *(naam van deelnemer)* ……..... te verduidelik.
- Ons hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek ’n feitelik korrekte weergawe oorgedra het van wat aan my vertel is.
- Ek tevrede is dat die deelnemer die inhoud van hierdie dokument ten volle verstaan en dat al sy/haar vrae bevredigend beantwoord is.

Geteken te *(plek*) .....…….. op *(datum*) ……...…….. 2016.

.....	.....
Handtekening van tolk	**Handtekening van getuie**

Appendix C: isiXhosa Consent Form

INCWADANA ENGOLWAZI NGOMTHATHI-NXAXHEBA KUNYE NEFOMU YEMVUMELWANO

ISIHLOKO SEPROJEKTHI YOPHANDO:

Ukuchaza iziphumo zokusebenza kubantu abaneNtsholongwane kaGawulayo abakumaziko karhulumente okubuyiselwa kwezimo emva kokuba befe icala

INOMBOLO YONXULUMANO: S15/10/232

UMPHANDI OYINTLOKO:
Tasneem Hartley

IDILESI:
Francie Van Zijl Drive
Tygerberg 7505
Cape Town South Africa

INOMBOLO YOQHAGAMSHELWANO: 079 474 8468

Uyamenywa ukuba uthathe inxaxheba kwiprojekthi yophando. Nceda uthathe ixesha lokufunda iinkcukacha ezibekiweyo apha, eziza kucacisa malunga nayiphi na indawo kule projekthi ongayiqondiyo ngokupheleleyo. Kubaluleke kakhulu ukuba woneliseke ngokupheleleyo koko kuqulathwe kolu phando nokuba ungabandakanyeka njani. Kwakho, ukuthatha kwakho inxaxheba **awunyanzelekanga kwaphela ukwenza ngokuzithandela,** kwaye ukhululekile ukuba ungarhoxa ekuthatheni inxaxheba. Ukuba uthi hayi, oku akuzi kukuchaphazela kakubi nangayiphi na indlela. Ungarhoxa nanini na ekuthatheni inxaxheba kuphononongo, nokuba ubuvumile ukuba uza kuthatha inxaxheba.

Olu phononongo luvunywe yiKomiti yokuziPhatha kuPhando lwezeMpilo yeYunivesithi yaseStellenbosch (S15/10/232) kwaye luza kwenziwa ngokwesikhokelo sokuziphatha nemithetho-siseko yesiBhengezo sikazwelonke saseHelsinki, kwiSikhokelo seNdlela yokuSebenza kakuhle kwezeMpilo eMzantsi Afrika neSikhokelo seNdlela yokuziPhatha kuPhando lwezoNyango (MRC).

Simalunga nantoni esi sifundo sophando?

- Uphononongo luza kwenziwa kwiZiko lokuBuyiselwa kwezimo eNtshona Koloni neNdawo eNika inkathalo ephakathi eLife Esidimeni

- Injongo yolu phando kukufuna ukuqonda ukuba yintoni echaphazela iziphumo zokusebenza ebantwini ebebehlaselwe kukufa icala nabaneNtsholongwane kaGawulayo. Iziphumo zokusebenza ziquka ukwazi ukubuyela kwimisebenzi yemihla ngemihla njengoko bebesenza phambi kokuba bahlaselwe sisifo sokufa icala. Kukho ukunqongophala kophando eMzantsi Afrika malunga neziphumo zokusebenza xa ubufe icala ngokunxulumene nemiba yoko kusemngciphekweni kwaye oku kuyaxhalabisa njengoko uMzantsi Afrika ililizwe elinabantu abakhula ngokukhawuleza abafa icala

- Xa sele uvumile ukuba kolu phononongo, uza kwenza uvavanyo olujonga indlela oqhele ukusebenza ngayo xa uhlolwa yingcali enyanga umzimba ngokuthambisa. Ingcali enyanga umzimba ngokuthambisa (umphandi) uza kukucela wenze ezinye izinto ezinjengokushukuma ebhedini, ukungagungqi uqine ume neengxelo zokuhamba kwakho nexesha nomgama owuhambayo emva kokuba uhlaselwe sisifo sokufa icala. Uza kubuzwa nemibuzo embalwa malunga noko ukucingayo ngale misebenzi. Uvavanyo lungathatha ngaphezulu okanye ngaphantsi kweyure kwaye kufuneka ulindele ukuba ungadinwa emva kolo vavanyo kodwa akukho nto eza kubeka engxakini (eza konakalisa) impilo yakho. Ungamana uzipha ikhefu uphumla xa usenza uvavanyo usitya namashwamashwam oza kuwanikwa.

- Iinkcukacha ezifunyenweyo ngawe ziza kuba yimfihlo kwaye ziza kufakwa ikhowudi apho kungekho namnye ngaphandle kwabo benza uphando abaza kuzazi ukuba zezakho ezo nkcukacha.

Kutheni umenyiwe ukuba uthathe inxaxheba?

- Uyilungele indlela yokukhethwa kwezigulane esifuna ukwenza uhlolo koku: Uhlaselwe sisifo sokufa icala kwaye uneNtsholongwane kaGawulayo

Luyakuba yintoni uxanduva lwakho?

- Uxanduva lwakho iza kuba kukuthatha inxaxheba kuphela kuhlolo ngokwenza (uvavanyo lokwenza izinto xa ulaliswa naphambi kokuba ukhutshwe.

Ingaba uza kuzuza ekuthatheni inxaxheba kolu phando?

- Iinkcukacha ezinikeziweyo ziza kunceda kuphando lwesifo sokufa icala, imiba yokusemngciphekweni neziphumo zokusebenza kwabantu baseMzantsi Afrika. Izigulane zexesha elizayo zingaxhamla koku njengoko olu phononongo luza kubanento eyenzayo kwimeko ekhoyo ukuphuhlisa ngcono inkqubo yokukhathalelwa kwempilo yethu nokusenza sibone okanye siqonde ngakumbi ukuba ingaba izifo ezifana neNtsholongwane kaGawulayo zinganeempembelelo ezinjani ekusebenzeni komntu xa ubukhe wahlaselwa sisifo sokufa icala.

Ingaba zikho iingozi ezibandakanyekayo ekuthatheni kwakho inxaxheba kolu phando

- Mncinci umngcipheko okhoyo kolu phononongo onokuquka ukudinwa xa kusenziwa uhlolo lomzimba njengomngcipheko wokuwa. Ezi mvavanyo kukuvavanywa ezonyango nokhuseleko olusemgangathweni ziza kusebenza ngawo onke amaxesha ohlolo ukuqinisekisa ukhuseleko lwakho.

Ukuba awuvumi ukuthatha inxaxheba, loluphi olunye unyango onalo?

- Ukuba awunqweneli kuthatha inxaxheba kolu phononongo okanye ofuna ukurhoxa akuzobakho zimeko zimbi eziza kukuchaphazela, ukuthatha kwakho inxaxheba ukwenza ngokuzithandela akunyanzelekanga.

Ngubani uza kufumana ingxelo yakho yamayeza

- Linkcukacha ezifunyenweyo ziza kuthathwa njengeziyimfihlo nezikhuselekileyo. Ukuba ziye zasetyenziswa kupapasho lwethisisi, igama lakho alizovezwa. Ngabaphandi kuphela nabasebenzi bezempilo esele benazo iingxelo zakho zempilo abazokwazi ukuzibona iingxelo zakho zempilo.

Kuza kwenzeka ntoni kwimeko yesiganeko esingalindekanga sokwenzakala ngenxa yokuthatha kwakho inxaxheba kwesi sifundo sophando?

- Xa enokwenzakala, lowo uthatha inxaxheba uza kunyangwa ngoonesi nooGqirha eWCRC neLife Esidimeni. Abathatha inxaxheba kuphando bakwabonelelwa nge-inshorensi yiYunivesithi yaseStellenbosch.

Ingaba uza kuhlawulwa ngokuthatha inxaxheba kwesi sifundo kwaye ingaba kukho iindleko ezibandakanyekayo

Abathatha inxaxheba baza kunikwa ipakethi yezinto ezityiwayo nemali ngexesha labo abalichithe kuvavanyo.

Ingaba ikho enye into ekumele uyazi okanye uyenze?

- Ungaqhagamshelana neKomiti ejongene nokuziPhatha kuPhando lwezeMpilo ku-021-938 9207 ukuba kukho izinto ezikuxhalabisayo okanye izikhalazo ezingakhange ziqwalaselwe ngokwaneleyo ngumphandi okolu phononongo.
- Uza kufumana ikopi yezi nkcukacha nefomu yesivumelwano ukuze uzigcinele.

Isifungo somthathi-nxaxheba

Ngokuytyikitya ngezantsi, Mna …….…… ndiyavuma ukuthatha inxaxheba kwisifundo sophando semfuzo esibizwa ngokuba *(faka ishloko sesifundo)*.

Ndazisa ukuba:

- Ndilufundile okanye ndalufunda olu lwazi kunye nefomu yemvumelwano kwaye ibhalwe ngolwimi endiliciko nendikhululekileyo kulo
- Bendinalo ithuba lokuba ndibuze imibuzo kwaye yonke imibuzo yam iphendulwe ngokwanelisayo.
- Ndiyakuqonda ukuba ukuthatha inxaxheba kolu phando kube **kukuzithandela kwam** kwaye andikhange ndinyanzelwe ukuba ndithathe inxaxheba.
- Ndingakhetha ukusishiya isifundo naninina kwaye andisayi kohlwaywa okanye uqal' ugwetywe nangayiphi indlela.
- Usenokucelwa ukuba usishiye isifundo phambi kokuba siphele, ukuba ugqirha wesifundo okanye umphandi ukubona kuyinzuzo kuwe, okanye ukuba andisilandeli isicwangciso sesifundo, ekuvunyelenwe ngaso.

Kutyikitywe e-(indawo) .....…..…….. ngo-(usuku) ……...…….. 2016.

..... **.....**

Umtyikityo womthathi-nxaxheba **Umtyikityo wengqina**

Isifungo somphandi

Mna *(igama)* …… ndiyafunga ukuba:

- Ndilucacisile ulwazi olu kweli xwebhu ku-……..……...
- Ndimkhuthazile ukuba abuze imibuzo kwaye athathe ixesha elifanelekileyo ukuba ayiphendule.
- Ndiyaneliseka kukuba uyakuqonda ngokwanelisayo konke okumalunga nophando okuxoxwe ngasentla.
- Ndisebenzise/andisebenzisanga toliki. (*Ukuba itoliki isetyenzisiwe kumele ityikitye isaziso ngezantsi.*

Kutyikitywe e-(indawo) .....…..…….. ngo-(usuku) ……...…….. 2016.

..... **.....**

Umtyikityo womphandi **Umtyikityo wengqina**

Isifungo setoliki

Mna *(igama)* …… ndazisa ukuba:

- Ndicende umphandi (*igama*) ……. Ekucaciseni ulwazi olu lapha kweli xwebhu ku-(*igama lomthathi-nxaxheba*) …….. ndisebenzisa ulwimi lwesiAfrikaans/lwesiXhosa.
- Simkhuthazile ukuba abuze imibuzo kwaye athathe ixesha elifanelekileyo ukuba ayiphendule.
- Ndimxelele eyona nto iyiyo malunga nokunxulumene nam.
- Ndiyaneliseka kukuba umthathinkxaxheba ukuqonda ngokupheleleyo okuqulathwe loluxwebhu lwemvumelwano eyazisiweyo kwaye nemibuzo yakhe yonke iphendulwe ngokwanelisayo.

Kutyikitywe e-(*indawo*) .....……..…….. ngo-(*usuku*) ……...…….. 2016.

.....	**.....**
Umtyikityo wetoliki	**Umtyikityo wengqina**

Appendix D: Data sheet: Socio-demographic, medical history, and outcome measure data score sheet

HREC: Project S/15/10/232 (Tasneem Hartley; Physiotherapy Division)

Patient Name:			**Code:**	
Date of admission: YYYY/MM/DD:	**Projected Date of discharge:** YYYY/MM/DD:	**Actual Date of discharge:** YYYY/MM/DD:	**Preferred Language:**	1. English ❑ 2. Afrikaans ❑ 3. Xhosa ❑ 4. Other ❑

Sociodemographic History				
A. DOB		**Age:**	**B. Gender**	1. Male ❑ 2. Female ❑
C. Race			1. Black ❑ 2. Mixed race ❑ 3. White ❑	4. Indian ❑ 5. Other ❑
Present Medical History Clinical			**D. Date of incident (stroke):**	
E. Diagnosis	1. Hemorrhagic ❑ 2. Infarction ❑		**F. Side affected**	1. Left hemiplegia ❑ 2. Right hemiplegia ❑
G. Special Investi-gations	1. CT 2. MRI 3. Other: _____ Findings: _____			
H. Documented stroke risk factors	1. Hypertension ❑ 2. Diabetes ❑ 3. Cholesterol ❑ 4. Smoker ❑ How much? _____ How long? _____ 5. Obesity ❑ 6. Substance abuse ❑ How much? _____ How long? _____ 7. Atherosclerosis (hardening and narrowing of arteries)❑ 8. Opportunistic infection (e.g. meningitis, TB, syphilis) ❑ 9. Not known ❑ 10. Other ❑ Describe: _____			
I. HIV status	1. Diagnosed HIV+❑ 2. Diagnosed HIV-❑ 3. Undiagnosed/ Unspecified (patient has not been tested or status is not documented) ❑			
J. Most recent CD4 count:	CD4 count: _____ Date: _____ Not documented ❑			
K. AD's used during rehab (Initial assess-ment)	1. None 2. Walking stick ❑ 3. Crutches ❑ 4. Walking frame/rollator ❑ 5. Wheelchair ❑ 6. Other ❑ Describe: _____			
L. AD's received on discharge	1. None ❑ 2. Walking stick ❑ 3. Crutches ❑ 4. Walking frame/rollator ❑ 5. Wheelchair ❑ 6. Other ❑ Describe: _____			

HREC: Project S/15/10/232 (Tasneem Hartley; Physiotherapy Division)

Outcome measure scores: Modified Rankin Scale; Barthel Index and Berg Balance scale (On admission and discharge)

Patient name: **Code:**

Barthel Index	**Admission Date:**	**Discharge Date:**
1. Feeding		
2. Bathing		
3. Grooming		
4. Dressing		
5. Bowels		
6. Bladder		
7. Toilet use		
8. Transfers (bed to chair and back)		
9. Mobility (On level surfaces)		
10. Stairs		
Total	**/100**	**/100**
Berg Balance scale		
1. Sitting to Standing		
2. Standing unsupported		
3. Sitting unsupported		
4. Standing to sitting		
5. Transfers		
6. Standing eyes closed		
7. Standing with feet together		
8. Reaching forward with outstretched arm		
9. Retrieving object from floor		
10. Turning to look behind		
11. Turning 360°		
12. Placing alternate foot on stool		
13. Standing with one foot in front		
14. Standing on one foot		
Total	**/56**	**/56**
Modified Rankin Scale		
Score 0-6	**/6**	**/6**

Appendix E: Modified Rankin Scale

Patient name: **Code:**

MODIFIED RANKIN SCALE (MRS)

Patient Name: _____
Rater Name: _____
Date: _____

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead

TOTAL (0–6): _____

References

Rankin J. “Cerebral vascular accidents in patients over the age of 60.”
Scott Med J 1957;2:200-15
Bonita R, Beaglehole R. “Modification of Rankin Scale: Recovery of motor function after stroke.”
Stroke 1988 Dec;19(12):1497-1500
Van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. “Interobserver agreement for the assessment of handicap in stroke patients.”
Stroke 1988;19(5):604-7

Appendix F: Barthel Index

THE BARTHEL INDEX

Patient Name: _____

Rater Name: _____

Date: _____

Activity	**Score**
FEEDING 0 = unable 5 = needs help cutting, spreading butter, etc., or requires modified diet 10 = independent	_____
BATHING 0 = dependent 5 = independent (or in shower)	_____
GROOMING 0 = needs to help with personal care 5 = independent face/hair/teeth/shaving (implements provided)	_____
DRESSING 0 = dependent 5 = needs help but can do about half unaided 10 = independent (including buttons, zips, laces, etc.)	_____
BOWELS 0 = incontinent (or needs to be given enemas) 5 = occasional accident 10 = continent	_____
BLADDER 0 = incontinent, or catheterized and unable to manage alone 5 = occasional accident 10 = continent	_____
TOILET USE 0 = dependent 5 = needs some help, but can do something alone 10 = independent (on and off, dressing, wiping)	_____
TRANSFERS (BED TO CHAIR AND BACK) 0 = unable, no sitting balance 5 = major help (one or two people, physical), can sit 10 = minor help (verbal or physical) 15 = independent	_____
MOBILITY (ON LEVEL SURFACES) 0 = immobile or < 50 yards 5 = wheelchair independent, including corners, > 50 yards 10 = walks with help of one person (verbal or physical) > 50 yards 15 = independent (but may use any aid; for example, stick) > 50 yards	_____
STAIRS 0 = unable 5 = needs help (verbal, physical, carrying aid) 10 = independent	_____
TOTAL (0–100):	_____

The Barthel ADL Index: Guidelines

1. The index should be used as a record of what a patient does, not as a record of what a patient could do.
2. The main aim is to establish degree of independence from any help, physical or verbal, however minor and for whatever reason.
3. The need for supervision renders the patient not independent.
4. A patient's performance should be established using the best available evidence. Asking the patient, friends/relatives and nurses are the usual sources, but direct observation and common sense are also important. However direct testing is not needed.
5. Usually the patient's performance over the preceding 24-48 hours is important, but occasionally longer periods will be relevant.
6. Middle categories imply that the patient supplies over 50 per cent of the effort.
7. Use of aids to be independent is allowed.

References

Mahoney FI, Barthel D. “Functional evaluation: the Barthel Index.”
Maryland State Medical Journal 1965;14:56-61. Used with permission.

Loewen SC, Anderson BA. “Predictors of stroke outcome using objective measurement scales.”
***Stroke.* 1990;21:78-81.**

Gresham GE, Phillips TF, Labi ML. “ADL status in stroke: relative merits of three standard indexes.”
***Arch Phys Med Rehabil.* 1980;61:355-358.**

Collin C, Wade DT, Davies S, Horne V. “The Barthel ADL Index: a reliability study.”
***Int Disability Study.*1988;10:61-63.**

Copyright Information

Appendix G: Berg Balance Scale

Berg Balance Scale

The Berg Balance Scale (BBS) was developed to measure balance among older people with impairment in balance function by assessing the performance of functional tasks. It is a valid instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research. The BBS has been evaluated in several reliability studies. A recent study of the BBS, which was completed in Finland, indicates that a change of eight (8) BBS points is required to reveal a genuine change in function between two assessments among older people who are dependent in ADL and living in residential care facilities.

Description:
14-item scale designed to measure balance of the older adult in a clinical setting.

Equipment needed: Ruler, two standard chairs (one with arm rests, one without), footstool or step, stopwatch or wristwatch, 15 ft walkway

Completion:

Time: 15-20 minutes

Scoring: A five-point scale, ranging from 0-4. “0” indicates the lowest level of function and “4” the highest level of function. Total Score = 56

Interpretation:

41-56 = low fall risk
21-40 = medium fall risk
0 –20 = high fall risk

A change of 8 points is required to reveal a genuine change in function between 2 assessments.

Berg Balance Scale

Name: _____ **Date**: _____
Location:
_____ **Rater**: _____

ITEM DESCRIPTION	SCORE (0-4)
Sitting to standing	_____
Standing unsupported	_____
Sitting unsupported	_____
Standing to sitting	_____
Transfers	_____
Standing with eyes closed	_____
Standing with feet together	_____
Reaching forward with outstretched arm	_____
Retrieving object from floor	_____
Turning to look behind	_____
Turning 360 degrees	_____
Placing alternate foot on stool	_____
Standing with one foot in front	_____
Standing on one foot	_____

Total _____

GENERAL INSTRUCTIONS

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

- the time or distance requirements are not met
- the subject's performance warrants supervision
- the subject touches an external support or receives assistance from the examiner

Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item # 12.

Berg Balance Scale

SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hand for support.

( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or stabilize
( ) 0 needs moderate or maximal assist to stand

STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding on.

( ) 4 able to stand safely for 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely for 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

STANDING TO SITTING
INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assist to sit

TRANSFERS
INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cuing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise to be safe

STANDING UNSUPPORTED WITH EYES CLOSED
INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays safely
( ) 0 needs help to keep from falling

Berg Balance Scale continued…

STANDING UNSUPPORTED WITH FEET
TOGETHER INSTRUCTIONS: Place your feet together and stand without holding on.

( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand 1 minute with supervision
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds

REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

( ) 4 can reach forward confidently 25 cm (10 inches)
( ) 3 can reach forward 12 cm (5 inches)
( ) 2 can reach forward 5 cm (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper, which is in front of your feet.

( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. (Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.)

( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling

TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cuing
( ) 0 needs assistance while turning

Berg Balance Scale continued…

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.

( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in > 20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete > 2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try

STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)

( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing

STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding on.

( ) 4 able to lift leg independently and hold > 10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds
( ) 2 able to lift leg independently and hold ≥ 3 seconds
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
( ) 0 unable to try of needs assist to prevent fall

\

( ) TOTAL SCORE (Maximum = 56)

Appendix H: English Version EQ5D-EL

Health Questionnaire

English version for South Africa

EQ5D-3L Name: Code:

By placing a tick in one box in each group below, please indicate which statements best describe your own state of health TODAY. (**P**- Pre-morbid; **A**- on admission; **D**- discharge)

Mobility	P	A	D
I have no problems in walking about	❑	❑	❑
I have some problems in walking about	❑	❑	❑
I am confined to bed	❑	❑	❑
Self-Care			
I have no problems with self-care	❑	❑	❑
I have some problems washing or dressing myself	❑	❑	❑
I am unable to wash or dress myself	❑	❑	❑
Usual Activities *(e.g. work, study, housework, family or leisure activities)*			
I have no problems with performing my usual activities	❑	❑	❑
I have some problems with performing my usual activities	❑	❑	❑
I am unable to perform my usual activities	❑	❑	❑
Pain / Discomfort			
I have no pain or discomfort	❑	❑	❑
I have moderate pain or discomfort	❑	❑	❑
I have extreme pain or discomfort	❑	❑	❑
Anxiety / Depression			
I am not anxious or depressed	❑	❑	❑
I am moderately anxious or depressed	❑	❑	❑
I am extremely anxious or depressed	❑	❑	❑

To help people say how good or bad their state of health is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale, in your opinion, how good or bad your own health is today. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your state of health is today.

Your own state of health today

P – Date

Best imaginable state of health

Worst imaginable state of health

A – Date

Best imaginable state of health

Worst imaginable state of health

D – Date

Best imaginable state of health

Worst imaginable state of health

Appendix I: Afrikaans Version

Gesondheidsvraelys

Afrikaanse weergawe vir Suid-Afrika

(Afrikaans version for South Africa)

Dui asseblief aan watter stellings u eie gesondheidstoestand vandag die beste beskryf deur 'n regmerkie in een blokkie by elkeen van die onderstaande groepe te maak. (P- pre-morbid; A- On Admission; D- Discharge

Name: **Code:**

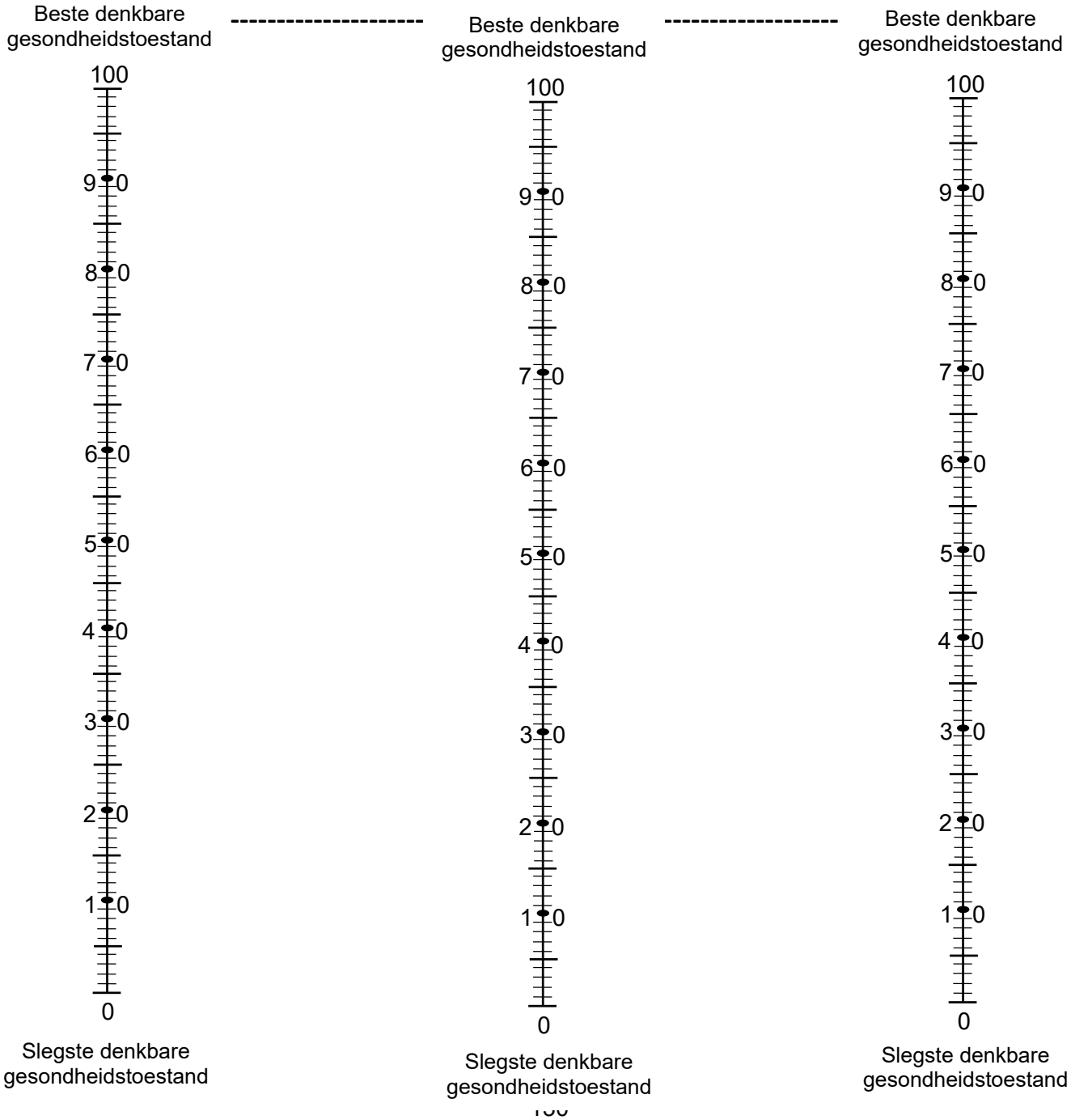
Beweeglikheid	P	A	D
Ek het geen probleme om rond te loop nie	❑	❑	❑
Ek het sommige probleme om rond te loop	❑	❑	❑
Ek is beperk tot die bed	❑	❑	❑
Selfversorging			
Ek het geen probleme om myself te versorg nie	❑	❑	❑
Ek het sommige probleme om myself te was of aan te trek	❑	❑	❑
Ek is nie in staat om myself te was of aan te trek nie	❑	❑	❑
Gewone Aktiwiteite *(bv. werk, studeer, huiswerk, familie- of ontspanningsaktiwiteite)*			
Ek het geen probleme om my gewone aktiwiteite uit te voer nie	❑	❑	❑
Ek het sommige probleme om my gewone aktiwiteite uit te voer	❑	❑	❑
Ek is nie in staat om my gewone aktiwiteite uit te voer nie	❑	❑	❑
Pyn / Ongemak			
Ek het geen pyn of ongemak nie	❑	❑	❑
Ek het matige pyn of ongemak	❑	❑	❑
Ek het uiterste pyn of ongemak	❑	❑	❑
Angstigheid / Neerslagtigheid			
Ek is nie angstig of neerslagtig nie	❑	❑	❑
Ek is matig angstig of neerslagtig	❑	❑	❑
Ek is uiters angstig of neerslagtig	❑	❑	❑

Om mense te help om te sê hoe goed of sleg hul gesondheidstoestand is, het ons ’n skaal (baie soos ’n termometer) geteken waarop die beste gesondheidstoestand wat u u kan indink, gemerk is met 100 en die slegste gesondheidstoestand wat u u kan indink, gemerk is met 0.

Ons wil graag hê dat u op hierdie skaal aandui hoe goed of sleg u eie gesondheid vandag na u mening is. Doen dit asseblief deur ’n streep te trek vanaf die blokkie hieronder (waar dit sê: “u eie gesondheidstoestand vandag”) tot by enige punt op die skaal wat aandui hoe goed of sleg u gesondheidstoestand vandag is.

U eie gesondheids-toestand vandag

P-



Appendix J: isiXhosa Version

Iphepha lemibuzo ngezempilo

Inguqulelo yesiXhosa saseMzantsi Afrika

(Xhosa version for South Africa)

Beka uphawu kwibhokisi ibenye kwiqela ngalinye echaza imeko yempilo yakho namhlanje, kwezi bhokisi zilandelayo. (P- pre-morbid; A- On Admission; D- Discharge)

Name: **Code:**

Musa ukuphawula ngaphezulu kwebhokisi enye kwiqela ngalinye.

Ukuhamba	P	A	D
Andinangxaki zokuhamba	❑	❑	❑
Ndinazo ingxakana zokuhamba	❑	❑	❑
Ndingumlwelwe obopheleleke ebhedini	❑	❑	❑
Ukuzinonophela isiqu			
Andinangxaki zokuzinonophela	❑	❑	❑
Ndinazo ingxakana zokuhlamba okanye ukuzinxibisa	❑	❑	❑
Andikwazi ukuzihlamba okanye ukuzinxibisa	❑	❑	❑
Izinto zesiqhelo *(Umsebenzi, Ukufunda izifundo Umsebenzi wasekhaya, Usapho, Ezolonwabo)*			
Andinangxaki nokuzenzela izinto zesiqhelo	❑	❑	❑
Ndinazo iingxakana zokuzenzela izinto zesiqhelo	❑	❑	❑
Andikwazi kuzenzela izinto zesiqhelo	❑	❑	❑
Iintlungu / Ukungaziva kakuhle			
Andinazintlungu okanye ukungaziva kakuhle	❑	❑	❑
Ndinentlungwana okanye ukungaziva kakuhle okungephi	❑	❑	❑
Ndinentlungu ezigqithileyo okanye ukungaziva kakuhle okugqithileyo	❑	❑	❑
Ukuxhalaba / Ukudakumba			
Andinaxhala okanye andidakumbanga	❑	❑	❑
Ndibuxhalaba okanye ndibudakumba	❑	❑	❑
Ndixhalabe gqitha okanye ndidakumbe gqitha	❑	❑	❑

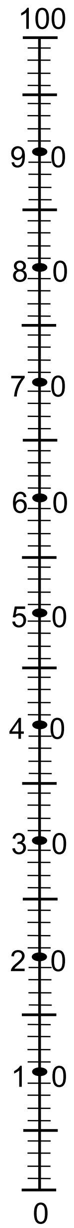
Ukunceda abantu ukuze baxele okokuba imeko yabo yempilo intle okanye imandundu na sizobe isikali (esifana nethemometha). Eyona meko entle yempilo iphawulwe ngo-100, eyona meko imandundu iphawulwe ngo-0.

Singathanda ubonise kwesi sikali ngokoluvo lwakho ukuba impilo yakho intle okanye imandundu kangakanani namhlanje. Nceda wenze oku ngokuzoba umgca osuka ebhokisini engezantsi ukuya kulo ndawo esikalini ibonisa ukuba imeko yempilo yakho intle okanye imbi kangakanani namhlanje.

Imeko yempilo yakho namhlanje

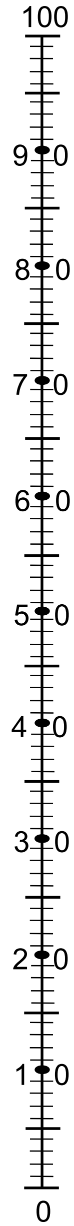
P- Umhla:----------------------- A- Umhla:------------------------------ D- Umhla:

Eyona meko entle yempilo onokuyiqikelela



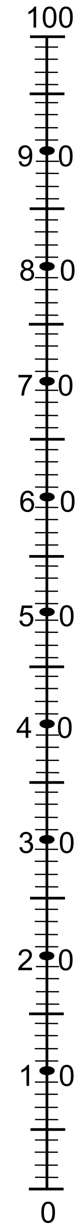
Eyona meko imandundu yempilo onokuyiqikelela

Eyona meko entle yempilo onokuyiqikelela



Eyona meko imandundu yempilo onokuyiqikelela

Eyona meko entle yempilo onokuyiqikelela



Eyona meko imandundu yempilo onokuyiqikelela

Appendix K: Ethics Approval Letter Stellenbosch University

Ethics Letter

23-Jun-2016

Ethics Reference #: S15/10/232

Title: The functional outcomes of stroke patients who are HIV positive, HIV negative and HIV undiagnosed, following inpatient rehabilitation: A descriptive study

Dear Miss Tasneem Hartley,

Your amendment request #3 dated 21 June 2016 refers.

The Health Research Ethics Committee approved the amended documentation.

The following amendments were approved:

1. Protocol version 3 dated 21 June
2. Consent form version 3 dated 21 June
3. Change of study title

Comment: It would appear that the major problem here is with clearance at chosen study site (WCRC). It may be worthwhile (in future applications) to approach study sites with a draft proposal prior to application for Ethics approval. The site co-ordinator could give feedback and protocol adjusted prior to submission to Ethics. The study would then only start after Ethics approval - but at least one has had commitment from the study site. Requesting a letter of support from study site at time of Ethics application also places the study site in a position of having to deliver on the agreed protocol.

If you have any queries or need further help, please contact the REC Office 219389819.

Sincerely,

REC Coordinator
Ashleen Fortuin
Health Research Ethics Committee 1

Appendix L: Approval Letter
Western Cape Government

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 6857; fax: +27 21 483 9895
5th Floor, Norton Rose House, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: WC_2016RP7_308
ENQUIRIES: Ms Charlene Roderick

Stellenbosch University

Private Bag x1

Matieland

7700

For attention: Ms Tasneem Hartley, Ms Gakeemah Inglis – Jassiem, Ms Marlotte Burger

Re: The functional outcomes of stroke patients who are HIV positive, HIV negative and HIV undiagnosed, following inpatient rehabilitation: A descriptive study.

Thank you for submitting your proposal to undertake the above mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Western Cape Rehab Centre	**Jenny Hendry**	**021 370 2316**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.

2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of

completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).

3. In the event where the research project goes beyond the *estimated completion* date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).

4. The reference number above should be quoted in all future correspondence.

Yours sincerely

A T HAWKRIDGE

DR A HAWKRIDGE

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 19/7/2016

Appendix M: Ethics Approval for extension

UNIVERSITEIT·STELLENBOSCH·UNIVERSITY
jou kennisvennoot • your knowledge partner

Ethics Letter

28-Feb-2017
Hartley, Tasneem T

Ethics Reference #: S15/10/232
Title: The functional outcomes of stroke patients who are HIV positive, HIV negative and HIV undiagnosed, following inpatient rehabilitation: A descriptive study

Dear Miss Tasneem Hartley

The Health Research Ethics Committee (HREC) approved the following progress report by expedited review process:

Progress Report dated: 7 November 2016

The approval of this project is extended for a further year

Approval date: 28 February 2017

Expiry date: 27 February 2018

Where to submit any documentation
Kindly submit **ONE HARD COPY** to Elvira Rohland, RDSD, Room 5007, Teaching Building, and **ONE ELECTRONIC COPY** to ethics@sun.ac.za

Please remember to use your **protocol number** **(S15/10/232)** on any documents or correspondence with the HREC concerning your research protocol.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005240 for HREC1
Institutional Review Board (IRB) Number: IRB0005239 for HREC2

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Good Clinical Pracices Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Sincerely,
Ashleen Fortuin
REC Coordinator
Health Research Ethics Committee 1