Functional outcome at discharge from an acute inpatient hospital setting following first-time stroke

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DECLARATION

I, Thameenah Solomon, declare that this research report is my own, unaided work.
It is being submitted for the Degree of Master of Science in Physiotherapy at the University of the Witwatersrand, Johannesburg, South Africa.

It has not been submitted before for any degree or examination at this or any other University.

Thameenah Solomon

30th day of September 2018 in Johannesburg

DEDICATION

This is for every single patient with stroke I have spoken to, treated, lost and learnt from, including my grandmother, Mrs. Ayesha Jeppie.

Rehabilitation means helping you, to help yourself.
Thank you for helping me pursue my purpose.

“How could she have had a stroke? She’s still walking”

ABSTRACT

Background: Stroke is a common cause of prolonged disability and often patients are discharged early from hospital without achieving functional independence. Known factors that influence functional outcome following stroke are, amongst others, stroke severity, age and gender.

Aim: To determine the functional outcome in ADLs and mobility of first-time stroke survivors upon discharge from an acute in-patient hospital setting. The objectives were a) to determine the ADL and mobility functional outcome at discharge of patients from an acute inpatient hospital setting following first-time stroke and b) to determine the factors that influence ADLs and mobility functional outcome at discharge from the acute inpatient hospital setting in patients following first-time stroke.

Method: This study was observational, descriptive and cross-sectional. Consecutively admitted, medically stable, first-time stroke survivors admitted to an acute care hospital and who were referred for rehabilitation during hospital stay were screened for eligibility. Participants underwent two assessments upon discharge: the Barthel Index (ADL) and Modified Rivermead Mobility Index (MRMI). Continuous data were summarised as median, IQR, means and standard deviations, minimum and maximum scores. Relationship tests were performed between outcome scores and independent variables. Univariate linear regression was performed between dependent and independent variables. Those with an independent relationship with outcome scores were placed in a multivariate stepwise regression to determine predictive factors of functional outcome in the setting.

Results: Sixty participants (35 Male and 25 female) were recruited. The mean age was 47.5 ± 12.14 and majority of the participants n= 52 (87%) had ischaemic strokes, moderate stroke severity (8.68 ± 4.48) and 20.6 ± 12.19 days length of hospital stay. Rehabilitation was initiated within one week of stroke (4.6 days ± 3.37) and total rehabilitation per day was 25.65 ± 15.07 minutes. Mean functional scores were 75/100 (BI) with self-care tasks most affected and 32/40 (MRMI) with mobility (walking) and stair-climbing most affected. Stroke severity was the single influencing factor found to influence both ADLs and mobility outcomes in this setting. The correlation between stroke severity and ADLs was moderate, negative and significant with r = -0.57 and p = 0.00. The correlation between stroke severity and mobility was moderate, negative and significant with r= -0.52 and p= 0.00.

Conclusion: Functional independence was achieved in some ADLs and mobility items at discharge. Majority of the sample required additional rehabilitation. Stroke severity was the single factor found to influence functional outcome in both ADLs and mobility at discharge.

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ACRONYMS

ADL	Activities of Daily Living
BI	Barthel Index
HIV	Human Immunodeficiency Virus
ICH	Intra-cerebral haemorrhage
ICU	Intensive Care Unit
LOS	Length of stay The number of days between admission and discharge
MRMI	Modified Rivermead Mobility Index
NIHSS	National Institutes of Health Stroke Scale
OTT	Onset to treatment (rehabilitation) The number of days between the date of onset of symptoms and initiation of rehabilitation

CHAPTER 1: BACKGROUND

1.1. Introduction

Stroke is a neurological condition that accounts for approximately 5.5 million deaths worldwide and 44 million disability-adjusted life-years lost (Mukherjee and Patil, 2011). It is the second-leading cause of death worldwide after ischaemic heart disease (Lozano et al., 2012). Majority of stroke-related data is derived from developed countries (Maredza, Bertram and Tollman, 2015). According to World Health Organization (2004), it is estimated that 5% of all stroke survivors live in Africa. Stroke prevalence and incidence in the South African urban setting is poorly documented. A recent study in the rural Agincourt sub-district found an estimated 842 incident cases of stroke where the crude stroke incidence rate was 244 per 100 000. The burden of disease in the entire rural South Africa was estimated at 13 000 000 with an estimated 33 500 strokes occurring in 2011 (Maredza, Bertram and Tollman, 2015). These figures highlight the severity of this public health problem across middle to high and low-income regions alike (Olaleye, Hamzat and Owolabi, 2013). Stroke was placed ninth in the rank of causes of disability (Bryer et al., 2010). This infers that optimal functional outcome is not achieved following stroke.

1.1.1. Functional outcome after stroke

Patients with stroke are affected by limitations at impairment, activity and participation levels. These include both basic and instrumental activities of daily living (ADLs), which are needed to run their households and function within their communities (Rhoda, Mpofu and De Weerdt, 2011). Thus, functional outcome includes the ability to perform ADLs as well as mobility. Function is assessed at different time-frames post stroke, often to predict overall functional outcome in the long term. In literature from developed nations, assessments of prognosis of function are performed at specific time frames following stroke e.g.: at three (Olai et al., 2007), six (Di Lauro et al., 2003) and twelve months (Olai et al., 2007). Stroke units are the gold standard for acute stroke care globally (Bryer et al., 2010) thus functional assessments following acute event are often performed in that setting. In the South African setting, in the absence of stroke units, as they have not been widely adopted, (Bryer et al., 2010) functional assessments are performed in hospitals with general medical wards, at rehabilitation settings or community health centres.

Improvement in function after stroke may occur up to twelve months post stroke with the most marked recovery occurring up to 30 days post event (Trombley et al., 2012). Patients with stroke are able to, on average, walk after three months (Sabine et al., 2002). As length of stay in the acute setting is short, this implies that at discharge from hospital, patients with stroke can still be dependent on a carer (Mamabolo et al., 2009). Nordin et al. (2012) support this finding and report that stroke survivors are discharged when they are medically stable,

without having achieved functional recovery particularly in mobility.

In rural South Africa, approximately 66% of stroke survivors require assistance with at least one activity (Connor et al., 2004). A compulsory community service year was introduced for graduating rehabilitation therapists in South Africa to, amongst other reasons, improve the provision of outpatient rehabilitation post-stroke. These facilities are not always accessible to patients due to lack of transport and funds (Mudzi, Stewart and Musenge, 2012). In the absence of outpatient rehabilitation, stroke survivors rely solely on caregivers and natural recovery for functional improvements (Mudzi, Stewart and Musenge, 2012). Thus, it can be inferred that gaining optimum function in the acute setting and stage following stroke is of great benefit to patients with stroke and their caregiver(s). There are factors which have been identified in literature to influence functional outcome such as age, gender, level of disability on admission and the time between stroke onset and initiation of rehabilitation, amongst others (Musicco et al., 2003). Literature on functional outcome at discharge from a tertiary hospital with a stroke unit exists from the Western Cape, South Africa (Parekh and Rhoda, 2013).

1.1.2. Factors that influence functional outcome after stroke

Recovery after stroke is greatly influenced by the clinical and demographic characteristics of the patient (Musicco et al., 2003). Therefore, establishing the influencing factors of functional outcome is linked to the population that is assessed. Functional outcome, in conjunction with demographic and clinical characteristics, can also be influenced by the structure of rehabilitation i.e. stroke unit versus general medical ward and the frequency and type of rehabilitation (Stroke Unit Trialists' Collaboration, 2007). Over time, various factors have been identified to predict functional outcome after stroke. Some of these factors are consistent across different settings and samples, and others inconsistent (Kwakkel and Kollen, 2013).

To date, limited literature is available on treatment duration in the acute in-patient hospital setting, particularly in developing countries. On average, basic classical training duration for upper limb rehabilitation (where a combination of physiotherapy and occupational therapy techniques are used) in a rehabilitation setting lasts 10 hours over a period of four weeks and therapy is administered in 30 minutes sessions, per week day (Oujamaa et al., 2009). High therapy intensity yields greater gains in functional independence and is related to a shorter length of hospital stay (Slade et al., 2002). It is recognized that functional independence cannot be solely attributed to the length of hospital stay but rather the availability of early, intensive rehabilitation that reduces hospital length of stay and improved functional outcomes at discharge (Slade et al., 2002). Therefore, as Mamabolo et al. (2009, p.15) stated, "functional independence cannot always be attributed to the duration of hospital stay".

Length of stay (LOS) following stroke varies. It was established in a study executed at a public hospital in Johannesburg, Gauteng, that LOS averaged six (Mudzi, Stewart and Musenge, 2012) and 12 (Mamabolo et al., 2009) days following a stroke. In a similar acute public hospital setting in Cape Town, Western Cape, mean LOS was slightly longer at 10.4 days (Parekh and Rhoda, 2013). The average between the two Johannesburg studies was nine days. This is slightly longer but comparable to a Malaysian hospital setting where LOS averaged 6.8 days (Nordin et al., 2012). The South African studies demonstrate that length of stay is relatively short in acute hospital settings in South Africa.

Consensus on the optimum time between stroke onset to initiation of rehabilitation as well as the definition of 'early mobilisation' or 'early rehabilitation' has not been established (Bernhardt et al., 2015). In the acute setting, a delay in initiation of rehabilitation can be an instruction from the medical team. Thus, the initial assessment of function may be performed within functional limitations and may not be an accurate display of functional ability (Parekh and Rhoda, 2013). Rehabilitation commenced within 24 hours post stroke has been said to achieve return to walking within 3.5 days compared to 7.5 days (Cumming et al., 2011). Musicco et al. (2003) found stroke survivors can achieve walking within one week and not specifically 24 hours. Therefore, 'early rehabilitation' should be considered to be within one week of stroke onset (Musicco et al., 2003). The ability to walk is one component of functional outcome. Thus, the influence of the timing between stroke onset and initiation of rehabilitation on functional outcome in ADL and mobility needs to be established. Despite this, earlier initiation of therapeutic intervention is said to influence long-term outcomes following stroke (Musicco et al., 2003).

Age has been established as a predictive factor of functional status at discharge in literature (Bagg, Pombo and Hopman, 2002; Nordin et al., 2012). Mamabolo et al. (2009) established that younger patients are more likely to be functionally independent at discharge compared to the older patient. This corresponds to a study by Abdul-sattar and Godab (2013) stating that advanced age was associated with poor functional outcome after rehabilitation. This could be due to disabilities and comorbidities commonly associated with advanced age (Nichols-Larsen et al., 2005). Stroke severity has also been established as a predictive factor of functional outcome at discharge from the acute stroke unit setting (De Villiers et al., 2011)

Females are found to have a higher stroke incidence (Bertram et al., 2013) with more disabling strokes, particularly in the acute stage. Gender differences in functional outcome were established in the sub-acute phase as well, in both ADLs and mobility where outcomes were better in males than females in both functional outcome domains (Drača, 2012).

A less predictive factor is stroke subtype (haemorrhagic vs. infarction). Scheepers et al. (2008) found in an in-patient rehabilitation setting, stroke survivors with intra-cerebral haemorrhage showed a confined recovery period compared to patients with cerebral infarction. Jørgensen et al. (1995) found contrasting results in their study conducted in an acute setting, concluding that stroke type had no influence on the recovery and prognosis of stroke but highlighted that strokes of haemorrhagic nature are more severe and have higher mortality. Thus, more research needs to be done on the influence of stroke subtypes on functional outcome in the acute setting.

Functional gains are greater during a short hospital stay, if early and intensive rehabilitation is available immediately rather than later (Collins et al., 2000). These functional gains apply to the short and long term (Collins et al., 2000). This type of intensive rehabilitation is best provided in a specialised stroke unit with organised, inter-disciplinary care (Bryer et al., 2011). This model of care has shown not only to improve short-term survival and functional independence post stroke but has also reduced the need for patients to be institutionalised (Stroke Unit Trialists' Collaboration, 2007). Due to of the lack of organized stroke units in tertiary hospitals in Tshwane, more information is required on stroke functional outcome at discharge from the acute inpatient hospital setting and the factors that influence it. With this information, acute care models for rehabilitation teams can be developed.

1.2. Problem statement

The demand for bed-availability in the acute South African public hospital setting is high. Therefore, patients with stroke are amongst many who are discharged early from the acute setting yet are still functionally dependent (Mamabolo et al., 2009). There are few rehabilitation centres to accommodate all stroke survivors needing intensive rehabilitation. Caring for functionally dependent patients can be physically demanding, hence burdensome on caregivers (Thomas and Greenop, 2008). In a study by Mamabolo et al. (2009), functional outcome at discharge was determined retrospectively, thus relying on patient's memory to recall their function at discharge, which is not always reliable.

Despite studies determining function at discharge having been conducted at acute hospital settings in Johannesburg and the Western Cape, it is necessary to establish function at discharge from this acute care setting in Tshwane, Gauteng as, according to the researcher's knowledge, no research on this topic has been conducted in this region before, particularly in a setting without a stroke unit. Factors found to influence functional outcome could allow for appropriate and efficient discharge planning and could inform the development of appropriate procedures to optimise medical and rehabilitative management in acute stroke, particularly for first-time stroke in this facility.

1.3. Research question

What is the functional outcome of first-time stroke survivors at discharge from an acute inpatient hospital setting and which factors influence this functional outcome?

1.4. Aim of the study

To determine the functional outcome of first-time stroke survivors upon discharge from an acute in-patient hospital setting.

1.5. Objectives of the study

1.5.1 To determine the functional outcome [Activities of Daily Living (ADLs) and mobility] of patients at discharge from acute inpatient hospital setting following first-time stroke.

1.5.2 To determine factors that influence functional outcome at discharge from an acute inpatient hospital setting in patients following first-time stroke.

1.6 Significance of the study

South African patients with stroke admitted to acute care public hospitals, spent six (Mudzi, Stewart and Musenge, 2012) and 12 days (Mamabolo et al., 2009) in a Johannesburg hospital at different time-frames averaging a LOS of 9 days and 10.4 days in a similar setting in Cape Town, averaging 9,4 days between the three centres across South Africa. To the researchers' knowledge, no literature exists identifying the functional outcome of patients with stroke upon discharge from an acute hospital without a stroke unit, in Tshwane, Gauteng. Results from this study will add to the existing research on functional outcome post stroke. Knowledge of function at discharge may give families an opportunity to prepare holistically for their family member's return home or transfer to another institution.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The following literature review aims to discuss the current literature on acute stroke epidemiology, functional outcome and the influencing factors thereof. Literature was found using the keywords: Acute stroke, Functional Outcome, Rehabilitation, influencing factors, ADLs and Mobility in PubMed, EBSCOhost, Google Scholar from March 2017 to January 2018.

2.2 Definitions of stroke and Functional Outcome

2.2.1. Definition of stroke

Cerebrovascular accident, commonly referred to as stroke, is defined by the World Health Organization (WHO, 1989) as a rapid development of focal or global brain function disorder with symptoms lasting more than 24 hours without an identifiable cause other than damage to a blood vessel. It can result in face and limb weakness, speech and sensory disturbances and limitations in function lasting more than 24 hours or death and classified either as ischaemic due to a blockage of the blood vessel or haemorrhagic resulting from a burst blood vessel (Kadojic et al., 2012). This differs from a transient ischaemic attack which is defined as focal neurological symptoms, lasting for less than 24 hours resulting from a temporary reduction in blood supply, leading to ischaemia of the brain in a particular area (Kadojic et al., 2012).

2.2.2 Definition of Functional Outcome

Functional recovery is defined by one's ability to perform activities of daily living (ADLs) and continue tasks at home (Trombly and Randomski, 2002).

2.3 Epidemiology of stroke

2.3.1 Global Burden of stroke

Stroke incidence in high-income countries has decreased by 42% while it has doubled in low and middle-income countries between 1970 and 2008 (Feigin et al., 2009). With an increase in stroke incidence in low and middle income countries, the burden of stroke worldwide and disability adjusted life years lost have increased significantly (Krishnamurthi et al., 2013).

The incidence, mortality and disability adjusted life years of both stroke subtypes (Ischaemic and haemorrhagic) in high-income countries have reduced in the younger population, where 'young' is considered to be <75 years (Krishnamurthi et al., 2013). Disability adjusted life years

are the total number of years of life lost due to premature mortality, adding the years lost resulting from the suboptimal health (Mathers et al., 2001). The reduction is attributable to improved prevention strategies by these regions (Yusuf et al., 2001).

A worldwide estimate of 11 569 538 ischaemic events occurred compared to 5 324 997 haemorrhagic events in 2010 where the greatest increase in ischaemic strokes occurred in Eastern Europe. This region also shares the highest increase in haemorrhagic strokes with central Europe between 1990 and 2010 (Krishnamurthi et al., 2013).

2.3.2 Epidemiology of stroke in Africa

Studies examining stroke across African countries often use hospital-based studies to determine incidence of stroke. Persons with strokes of mild severity may not be admitted to hospital, thus using these studies for accurate stroke incidence data may not be reliable (Owolabi et al., 2015). Community-based studies therefore show more accurate stroke incidence rates. While some studies exist across Africa, a lack of accuracy could play a role in the type and quality of data produced (Owolabi et al., 2015).

Majority of strokes, in each subtype (ischaemic 63%; haemorrhagic 80%), took place in low to middle income countries, in the 20 - 64 age category, particularly in the north and sub-Saharan Africa regions between 1990 and 2010 (Krishnamurthi et al., 2013).

Annual stroke incidence on the African continent, adjusted for age, is estimated to be 316 per 100 000 and prevalence rates adjusted for age are estimated to be up to 981 per 100 000. High-income countries have displayed stroke incidence in an older age group compared to Low income countries like those found in Africa; mean of 66 years in high income countries compared to 57 in low income countries. These high incidence and prevalence rates highlight the high burden of stroke across Africa.

2.3.3 Epidemiology of stroke in South Africa

Rural South Africa has an estimated population of 13 million people (Maredza, Bertram and Tollman, 2015). A study done in the Agincourt sub-district in rural South Africa between 2007 and 2011 estimated that the crude incidence of stroke in that region is 244 per 100 000 and 259 per 100 000 in all of rural South Africa. When adjusted for age, the incidence was 347 per 100 000 person years. An estimate of disability adjusted life years for South Africa as a whole was estimated to be 1570 per 100 000 (Maredza, Bertram and Tollman, 2015). This is similar to the figures presented by Owolabi et al. (2015) on the stroke incidence on the African continent. This analysis did not distinguish the burden of disease between stroke subtypes or include persons with stroke who passed away before 28 days, which could have

influenced the figures. Despite this, it highlighted that the overall burden of disease of stroke in rural South Africa, like other African countries, is very high (Maredza, Bertram and Tollman, 2015).

Limited information is available on recent stroke incidence and prevalence in the urban South Africa setting (Bertram et al., 2013). In 1998 and 2003, South African Demographic Household Surveys were performed countrywide. A total estimation of 75 000 new strokes occurred in 2008 with higher numbers in younger age groups and overall, higher incidence in the female gender (Bertram et al., 2013).

People living with stroke in South Africa was calculated to be 350 000 in 2007; 35% of which had moderate to severe disability (Bertram et al., 2013). Despite this data being a decade old and stroke incidence and prevalence may have changed, these figures provide some insight into the severity of the stroke in South Africa.

HIV has been found to be an independent risk factor for stroke (Cole et al., 2004), which could have a significant impact in the South African population, by increasing the incidence of stroke, as the virus has reached epidemic status in the country (Bradshaw et al., 2002).

The highest incidences of haemorrhagic stroke occurred in east and southern sub-Saharan Africa in 2010 (Krishnamurthi et al., 2013). South African specific data on the frequency and distribution of stroke subtype is not available.

2.4 Mechanisms of functional recovery

According to Kollen et al. (2005), progression in time is an independent factor for progress of recovery in stroke. It has therefore been challenging to distinguish between spontaneous neurological recovery and the influence of rehabilitation only on resultant functional outcome (Malec and Basford, 1996).

Independent of the type and amount of rehabilitation input given, patients with stroke can recover functionally over time. It is particularly challenging to quantify the effect of time on recovery. Thus, it is important to consider the mechanisms of recovery in rehabilitation (Kwakkel, Kollen and Lindeman, 2004).

Restitution and substitution, resolution of diaschisis and tissue repair have been used to describe the mechanisms of functional recovery following stroke over time (Kwakkel, Kollen and Lindeman, 2004). As a result of the non-linear pattern of recovery following stroke, with the possibility of rehabilitation influencing the physiological mechanisms which give rise to

functional recovery, true prediction of functional recovery has not been well understood (Kwakkel, Kollen and Lindeman, 2004).

2.5 Acute medical care following stroke

Medical management post stroke is aimed at preventing further cerebral damage (Hachiniski et al., 2010). This includes stabilization of blood pressure, which has a positive impact on functional outcome (Fukuda et al., 2015). It has improved significantly in recent years resulting in the development of stroke management protocols and national guidelines (Kahn and Tollman, 1999), the introduction of thrombolysis within four and a half hours (preferably within three hours) following stroke (Bryer et al., 2010) and specialised stroke units with interdisciplinary care (Bryer et al., 2011).

Intravenous thrombolytic therapy with recombinant tissue plasminogen activator, used in acute ischaemic strokes has been found to improve neurological deficits considerably following stroke worldwide (Bryer and Wasserman, 2013). It is widely used globally, however, in the South African public health sector, there are few studies showing its usage and effect despite other countries showing its safety and effectiveness (Bryer and Wasserman, 2013). If administered, clinical outcome could improve considerably resulting solely from this acute-care medical management and the earlier recombinant tissue plasminogen activator is given within the stipulated timeframe the better the clinical outcome in ischaemic strokes (Bryer et al., 2010) particularly in those with moderate stoke severity (Muchada et al., 2014)

Stroke units have become the ideal framework in which acute strokes are managed. According to Musicco et al. (2003), patients with stroke are admitted to acute care facilities for medical stabilisation for up to 15 days after which they can be transferred to a rehabilitation facility. The stroke unit model of care has been shown to reduce fatality following stroke as a result of an experienced team of multiple disciplines working together and communicating with each other in a specific location in the acute and sub-acute phases following stroke to achieve common goals (Bryer et al., 2010). Literature from developed nations reiterates these findings; that better clinical outcomes result in settings where coordinated interdisciplinary services are provided (Langhorne et al., 1993). These units are scarce in the South African public sector and to the researcher's knowledge; do not exist in public health facilities in Tshwane.

2.6 Functional outcome following acute stroke

Stroke results in limitations at impairment, activity and participation levels, thus the patient may be able to perform a functional task yet residual neurological deficits persist and reduce overall functional capacity (Filho et al., 2001). These functional tasks include both basic and

instrumental activities of daily living, which are needed to run households and to function within communities (Rhoda, Mpofu and De Weerdt, 2011). Marked recovery following stroke occurs up to 30 days post event (Duncan and Min Lai, 1997). This implies that when some patients are discharged from acute care hospitals, they can still be dependent on a carer (Mamabolo et al., 2009). Nordin et al. (2012) supports this statement by reporting that stroke survivors are discharged when they are medically stable without having achieved functional recovery, particularly in mobility.

Within the first three months, functional gains are greatest, after which they are found to 'plateau' between three and six months (Van de Port et al., 2006). Patients with stroke generally regain their ability to walk in this period (Sabine et al., 2002). Motor recovery is 'almost completed' between four and ten weeks from stroke onset according to Kwakkel et al. (2006). Improvement in all function, however, is not limited to the first six months and may extend to twelve months post stroke (Duncan and Min Lai, 1997).

According to Kwakkel, Kollen and Lindeman (2004), the severity of the damage within the cerebral tissue is expressed by the length of time without improvement after stroke as well as the functional gains in the early stage post-stroke.

Rehabilitation is provided with the ultimate aim of achieving functional independence at the level which allows for reintegration within family and community life (Kwakkel, Kollen, Lindeman, 2004). This outcome is ideal and not always achieved (Bryer et al., 2010). A team of professionals is thus essential in facilitating the individual recovery pattern of each patient to result in maximal functional independence (Kwakkel, Kollen and Lindeman, 2004) Despite functional outcome assessed at discharge from a particular setting to determine possible overall functional outcome, total potential function is not limited to the patients performance at one point in time (Mamabolo et al., 2009). Thus, patients in the chronic phase should receive continued rehabilitation and support (Rhoda, Mpofu and De Weerdt, 2011).

2.7 Review of Outcome Measures used in this study

Outcome measures are used for goal setting and treatment plans as well as for documentation and progress monitoring purposes (Tsang et al., 2014). Reliable, valid and responsive outcome measures are recommended for use following stroke to be able to set appropriate goals for patients (Tsang et al., 2014) and, amongst other reasons, to establish the functional independence and progress over time (Gresham et al., 1995). Many outcome measures have been described in literature as no single outcome measure can assess all possible functional limitations post stroke. The use of outcome measures is recommended in

the management of adult stroke rehabilitation care clinical practice guidelines (Duncan et al., 2005).

Three outcome measures are discussed below: the National Institutes of Health Stroke Scale (NIHSS), the Barthel Index (BI) and the Modified Rivermead Mobility Index (MRMI).

National Institutes of Health Stroke Scale (NIHSS)

The National Institutes of Health Stroke Scale (NIHSS) is a 15-item scale valid for measuring stroke severity. It has also been used to predict prognosis and assist with planning for post stroke care (Kasner, 2006). The rating for each item is scored with three to five grades, with zero (0) as normal (NIHSS International). This scale is a graded examination tool, which assesses speech, language, cognition, attention, visual field abnormalities, sensory impairments and ataxia. The NIHSS score has been determined to be a strong predictor of stroke functional outcome (Veerbeek et al., 2011). Kwakkel et al. (2013) specifies that the NIHSS in its assessment of the severity of neurological deficits associates strongly with the final basic ADL outcome more than three months post stroke. In addition to determining the severity of neurological deficits and functional outcome, the NIHSS was also found to be used to determine and streamline the discharge destination post stroke where patients who score less than five on admission are most likely to be discharged home, those who score between six and 13 will usually need acute inpatient rehabilitation and those more than 14 require long-term intervention (Schlegal et al., 2003). The NIHSS has an excellent test-retest reliability with ICC = 0.93 (Goldstein and Samsa, 1997). It also has excellent inter-rater and intra-rater reliability (ICC = 0.95) (Goldstein and Samsa, 1997) and concurrent validity (Adams et al., 1999).

The Barthel Index (BI)

The Barthel Index (BI) is an ordinal (Quinn, Langhorne and Stott, 2011) widely used, valid and reliable, observer-rated, multi-item summing rating scale to evaluate disability in terms of dependency (Hobart et al., 2001). It measures the ability of an individual with a neurological or neuromuscular disorder to care for him/herself in ADLs (feeding, grooming, bathing, dressing, bowel and bladder care, toilet care and mobility). It has adequate to excellent inter-rater and intra-rater reliability values and is quick to administer (Hsueh, Lee and Hsieh, 2001). The original BI was used in this study as the shortened version (BI-5) was found not to discriminate function of those with severe disability, particularly at admission (Hsueh et al., 2002).

While widely used, the original BI received some criticism for being too simple and thus unresponsive to change. The Functional independence measure was subsequently

developed, providing a greater number of response options (Houlden et al., 2006). The appropriateness (ability of range of disablement in population studied) and responsiveness (detect clinically significant change in the outcome measured) of the BI and functional independence measure to change was compared. The study was conducted in an in-patient rehabilitation setting for younger patients after first-time neurological damage. The outcome measures were rated within 10 days of admission and two weeks of discharge. Despite showing higher floor and ceiling effects to the functional independence measure, they were less than those recorded in community settings (Houlden et al., 2006). The BI is the preferred functional assessment measure to use in acute inpatient rehabilitation to measure self-care, mobility and sphincter control (Houlden et al., 2006) and is quick and simple to administer (Hsueh, Lee and Hsieh, 2001).

The BI has been used to assess disability upon admission or within the first 72 hours post stroke in various studies to predict the functional outcome at cross-sectional points in stroke recovery for example three months and six months. Its reliability to assess actual performance in this early phase has been questioned due to patients still being bedridden, resulting in an underestimation of true ADL performance (Kasner, 2006). Thus it can be inferred that the use of the BI in the acute phase post stroke is reliable in predicting function at three or six months post stroke but not preferred within the first 72 hours.

The Modified Rivermead Mobility Index (MRMI)

The Modified Rivermead Mobility Index (MRMI) is an outcome measure assessing functional mobility in patients following stroke (Tsang et al., 2014). It is a six-point ordinal scoring system. It records the amount of assistance required to achieve tasks of mobility ranging from 0 (unable to perform) to 5 (independent). It assesses eight items, with direct observation, which include turning over, moving from a lying to seated position, sitting balance, standing up from sitting, standing, transfers, walking and stair-climbing (Johnson and Selfe, 2004) and is relevant to the aims of stroke rehabilitation. It is important to note that it is not a measure of the quality of the movement, rather the ability to perform the movement (Lennon and Johnson, 2000). The former may negatively influence the outcome of the scoring, if the assessing therapist focuses on quality rather than the ability of mobility (Lennon and Johnson, 2000).

The original Rivermead Mobility Index (RMI) was adapted from the Rivermead Motor Assessment for a trial aimed at evaluating the effect of physiotherapy on mobility in patients with stroke (Lennon and Johnson, 2000). A critical limitation of the RMI scoring was found, affecting its reliability and validity; items we scored as ‘yes’ (1) or ‘no’ (0), resulting in insensitivity towards small changes in recovery (Wright, Cross and Lamb, 1998). Thus, as

one of the main goals of rehabilitation following stroke is to improve mobility (Lennon and Johnson, 2000), a more sensitive-to-change scoring system was required.

The MRMI was used to assess 16 patients receiving care at either an elderly care rehabilitation unit or stroke rehabilitation unit in a tertiary hospital. Its inter-rater reliability, test-retest reliability and internal consistency was assessed amongst stroke survivors who had been diagnosed with stroke within six weeks prior. Participants had a mean age of 74.25 years and were assessed by therapists with varying levels of experience (Lennon and Johnson, 2000). The MRMI, which is quick to administer, averages 17 minutes to complete using direct observation (Johnson and Selfe, 2004). Interclass correlation coefficient was used to demonstrate inter-rater reliability; (ICC = 0,98 $p < 0,001$), thus demonstrated that high reliability between raters was achieved (Lennon and Johnson, 2000). Test-retest reliability showed stable scores in a paired t-test ($t = 0.732$; $p = 0.47$), thus demonstrating reliability between tests. The effect size was found to be 1.15 (above the value of 0.08 representing the lower limit of responsiveness to change) thus demonstrating a high responsiveness to change in mobility status. Internal consistency (the association of all items assessing mobility) shown by Cronbach's alpha where alpha = 0.93, demonstrated high internal consistency (Lennon and Johnson, 2000). Concurrent validity, however, is yet to be established (Lennon and Johnson, 2000). With psychometric properties mostly positively demonstrated in this study, the MRMI is an appropriate tool to evaluate and mobility in the acute phase following stroke (Lennon and Johnson, 2000). This is supported by Tsang et al. (2014) who examined the measurement properties of the MRMI with the Modified Functional Ambulation Classification in a Chinese stroke population and recommended the MRMI for use as an outcome measure in the stroke population.

2.8 Factors influencing Functional Outcome

Various factors have been described in literature as 'prognostic factors', assigning association between them and functional outcome following stroke (Kwakkel and Kollen, 2013). These factors are spread between stroke related (clinical), socio-demographic and rehabilitation related factors (Musicco et al., 2003). Examples for each used by Musicco et al. (2003) were age, gender and living alone as socio-demographic factors, side of brain lesion and level of disability on admission as the clinical factors and rehabilitation factors were the categorized time-frame between stroke to initiation of rehabilitation and rehabilitation duration (defined by number of months in which rehabilitation was received). These are only a fraction of the prognostic or predictive factors, which have been used across various settings worldwide, and are not consistent across settings as stroke samples are heterogeneous (Kwakkel and Kollen, 2013).

Knowledge of and understanding the influence of these factors is important to develop specific rehabilitation strategies and goals for maximum functional gain in the critical, early phase post stroke and allow for appropriate discharge planning (Kwakkel and Kollen, 2013) as well as to decrease any strain placed on caregivers or the family.
Literature on stroke related factors (type and severity), demographic factors (age and gender) and management factors (length of stay, onset to treatment and treatment duration are explored below. These factors were explored in this study as they were found to be most appropriate in the acute inpatient hospital stage post-stroke in literature and have direct influence of acute care rehabilitation management protocol development.

Stroke type

Patients with intra-cerebral haemorrhage (ICH) are treated with greater caution in the early phase post stroke for improved long-term outcome (Reuter et al., 2016). This may result in a delay of initiation of rehabilitation compared to ischaemic strokes.

Scheepers et al. (2008) investigated the difference between development of ADL independence in cerebral infarction and ICH over the first year post stroke and found a greater delay in transfer to a rehabilitation centre from acute care hospitals for those with ICH than those with cerebral infarction. This could result from a need to stabilize patients with ICH over a longer period than those with cerebral infarction for reasons mentioned above.

The BI functional outcome measure was used in a study by Scheepers et al. (2008) to assess independence in ADLs. The study took place in a rehabilitation setting and initial functional severity and acute medical management was not recorded. The development of ADL independence was assessed over time and the main results were: patients with cerebral infarction took longer to recover (26 weeks) compared to ICH (10 weeks) and the recovery between 12 and 26 weeks was faster in those with cerebral infarction, compared to ICH. A shorter period of recovery in patients with ICH may occur due to the haematoma resolving, decreased presence of surrounding oedema with greater potential of brain tissue function restoration compared to ischaemic strokes where tissue repair will occur in the areas distant from but associated with the lesioned area, thus slower recovery (Scheepers et al., 2008). The results in non-linear recovery pattern thus could be due to spontaneous neurological recovery rather than rehabilitation, as suggested by Kwakkel, Kollen and Lindeman (2004). It is thus important to acknowledge the possibility that functional outcome, particularly in the acute phase following haemorrhagic stroke, could result from combined physiological recovery and rehabilitation received.

Stroke severity

Stroke severity is a well-established predictive factor in literature of functional status at discharge (Bagg, Pombo and Hopman, 2002; Nordin et al., 2012). In a systematic review on factors which predict ADLs outcomes by Kwakkel and Kollen (2013), a strong predictor of final basic ADL three months after stroke was the severity of neurological deficits assessed in the acute phase following stroke. In a review by Coupar et al. (2012), a similar result was found for the prediction of upper limb function where it is reiterated that initial severity in motor impairment or function determines the recovery of upper limb recovery following stroke.

Age

Age, like stroke severity, is a well-established predictive factor of functional status at discharge in literature (Bagg, Pombo and Hopman, 2002; Nordin et al., 2012). Abdul-Sattar and Godab (2013) states that advanced age was associated with poor functional outcome after rehabilitation. A study by Mamabolo et al. (2009), which aimed to determine post discharge functional improvements in patients with stroke, established that younger stroke survivors are more likely to be functionally independent at the time of discharge. A community-based study found that the discharge BI score is on average three points less than that from someone who is 10 years younger, highlighting that ADL recovery is influenced by advanced age possible due to difficulties in the ability to compensate for movement lost. However, neurological recovery is not affected (Nakayama et al., 1994)

Length of stay

Length of stay (LOS) following stroke varies. It was established two studies executed at a public hospital in Johannesburg, at different time periods, that LOS averaged six days (Mudzi, Stewart and Musenge, 2012) and 12 days (Mamabolo et al., 2009) following stroke. The average LOS between the two studies is nine days. In a similar setting in Cape Town, LOS averaged 10.4 days. This average LOS is slightly longer but comparable to a Malaysian population where LOS in an acute care hospital averaged 6.8 days (Nordin et al., 2012). Mamabolo et al. (2009) inferred that stroke survivors who stayed in hospital for between six to twelve weeks were more functionally independent than those who stayed in hospital for less than two weeks. For those who stayed less than two weeks, their decreased LOS could be attributed to mild loss of function or increased therapy intensity is over a short period. Functional gains are greater during a short hospital stay if early and intensive rehabilitation is available immediately rather than later (Collins et al., 2000). These functional gains apply to the short term and long term. It is recognized that functional independence cannot solely be attributed to the length of hospital stay but rather the availability of early, intensive rehabilitation that reduces hospital length of stay and improved functional outcomes at discharge (Slade et al., 2002). It is important to establish the average length of hospital stay and current standard practices and in the study setting for patients with stroke to identify

procedures which need to enhanced or improved on. This may improve the flow of patients from casualty to ward, to rehabilitation or discharge home and may improve functional goal setting to achieve the best possible outcome with optimal use of the hospital resources resulting in efficient and effective discharge planning to the appropriate facility.

Stroke onset to treatment (rehabilitation)

Rehabilitation is aimed at recovering motor function, regaining ability to perform activities of daily living (ADLs) and mobility post stroke and ultimately reduce disability in the long term (Hachinski et al., 2010). Consensus on the definition of 'early' has not yet been reached but various studies have explored the possibilities through clinical trials (Bernhardt et al., 2015).
In a study by Musicco et al. (2003) the onset to treatment time was not found to be statistically significant with death or the development of early failure (premature or unwarranted interruption of stroke rehabilitation for various reasons), however, negative outcomes were reduced in those who commenced rehabilitation within one week after stroke. A limited window-period of increased receptivity and heightened plasticity immediately after stroke has been identified (Murphy and Corbett, 2009). Thus, initiation of rehabilitation should commence within one week (Musicco et al., 2003).

Rehabilitation type, duration and intensity

Rehabilitation is not an established intervention but rather a combination of processes (Wilson, 1993) aimed at restoring function (Chiodo et al., 1992). In a study by Musicco et al. (2003), rehabilitation was defined as the initiation of passive or active mobilisation during acute hospitalisation performed at least once per day. Literature recommends that patients with stroke should begin rehabilitation as soon as they are medically stable (Duncan et al., 2005).

Rehabilitation duration and frequency is quantified in minutes per day by rehabilitation professionals and over how many days administered (Bosch et al., 2013) where as intensity is the energy expenditure on a specific task, which can be difficult to quantify, thus inconsistencies are noted in literature (Bosch et al., 2013). The frequency, duration and intensity of interventions or rehabilitation fall under the umbrella term 'dose' and optimum dosage post stroke rehabilitation, whether for upper limb recovery or mobility remains undefined. No consensus on optimal frequency and therapy duration has been established, particularly in the acute stage (first seven days) post stroke (Bernhardt et al., 2007).

According to Canadian Best Practice Recommendations for Stroke Care, in the rehabilitation setting, direct therapy by each relevant discipline must be provided for at least one hour per day for at least five days per week if there is a need for it, if the patient can tolerate it and if the stroke severity allows for it (Lindsay et al., 2008). In the acute setting, however, therapy

duration was observed to be much less (up to 24 minutes per day) in acute stroke units within the first 14 days post-stroke. Therapy was provided by either a physiotherapist or an occupational therapist and infrequently by both disciplines on the same day (Bernhardt et al., 2007). The study did not assess functional outcomes and thus a dose-response relationship was not established for best practice in the acute stage post stroke. Rehabilitation in acute stroke units has reported therapy separately for each rehabilitation discipline per weekday, amounting to under one and a half hours for combined physiotherapy and occupational therapy per day (Langhorne et al., 2002). It is important to note that the purpose of stroke units differs (Bernhardt et al., 2007). Thus, rehabilitation practices and treatment duration for each discipline between units primarily used for medical stabilisation compared to those used for comprehensive early rehabilitation, may vary (Bernhardt et al., 2007).

CHAPTER 3: METHODOLOGY

3.1 Research Design

This was an observational, descriptive and cross-sectional study.

3.2 Research Setting

Participants were recruited from a conveniently selected tertiary hospital, Steve Biko Academic Hospital, located in Tshwane, Gauteng. It is an 832-bed tertiary healthcare institution providing specialized services on referral basis. Patients admitted to the casualty, wards and intensive care units (ICU) were among those eligible for participation. A therapist from each allied health discipline is allocated to each ward and / or ICU. Patients' are treated on referral basis.

Hospital procedure for patients with stroke were as follows: Patients were assessed by a casualty officer after which those aged 59 and younger were assessed by personnel from the Neurology department and those 60 years and older were assessed by personnel from the Internal Medicine department, as determined by hospital and departmental management. The patients were referred to the appropriate allied health team members depending on their presenting deficits. Assessments by the allied health team were generally performed within 24 hours at which time treatment plans were drawn up. Patients received usual care depending on the clinical presentation of the patient on the day. Patients were treated in the ward or gym settings as frequently as possible until independent or discharge. If the patient had not achieved basic bed mobility and mobility in walking and ADLs in this period, an application was made to a nearby provincial rehabilitation centre.

3.3 Sample selection

All consecutively admitted, first-time stroke survivors (ischaemic and haemorrhagic), referred to the rehabilitation team were screened for eligibility (Appendix 1) for participation over a period of one year from July 2016 until July 2017.

3.3.1 Inclusion Criteria

The following criteria were required for participants to be included in this study:
Medically stable adults (male and female) over the age of 18, following first time stroke, with resultant hemiplegia who, either individually or via next of kin, provided consent.

3.3.2 Exclusion Criteria

Patients were excluded from this study if they were dependent in ADLs and / or mobility before their stroke.

3.3.3 Sample size determination

Six factors, which could possibly influence function, were identified from literature: age, stroke subtype, stroke severity, the number of days between stroke onset to commencement of rehabilitation, the length of stay in days and rehabilitation duration. According to recommendations by Nunnally (1978), ten persons per factor are needed to show significance in measures assessed. Thus, at least sixty participants were required for this study.

At Steve Biko Academic Hospital for the period April 2014 to March 2015 (12 months), physiotherapists treated 397 stroke survivors and from the period April 2015 to December 2015 (9 months), physiotherapists treated 398 stroke survivors. The above figures indicate that the required sample size could be reached at Steve Biko Academic Hospital.

3.4 Measurement instruments

3.4.1 Barthel Index (BI)

The Barthel Index (Appendix 2) is a widely used, valid and reliable, observer-rated, multi-item, summing rating scale used to evaluate disability in terms of dependency (Hobart et al., 2001) and is ordinal in nature (Tennant, Geddes and Chamberlain, 1996). Measuring the ability of an individual with a neurological or neuromuscular disorder to care for him/herself in ADLs (feeding, grooming, bathing, dressing, bowel and bladder care, toilet care, and mobility), it is therefore appropriate for use following acute stroke. It has adequate to excellent inter-rater and intra-rater reliability (Hsueh, Lee and Hsieh, 2001) and is quick to administer, taking two-to five minutes with self-report and up to twenty minutes with direct observation. Sulter, Steen and de Keyser (1999) report that independence in basic vital care is achieved by a score of at least 60% on the BI. Minimal assistance is required with a score of 85% and support is no longer required when a total score of 90% has been achieved (Uyttenboogaart et al., 2005).

3.4.2 National Institutes of Health Stroke Scale (NIHSS)

The NIHSS (Appendix 3) is a 15-item ordinal scale (Millis et al., 2007), valid for measuring stroke severity. The rating for each item is scored with 3 to 5 grades, with 0 as normal (NIHSS International). This scale is a graded examination tool, which assesses speech, language, cognition, attention, visual field abnormalities, sensory impairments and ataxia. It has good sensitivity and specificity. Its appropriateness is established in the acute setting. The NIHSS score has been determined to be a strong predictor of stroke functional outcome (Veerbeek et al., 2011). A trained professional calculates the NIHSS score following clinical assessment.

3.4.3 Modified Rivermead Mobility Index (MRMI)

The MRMI (Appendix 4) is a six-point ordinal scoring system. It records the amount of assistance required to achieve tasks of mobility. These include turning over, moving from a lying to sitting position, sitting balance, standing up from sitting, standing, transfers, walking and stair-climbing (Johnson and Selfe, 2004). It has demonstrated high inter-rater reliability (0,98 $p < 0.001$), responsiveness to change in mobility status and high overall internal consistency (Lennon and Johnson, 2000) and averages 17 minutes to administer therefore allowing therapists to document mobility status quickly (Johnson and Selfe, 2004).

3.4.4 Demographic questionnaire

The demographic questionnaire (Appendix 5) records information about patient characteristics (demographic and clinical) such as age, number of days between stroke onset and commencement of rehabilitation.

3.5 Procedures

3.5.1 Ethical approval

Before this study commenced, approval was sought and obtained from the University of Witwatersrand, Human Research Ethics Committee (Medical) (M160531) (Appendix 6).

3.5.2 Recruitment

Recruitment was conducted in two phases:

Phase one*:* Gaining access or permission

Permission was requested and obtained from the hospital CEO (Appendix 7) to access the clinical setting and patients with stroke until the sample size was met.

Phase two: Identification of participants

The proposed research procedure was verbally presented to various staff members working in Neurology, Internal Medicine, Neurosurgery, Cardiology and Allied Health Disciplines, amongst others, to request referral of all stroke survivors to allied health services following admission to Steve Biko Academic Hospital.

All consecutively admitted stroke survivors, referred for rehabilitation were screened for eligibility by the researcher. The screening tool was kept separate by the researcher for additional data purposes. If the inclusion criteria were met, the study was explained in an information letter (Appendix 8) and informed consent for participation (Appendix 9) was obtained from the patient or next of kin by the researcher who was also a treating therapist to some of the participants in this study. No specific time frame was stipulated between providing information about the study and obtaining consent. In some cases it was immediate

and in others consent was obtained the following day. The participant's thumbprint was used if they were unable to sign.

3.6 Data Collection

Once the patients with stroke agreed to participate:

A demographic questionnaire (Appendix 5) was completed from information provided in the medical records. This included: participant age, stroke subtype, stroke severity as per NIHSS guidelines as documented by the medical doctor and number of days between onset from stroke to commencement of rehabilitation (independent variables).

During hospital stay:

- All participants received usual care by nursing staff and the rehabilitation team; qualified staff members as well as students from the University of Pretoria and Sefakho Makgatho University.
- There is no formal protocol implemented in the hospital for acute stroke management. Usual care consists of patient education, pressure care, joint range of movement maintenance, re-education of bed mobility, transfers, gait re-education, stair-climbing and ADLs retraining, which are all performed according to the patients' needs. Patients are treated in the ward or gym settings. Ward exercise programs are provided for those who can follow instructions. Therapists' train caregivers if needed.

Upon discharge (home, transfer to another hospital or rehabilitation centre):

- Arrangements were made with the medical doctor for the participant to be discharged via the physiotherapy department where they underwent one attempt of the BI and MRMI (dependent variables) functional assessments by the researcher or the research assistant. Stairs were available to accurately assess the participant's ability to perform this item of the functional assessment.
- From the occupational therapists (OTs) and physiotherapists (PTs) daily statistics records, as well as from the students' daily statistics records from both disciplines, therapy duration (independent variable) in hours was calculated where one unit equated fifteen minutes of individual therapy and documented in a discharge summary (Appendix 10).
- Length of stay was calculated and documented (independent variable).
- Therapy duration was calculated as the total rehabilitation in hours, divided by the total number of weekdays during acute hospital admission and not 'active rehabilitation' days, where days that patients remained in the hospital, despite being discharged from therapy, were excluded from the calculation.

- Participants who needed additional rehabilitation were referred to their nearest out-patient facility or rehabilitation unit as per standard practice. The discharge destination was recorded.
- If additional services beyond the rehabilitation team's scope of practice were needed, it was requested that they be addressed at medical follow-up appointments

3.7 Data Management

Data were captured and cleaned in EXCEL™ after which they were imported into STATISTICA™ where analysis took place. The level of significance was set as: $p \leq 0.05$.

3.8 Statistical Analysis

Objective 1:

- The BI and MRMI both produced continuous data, which were summarised as median, IQR, means and standard deviations, minimum and maximum scores.

Objective 2:

- The Shapiro-Wilk test was used to test for normality of the total scores of each outcome measure.
- Independent variables were summarized as median, IQR, means, standard deviations, minimum and maximum scores.
- Functional outcome for each item of each outcome measure assessment at discharge was described by median and interquartile range.
- Relationship tests [Spearman's for continuous data and Mann-Whitney U for categorical data (gender and stroke type)] of the total BI and MRMI scores against independent variables were performed. Stroke type was categorised into ischaemic and haemorrhagic stroke.
- Univariate linear regression between the dependent variables (BI and MRMI) and independent variables was performed.
- Variables found to have an independent relationship with outcome scores at discharge were placed in a multivariate stepwise regression with dependent variables (BI and MRMI) determining predictive factors at discharge from the acute inpatient hospital setting following first time stroke.

3.9 Ethical Considerations

- *Confidentiality:* Assigning a code to each participant's records will ensure confidentiality and anonymity. Each participant or next of kin will be provided with the necessary study details.

- *Autonomy*: Potential participants will not be coerced into participating in this study and may withdraw from the study at any time.
- *Consent:* The informed consent form and study procedure will be explained to the participant or next of kin in detail. The benefits and risks of participation will be clearly demonstrated.
- *Non-maleficence*: Assessment tools are questionnaire and function based. Exertion during assessment will be monitored closely. Neither of the functional outcome assessment tools are invasive or harmful.
- *Beneficence:* Results from this study will add to the existing knowledge on function at discharge from an acute inpatient hospital setting in South Africa. This study can be used as a pilot study for larger studies or clinical trials.

CHAPTER 4: RESULTS

4.1 Introduction

Demographic information, results of functional assessments upon discharge and the factors influencing functional outcome will be presented in this section, as per study objectives. The objectives were to 1) determine the functional outcome [Activities of Daily Living (ADLs) and mobility] of patients at discharge from acute inpatient hospital setting following first-time stroke and 2) To determine factors that influence functional outcome at discharge from an acute inpatient hospital setting in patients following first-time stroke.

Results will be presented as a demographic profile of the study participants, values of each independent variable assessed, a summary and breakdown of function within each outcome measure, a summary of univariate analysis of each independent variable for each outcome measure and the multivariate stepwise regression showing the factors which influence ADLs and mobility functional outcomes at discharge from the acute inpatient hospital setting.

4.2 Summary of the demographic and clinical profile of the study participants

Sixty first-time stroke survivors were recruited between July 2016 and July 2017. Two participants who signed consent passed away prior to discharge and were thus excluded and replaced. No information was kept to determine how many patients were screened, how many were eligible or ineligible for this study.

Results of the stroke survivors' gender, stroke type, rehabilitation discipline involved in the treatment of patients before discharge, discharge destination and stroke survivors who required additional rehabilitation post discharge are presented in Table 4.1.

Table 4.1 Gender, stroke type, rehabilitation discipline involved, discharge destination and additional rehabilitation post discharge (n = 60)

Characteristic	Level	Number (n= 60)	Percentage
Gender	Male	35	58%
	Female	25	42%
Stroke Type	Ischaemic	52	87%
	Haemorrhagic	8	13%
Rehabilitation Discipline	Physiotherapy	59	98%
	Occupational Therapy	41	68%
	Both Physiotherapy & Occupational Therapy	40	67%
Discharge Destination	Home	41	68%
	Rehabilitation Centre	12	20%
	Other Hospital	7	12%
Additional Rehabilitation	Required	40	67%
	Not required	20	33%

Majority of the patients with stroke in this study were male (58%), had ischaemic stroke (87%) and received physiotherapy (98%). Upon discharge, majority of the sample (67%) required additional rehabilitation and 68% were discharged home.

Results of the patients' age, length of stay, stroke onset to treatment (OTT), stroke severity (NIHSS) and treatment duration per day are presented in Table 4.2.

Table 4.2. Age, Length of Stay, Onset to Treatment, Stroke Severity (NIHSS) and Treatment Duration (n = 60)

Variable	Median	IQR	Mean	SD	Minimum	Maximum
Age *(years)*	46.5	38-55.5	47.5	12.14	23	78
LOS* *(days)*	18	12-26	20.61	12.19	3	65
OTT** *(days)*	3.5	2-6	4.6	3.37	1	17
NIHSS ***(/42)	8	5-12	8.68	4.48	2	20
Treatment Duration per day *(Minutes)*	22.5	11.57 – 35.66	25.65	15.08	3.75	62.04

** LOS: Length of stay; ** OTT: Onset to treatment; *** Interpretation of stroke severity: 0-5 mild, 6-14 mild to moderately severe, 15-24 severe and > 25 very severe.*

The average age of the patients with stroke in this study was 47,5 ±12.1 years with moderate stroke severity 8.68 ± 4.48 and participants stayed in hospital for more than a fortnight (20.6 ± 12.19 days). Rehabilitation started within a week (4.6 ± 3.37 days) and lasted on average under 30 minutes (25.65 ± 15.08) per day.

4.3 Summary of functional outcome of the sample in Activities of Daily Living and Mobility

The Shapiro-Wilks test was used to test for normality (p – value) of the functional outcome scores (Figure 4.1).

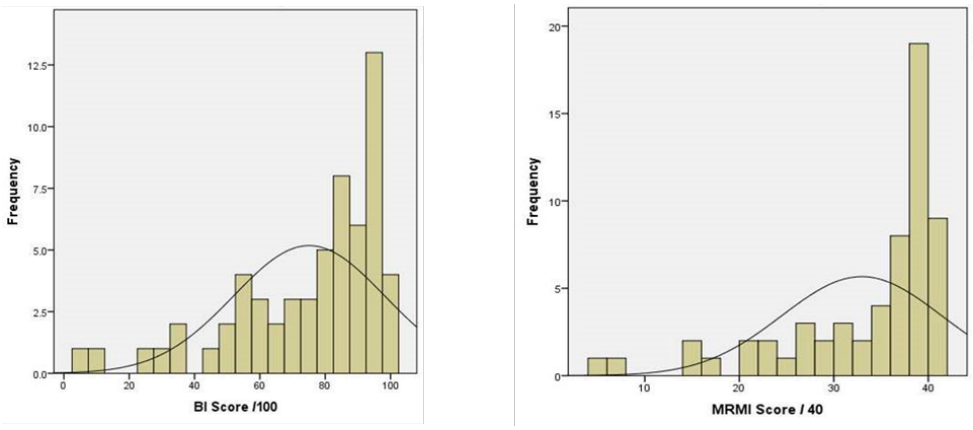

Figure 4.1 Histogram showing normality of BI and MRMI outcome measures

Table 4.3 Shapiro-Wilk test displaying distribution of total BI and MRMI outcome measure scores

	Shapiro-Wilk		
Outcome Measure	Statistic	Degrees of Freedom (df)	Sig.
BI Score /100	0.86	60	0.00
MRMI Score / MRMI Score /40	0.77	60	0.00

The functional outcome total scores for each outcome measure were not normally distributed; BI and MRMI ($p<0.05$) (Table 4.3). Functional outcome in ADLs and mobility were calculated using the Barthel Index (BI) and Modified Rivermead Mobility Index (MRMI) outcome measures upon discharge. Medians, interquartile range, means, standard deviations, minimum and maximum scores represented the data. These are presented in Table 4.4.

Table 4.4. Functional Outcome at discharge for Activities of Daily Living measured by the Barthel Index (BI) and Modified Rivermead Mobility Index (MRMI) (n = 60)

Outcome measure	**Median**	**IQR**	**Mean**	**SD**	**Min**	**Max**
Barthel Index (BI) (/100)	85	60 - 95	75	23.11	5	100
Modified Rivermead Mobility Index (/40)	37	30 - 38	32	8.44	5	40

Means of BI and MRMI outcome measured at discharge, were 75/100 and 32/40 respectively. Both means were lower than the median scores.

The median value and interquartile range (IQR) of each item assessed by outcome measures used in this study are presented in Table 4.5 and 4.6.

Table 4.5 Functional outcome for each item of the Barthel Index at discharge described by median and interquartile range (IQR) (n = 60)

BI Items	Median (IQR)
Feeding (/10)	5.0 (5-10)
Bathing (/5)	5.0 (0-5)
Grooming (/5)	2.5 (0-5)
Dressing (/10)	5.0 (5-10)
Bowels (/10)	10.0 (10-10)
Bladder (/10)	10.0 (10-10)
Toilet Use (/10)	10.0 (5-10)
Transfers (Bed to chair and Back) (/15)	15.0 (10-15)
Mobility (on level surface) (/15)	15.0 (10-15)
Stairs (/10)	5.0 (5-7.5)

Performance of ADLs was more affected in feeding, bathing, grooming, dressing, toilet use and stair climbing, scoring 50% and below.

Table 4.6 Functional Outcome for each item of the Modified Rivermead Mobility Index at discharge described by median and interquartile range (IQR) (n = 60)

MRMI Items (/5 each)	Median (IQR)
Turning over	5.0 (5-5)
Lying to sitting	5.0 (5-5)
Sitting balance	5.0 (5-5)
Sitting to standing	5.0 (3.5-5)
Standing	5.0 (4-5)
Transfers	5.0 (3-5)
Walking indoors	5.0 (2.5-5)
Stairs	5.0 (1-3)

Mobility items assessed at discharge by MRMI, show basic bed mobility was achieved for majority of the sample with indoor walking and stair-climbing more affected; both with items within IQR scoring 50% and below.

4.4 Factors that influence functional outcome

The correlation strength, direction and significance between each variable with each outcome measure were determined. These are displayed in Table 4.7 for BI and Table 4.8 for MRMI respectively.

Table 4.7 Relationship between activities of daily living functional ability and age, treatment duration, onset to treatment (OTT), length of stay (LOS), stroke severity, stroke type and gender (n = 60)

Type of Data Produced	Variable	Coefficient ($R_{S)}$	P-value BI	Strength, Direction and significance of correlation
Continuous *(Spearman Correlation)*	Age	-0.26	0.04*	Weak, Negative Significant
	Treatment duration	-0.40	0.00*	Moderate, Negative Significant
	OTT	-0.08	0.51	Weak, Negative Not Significant
	LOS	-0.17	0.17	Weak, Negative Not Significant
	Stroke severity	-0.57	0.00*	Moderate, Negative Significant
Categorical *(Mann-Whitney U)*	Stroke type	171.5	0.42	Not Significant
	Gender	342.0	0.14	Not Significant

**significant*

There was a weak negative correlation between age and ADLs functional outcome indicating that as age increases functional ability decreases. There was a moderate negative correlation between treatment duration and ADLs functional outcome, indicating that the longer the treatment, functional outcome decreases.

There was a moderate negative correlation between stroke severity and ADLs functional outcome indicating that as stroke severity increases, functional ability decreases.

Table 4.8 Relationship between mobility functional ability and age, treatment duration, onset to treatment (OTT), length of stay (LOS), stroke severity, stroke type and gender (n = 60)

Type of Data Produced	Variable	Coefficient (R_S)	P-value MRMI	Strength, Direction and significance of correlation
Continuous *(Spearman Correlation)*	Age	-0.29	0.02*	Weak, Negative Significant
	Treatment duration	-0.33	0.01*	Weak, Negative Significant
	OTT	-0.04	0.73	Weak, Negative Not Significant
	LOS	-0.14	0.25	Weak, Negative, Not Significant
	Stroke severity	-0.52	0.00*	Moderate, Negative Significant
Categorical *(Mann-Whitney U)*	Stroke type	162.5	0.31	Not Significant
	Gender	312.5	0.05	Not Significant

**significant*

There was a weak negative correlation between age and mobility functional outcome indicating that as age increases functional ability decreases.

There was a weak negative correlation between treatment duration and mobility functional outcome, indicating that the longer the treatment, functional outcome decreases.

There was a moderate negative correlation between stroke severity and mobility functional outcome indicating that as stroke severity increases, mobility functional ability decreases.

4.5 Predictors of functional outcome

Predictors of functional outcome were established using linear regression. Univariate linear regression was done followed by stepwise linear regression

Table 4.9: Univariate linear regression between the dependent variable (BI) and independent variables (age, treatment duration, onset to treatment, length of stay, stroke severity, stroke type and gender)

Variables			95% Confidence Interval	
	Beta	P-value	Upper	Lower
Age	-0.30	0.01*	-0.10	-1.05
Treatment Duration	-0.31	0.01*	-0.09	-0.86
Onset to Treatment	-0.03	0.81	1.58	-2.01
Length of Stay	-0.26	0.04*	-0.01	-0.97
Stroke Severity	-0.55	0.00*	-1.71	-3.97
Stroke Type	-0.11	0.36	9.56	-25.62
Gender	-0.22	0.08	1.48	-22.33

**Significant independent predictors of BI outcome*

Variables found to be independent predictors of BI outcome (statistically significant) at discharge are: age, treatment duration, length-of-stay and stroke severity. These were placed in a multivariate stepwise regression to determine predictors of functional outcome at discharge for both outcome measures. Stepwise regression for ADLs is represented in Table 4.10.

Table 4.10: Multivariate stepwise regression between dependent variable (BI) and independent variables, determining predictive factors at discharge from the acute inpatient hospital setting following first time stroke

Model (BI)			t	Sig.	95% Confidence Interval	
		Beta			Lower Bound	Upper Bound
1	(Constant)		18.11	0.00	88.73	110.78
	NIHSS /	-0.55	-5.03	0.00	-3.97	-1.71
2	(Constant)		12.87	0.00	117.07	160.22
	NIHSS /	-0.61	-6.22	0.00	-4.18	-2.14
	Age	-0.39	-4.05	0.00	-1.13	-0.38

Stroke severity, as represented by NIHSS, was the only factor which independently influenced ADL functional outcome at discharge from an acute inpatient hospital setting. As the NIHSS score increases by one-point, the total BI score decreases by 0.5 points.

Independently, age is not a significant influencing factor of ADL functional ability score at discharge. However, a single year increase in age combined with a single point increase in stroke severity score results in the total Barthel Index score to decrease by 0.6 points.

Table 4.11: Univariate linear regression between the dependent variable (MRMI) and independent variables (age, treatment duration, onset to treatment, length of stay, stroke severity, stroke type and gender)

Variables			95% Confidence Interval	
	Beta	P-value	Upper	Lower
Age	-0.34	0.00*	-0.06	-0.40
Treatment Duration	-0.28	0.02*	-0.01	-0.30
Onset to Treatment	0.02	0.88	0.70	-0.61
Length of Stay	-0.22	0.08	0.02	-0.33
Stroke Severity	-0.50	0.00*	-0.53	-1.38
Stroke Type	-0.13	0.29	3.01	-9.81
Gender	-0.26	0.04*	-0.20	-8.81

**significant independent predictors of MRMI at discharge*

Variables found to be independent predictors of mobility functional outcome at discharge are: age, treatment duration, stroke severity and gender). These variables were placed in a multivariate stepwise regression model to determine predictors of functional outcome at discharge for mobility. This is represented in Table 4.12.

Table 4.12: Multivariate stepwise regression between dependent variable (MRMI) and independent variables, determining predictive factors at discharge from the acute inpatient hospital setting following first time stroke

Model (MRMI)			**t**	**Sig.**	**95%CI**	
		Beta			**Lower Bound**	**Upper Bound**
1	(Constant)		19.86	0.00	37.10	45.42
	NIHSS	-0.50	-4.49	0.00	-1.38	-0.53
2	(Constant)		14.10	0.00	48.55	64.61
	NIHSS	-0.57	-5.73	0.00	-1.46	-0.70
	Age	-0.43	-4.28	0.00	-0.43	-0.15

Stroke severity as represented by NIHSS was the only factor which independently influenced functional outcome represented by items assessed for mobility at discharge from an acute inpatient hospital setting. As the NIHSS score increases by one-point, the total mobility score decreases by 0.5 points.

Independently, age is not a significant influencing factor of mobility at discharge. However, a single year increase in age, when combined with a single point increase in stroke severity score, decreases the mobility score by 0.57 points.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter will discuss the findings of this study with regards to demographics, functional outcome of patients following first-time stroke and the factors influencing patient function at discharge from the acute inpatient hospital setting following first-time stroke. This chapter will be presented as follows:

5.2 Sample demographics
5.3 Functional outcome at discharge
5.4 Factors that influence functional outcome
5.5 Limitations

5.2 Sample Demographics

A total of 60 participants were recruited to be part of this study. They were admitted to various wards and ICUs at Steve Biko Academic Hospital, a tertiary hospital in Tshwane, Gauteng. A stroke unit, which is the gold standard of organised post-stroke care worldwide (Bryer et al., 2010), does not exist in the current hospital setting. Most patients under the age of 60 were treated in a ward that only manages neurological conditions. Others, especially older patients, were managed in other wards and ICU settings. Rehabilitation by a physiotherapist, occupational therapist or both was provided during their hospital stay.

Age

The mean age of this sample (47.5 ± 12.14 years), was younger than in a sample examining functional outcomes at discharge in a tertiary setting in the Western Cape, South Africa, 59.83 ± 15.71 (Parekh and Rhoda, 2013). Although more than a decade in difference in mean age, both study sample age means are in line with the trend that first-time patients with stroke are younger than before, particularly in low and middle income regions, as found in Africa (O'Donnell et al., 2010). Patients with uncontrolled hypertension, a risk factor for stroke, have increased in the younger population in Africa over time (Mensah, 2008; Lemogoum, Degaute and Bovet, 2005). HIV also contributes significantly to the high incidence of stroke in the younger population in South Africa (Connor et al., 2005). HIV results in small vessel vasculopathy, which could increase the risk of stroke (Connor et al., 2000). The prevalence of medical risk factors, such as hypertension and HIV, were not determined in this study sample.

Gender

Majority of the study participants were male (58%). This is inconsistent with other South African studies such as those by Mamabolo et al. (2009), where gender distribution was

higher in females (60%) and Connor et al. (2000), who conducted a study in the South African Agincourt district which found a lower stroke prevalence in males than females. In a study conducted in the United States of America, within the 45-84 years age group, men had a higher stroke incidence than women (Petrea et al., 2009). Women in the older age group (85-94 years), however, had a higher stroke incidence (Petrea et al., 2009). The findings by (Petrea et al., 2009) are consistent with the current study gender distribution, particularly as the mean age of first time strokes in this study falls within the 45-84 years age group.

Stroke type

The sample consisted of patients with stroke type distributed unevenly between ischaemic strokes (87%) and haemorrhagic strokes (13%). The Global Burden of Disease data found that during the period of 1990 and 2010, South Africa's ischaemic stroke incidence increased (Owolabi et al., 2015). In Africa, the incidence of both stroke types increased between 1990 and 2010. However, the incidence of haemorrhagic stroke was greater than ischaemic (28.7% and 14.8% respectively) (Owolabi et al., 2015). Parekh and Rhoda (2013) found the distribution between ischaemic and haemorrhagic strokes was 89% and 10% respectively. The consistency of the mentioned study with the latter study could possibly be due to the mentioned study and current study both taking place in acute tertiary hospitals in urban settings in South Africa to which admission is on referral basis.

In a study that compared prognosis and stroke type, patients with ICH had more severe strokes with poorer outcome (Jørgensen et al., 1995). Mortality rates for haemorrhagic strokes have been reported to be higher in sub-Saharan Africa compared to North America and Europe when adjusted for age (Krishnamurthi et al., 2013). This suggests that patients with severe haemorrhagic strokes may not reach the appropriate institution in time for adequate management, thus poorer outcome or mortality. This could explain the low number (eight) of patients with haemorrhagic compared to ischaemic stroke (52) in this study.

Stroke Severity

The mean stroke severity in this study was a NIHSS of 8.68 ± 4.48. This falls into the 'moderately severe' category (Brott et al., 1989). In the current study, admission stroke severity was not categorised into mild, moderate and severe cases. According to Schlegal et al. (2003), a NIHSS score between six and thirteen indicates that inpatient rehabilitation will be required. This infers that study participants had the potential for good functional outcome based on initial severity alone.

Allied Health Disciplines in acute stroke management

Physiotherapists were involved in the rehabilitation of almost all of the patients (98%) compared to occupational therapists who were involved in the management of 68% of the sample. Parekh and Rhoda (2013) reported that acute care rehabilitation by physiotherapists and occupational therapists was almost equal (75% and 79% respectively). The difference in the distribution between disciplines administering therapy in this study compared to Parekh and Rhoda (2013) could be explained the presenting stroke severity of these patients. For those with mild or severe stroke, OT may have been omitted. In severe cases, this may have been due to the lack of active participation in retraining ADLs. Additionally, in those with mild stroke, ADLs may have been independent, resulting in no need for active OT intervention. The therapist's may have prescribed ward and home programs instead. Physiotherapy, which is still required to prevent secondary complications such as deep vein thrombosis and pneumonia (Bamford et al.,1990) even if the patient is not participating actively in the session, may have continued in these severe cases.

Patients who were seen to have a poor prognosis were attended to less frequently by therapists in a study, which sought to provide insight into rehabilitation provision by physiotherapists and occupational therapists in Germany (Reuter et al., 2016). It was inferred that therapists' discretion determined whether a patient needed therapeutic intervention, particularly in mild cases and those of which poor outcome was predicted (Reuter et al., 2016). This may have occurred in the current study and therapists' could have decreased total 'active therapy' days in inpatient care for those with poor outcome with the fear of therapy doing more harm than good. Thus, when rehabilitation duration was calculated and included days where no therapy was administered in the current study, an inaccurate calculation of therapy duration could have been made, particularly for those with severe strokes, influencing the overall rehabilitation duration calculation.

Onset to Treatment

The mean stroke onset to initiation of rehabilitation in days by either the physiotherapist or occupational therapist was 4.6 ± 3.37 days. Functional outcome is said to be better when rehabilitation is initiated early and performed with high intensity (Bernhardt et al., 2015) taking medical stability into careful consideration. Thus, inferring that a delay in initiation of rehabilitation resulting from instruction by the medical doctor can be due to medical instability, not only delays caused by institutions or delay in arrival at hospital. In the United States of America, different settings prioritise different aspects of stroke management and in the acute hospital setting, achieving medical stability, ensuring correct medical management is achieved, is of primary importance (Winstein et al., 2016). In the current study setting there is no protocol in place stipulating the specific role of the institution in stroke management. As

it is an acute tertiary hospital setting, a diagnosis should be made and cause should be identified.

Post-stroke complications resulting from immobility can be detrimental. Complications include pneumonia, deep vein thrombosis (Bamford et al.,1990) and pulmonary embolism (Bryer et al., 2010). Early mobilisation is primarily used to prevent and reduce the development these immobility-related complications (Bamford et al., 1990) and is recommended in the South African guideline for management of acute stroke (Bryer et al., 2010).

Consistency in the definition of early mobilisation remains unclear; whether this includes out of bed mobilisation or passive movements and positioning and whether early is defined as within 24 hours of stroke onset or within a few days (Bernhardt et al., 2015). The specific timeframe for initiation of mobilisation, which results in the best overall functional outcome post stroke, remains unclear (Bernhardt et al., 2015). It is therefore agreeable that early rehabilitation can fall within the first week post stroke onset (Musicco et al., 2003). This was achieved in the current study.

In a similar setting in Melbourne, Australia, stroke onset to treatment was 5.6 days post stroke (Bernhardt et al., 2007). Despite the mean age being higher (71.3), and not all patients having had their first stroke in the study (which could have increased the time between onset and initiation of treatment), onset to treatment can be seen as similar between middle-income countries and high-income countries in inpatient hospital settings following acute stroke Bernhardt et al. (2007).

Length of hospital stay

Length of hospital stay in this study was longer, 20.6 ± 12.19 days, compared to other public, tertiary institutions in South Africa: six days (Mudzi, Stewart and Musenge, 2012), 12 days (Mamabolo et al., 2009), 10.4 days (Parekh and Rhoda, 2013) and eight days in a secondary institution with a stroke unit (De Villiers et al., 2011). The average length of stay between the four-abovementioned South African studies is nine days, which is less than half the length of stay of the current study. The reasons for prolonged length of stay, however, were not documented and could vary from the development of secondary infections to delays in undergoing radiological investigations or surgical procedures or awaiting transfer to a rehabilitation centre. In a study by Rhoda, Mpofu and De Weerdt, (2011), which aimed to establish the activity limitations of patients with stroke who were undergoing outpatient rehabilitation following stroke in the Western Cape, South Africa, the median number of days post stroke at recruitment to their study was 21. This demonstrates that they the patients with

stroke had already been discharged home from an acute care hospital by day 21 following stroke. Patients with stroke across in the current study and in one study performed in the Western Cape were discharged within the first three weeks following stroke. Length of stay differs between institutions but the trend remains to discharge patients early. Length of stay in acute care facilities prior to admission at a specialised rehabilitation facility in Canada was 33 days (Foley et al., 2012), which is longer and contrasts to the South African studies mentioned above. The current study facility, with a longer LOS, is more aligned to practices in high-income countries compared to other public facilities in South Africa.

Following a short inpatient hospital stay following stroke, patients in South Africa are discharged home with outpatient therapy follow up appointments. There are two public inpatient rehabilitation centers in Tshwane (Gauteng Department of Health, 2018) which service more than one province. Resulting from a limited number of beds in rehabilitation centres, patients with stroke receive continued outpatient rehabilitation at Community Health Centre's (Hale and Wallner, 1996). Early discharge from acute care hospitals implies that patient with stroke are often still in the acute and sub-acute phases and may require intensive therapy. Patients with stroke treated in Community health centres in South Africa have been reported to receive less than six sessions of physiotherapy over a six-month period with total rehabilitation duration over these sessions lasting under two hours (Rhoda, Mpofu and De Weerdt, 2009). Community health centres are thus inadequately equipped for these patients (Hale and Wallner, 1996) as more intensive therapy is required to yield better functional outcome in the acute and sub-acute phases post stroke (Stroke Unit Trialists' Collaboration, 1997).

In the current study, most patients were young and could have possibly stayed in hospital for longer compared to other tertiary settings due to a greater potential of functional recovery (Wilson, Houle and Keith, 1991), thus had a better chance of being functionally independent at discharge (Mamabolo et al., 2009)

Discharge Destination

Majority of this study sample (68%) were discharged home, 20% were transferred to rehabilitation centres and the remaining (12%) percent were transferred as inpatients to other hospitals. These findings are inconsistent with the study by Parekh and Rhoda (2013) where majority of patient's (53.1%) were referred for in-patient rehabilitation and the remaining percentage as outpatients (46.8%). This could be as a result of lower stroke severity and longer length of stay in the current study setting thus more opportunity for patients to receive rehabilitation by therapists compared to a shorter length of stay and more severe initial presentation of stroke described by Parekh and Rhoda (2013).

The study by Parekh and Rhoda (2013) was conducted in the Western Cape where its provincial rehabilitation centre, Western Cape Rehabilitation Centre, has a bed capacity of 240 for a total population of 5 822 634 (Statistics SA, 2011) compared to 137 beds in total, distributed between five rehabilitation centres in Gauteng province, which has a total population of 12 272 263 (Statistics SA, 2011). Tshwane Rehabilitation Centre, one of two government rehabilitation centers in Tshwane, Gauteng (Gauteng Department of Health, 2018) has a 57 bed capacity (Tshwane Rehabilitation Centre, 2018) for a city that has a population of 2 921 488 (Statistics SA, 2011). The higher percentage of patients being transferred to Western Cape Rehabilitation Centre compared to Tshwane Rehabilitation Centre could be due to more bed availability in the former facility, thus contributing to a shorter length of stay in the acute care hospital. A lower number of bed availability in Tshwane rehabilitation centre could result in an extended period between application and transfer to the facility. Thus, patients may remain in the acute hospital setting to achieve mobility. The number of beds highlighted above indicates a reduced structural capacity for patients to receive intensive rehabilitation post stroke in Tshwane and a further indication that patients are more likely to be discharged home with suboptimal function from the acute setting.

Criteria for non-admission to Tshwane Rehabilitation Centre are: if patients are mobile thus can be discharged home with appropriate mobility aids and with an out-patient follow-up appointment if applicable or have minimal chance of good functional recovery resulting in being discharged to care facilities or home with family training. In some cases when the time between application for admission to a rehabilitation centre and admission becomes too long, and the study setting is pressurised to avail beds for new admissions, patients with stroke are requested to wait at home for their admission to the rehabilitation centre. If circumstances do not allow for discharge home prior to admission to a rehabilitation centre, special considerations are made for the patient to remain in the acute setting until a bed at the rehabilitation centre becomes available. Although specific data were not collected for the time-delay in days between application and transfer to a rehabilitation centre, limited bed availability it is expected to increase length of stay in the study setting which may have resulted in an increased length of stay for these participants or resulted in the high percentage of patients being discharged home.

Functional outcome analysis of this study shows that limitations in ADLs and mobility remained despite majority of these patients being discharged home. Thus, a caregiver or community member would need to assist with important ADLs such as feeding, grooming, bathing and toileting, increasing caregiver burden and further highlighting the need for intensive rehabilitation services

Rehabilitation Duration

Daily rehabilitation amounted to 25.65 minutes or 0.43 hours (combination of physiotherapy and occupational therapy) per weekday only, as non-critical physiotherapy services and occupational therapy services are not available on weekends in the study setting. The mean total rehabilitation over the duration of patient hospital stay was 5.9 Hours. There is the potential that these numbers are inaccurate as statistics were handwritten by therapists and students and could have been documented incorrectly or misplaced, however it is the only data available and thus is still of value to analyse. There is no prescription of therapy duration in this setting for patients with stroke.

In a stroke unit housed within a district hospital in the Western Cape, rehabilitation duration amounted to less than two hours per week (24 minutes per day) (De Villiers et al., 2011). Bernhardt et al. (2007), who performed an observational behavioural mapping study in five stroke units within teaching hospitals in Melbourne, Australia, found that within the first 14 days post stroke, patients were treated, in total, by physiotherapists and occupational therapists for up to 24 minutes per day. Both studies are thus comparable to the current study, despite it not having a stroke unit.

Therapy duration in this study setting could be limited due to high patient numbers and low therapist to patient ratio; one physiotherapist and one occupational therapist are allocated per ward (average of 24 beds per ward) where patients are seen on referral basis. Therapists may be allocated to more than one ward and ICU. It is common for therapist to patient ratio to be 1:10 – 1:12 for physiotherapists and 1:11 – 1:14 for occupational therapists (Bernhardt et al., 2008).

Few studies exist investigating rehabilitation duration in the acute inpatient hospital setting for comparison, particularly with the advent on stroke units where coordinated, interdisciplinary teams are available for intensive rehabilitation of at least one hour per day, per discipline. Jette et al. (2005) report that increased daily rehabilitation duration in acute stages has the potential for improved functional independence. This independence is achieved in a shorter period of time and results in a reduced hospital stay (Jette et al., 2005). In a study comparing the functional outcome between patients who received conventional once daily rehabilitation lasting 45 minutes to intensive rehabilitation performed twice daily (total of two hours) 14 and 180 days post stroke, no difference was found between the groups (Di Lauro et al., 2003). The study excluded those with cerebral haemorrhage and mild paresis thus reducing the ability to compare outcomes with the current study. This finding suggests that patients with stroke in the acute phase should receive maximum therapy, according to the patients' needs. In a Japanese study, higher frequency of therapy with therapy duration reaching more than two hours per day, was found to show significant

improvement in BI scores in ischaemic strokes but not in ICH in the acute stage (Nakazora et al., 2017).

Thus, 'rehabilitation duration' in strokes of mild severity, where therapy ceased prior to discharge from hospital, could have influenced total rehabilitation duration scores in this study. For patients who were initially not suitable for therapeutic treatment due to medical instability, or not treated due to absence from the ward, the rehabilitation duration could be different when those days of non-treatment are included, reducing in the final rehabilitation duration calculation. Total treatment duration for each patient was collected from each therapists' daily statistics thus this data for number of days on which no treatment was given was not collected.

5.3 Functional outcome at discharge

Functional outcome assessments were performed at discharge from acute hospital where length of stay averaged less than three weeks and stroke severity of the sample was moderate. Sixty-seven percent of the study sample required additional rehabilitation and 33% were independent in ADLs and mobility. This is to be expected as length of stay was relatively short and patients with stroke have up to one year to improve in functional outcome (Duncan and Min Lai, 1997). With that in mind, the first 30 days are the most critical for marked functional recovery to be achieved (Duncan and Min Lai, 1997)) due to enhanced neuroplasticity in this early phase post stroke (Murphy et al., 2013).

Functional outcome was determined upon discharge by the BI and MRMI. The mean BI score was 75/100. A BI score of less than 60% suggests poor outcome in basic vital ADLs (Sulter, Steen and de Keyser, 1999). The mean BI of this sample was higher than this, thus most could be discharged home. The mean total score fell below 85% highlighting that, despite independence in vital self-care tasks achieved and likelihood of being discharged home, the study sample still required assistance with ADLs. Mamabolo et al. (2009) report that at discharge, 47% of the sample assessed in their study was functionally independent. This is lower than the current study but other factors such as longer length of stay and the possibily more rehabilitation received could have influenced the current study's outcome. Initial stroke severity was not recorded in the study by Mamabolo et al. (2009), which could have influenced the outcome.

The mean MRMI score was 32/40. Tsang et al. (2014) found that an admission score of more than 17 on the MRMI was found to have a favourable outcome of indoor and outdoor walking upon discharge and more likely to be discharged home. Mobility was not assessed upon admission but this score can be used in an acute setting to plan for the best setting for

continued rehabilitation. With a discharge score of 32/40, it is likely that these patients with stroke have a high chance of independent mobility in the course of recovery.

Following analysis of individual item scores within outcome measure assessments, by determining the interquartile ranges of each item; feeding, bathing, grooming, dressing, toilet use and stair climbing were the ADLs which were significantly affected (< 50% achieved by the sample) at discharge, assessed by the BI. Despite the total functional outcome scores for each outcome having high total scores (≥ 75% achieved in each), the findings in this study are consistent with that of Rhoda, Mpofu and De Weerdt (2011) who found that patients required assistance with all basic activities of daily living, except for bladder and bowel control, transfers and mobility in the acute and sub-acute phases (less than six weeks post stroke).

It is reported in literature that between 33% and 66% of patients with upper limb weakness do not recover function within the first six months, with only 20% achieving functional independence in this same time frame (Sunderland et al., 1994). Kwakkel, Kollen and Lindeman, (2004) report that 11.6% of their study sample achieved complete independence in upper limb function and 38% had signs of dexterity at six months. Thus, a significant improvement upper limb function, in terms of ADLs is not expected at discharge from the acute setting and this study's results are consistent with global literature.

The BI assesses three mobility items namely transfers to chair and back, walking on level surfaces and stair climbing. Scoring is subdivided into performance with major or minor help, inability or independence. The MRMI assesses eight mobility items namely the ability to turn over in bed, transition from lying to sitting, sitting balance, sitting to standing, standing, transfers, walking indoors and stair climbing. Scoring is subdivided into requiring assistance of two, assistance of one, supervision or verbal cueing, requiring an aid or appliance, inability or independence. When isolating walking ability in each outcome measure, walking indoors as assessed by the MRMI was severely affected (50% achieved by sample) compared to most patients (67%) being able to mobilise on a level surface upon discharge assessed by the BI. This may result from the BI ability scores being subdivided into four compared to six in the MRMI ability score, thus less room for variability and may be more sensitive to actual performance of each functional item in the latter scale as noted by the difference in mobility outcome percentages. Independence in mobility is an important goal in rehabilitation and thus prioritised (Kwakkel and Kollen, 2013). As walking independence can be achieved by three months post stroke (Sabine et al., 2002), it is thus not expected that patients will achieve complete independence in walking in this phase but improvement in walking ability can be made.

5.4 Factors that influence functional outcome at discharge

Relationship tests between total scores of each outcome measure against independent variables were performed. A weak but significant, negative relationship was found between age and ADL outcomes; moderate, significant and negative relationship was found with treatment duration and ADLs outcomes and stroke severity and ADLs outcome was found to have a moderate, significant, negative correlation. It can be expected that as age increases, ADLs function decreases, showing consistency with previous studies (Parekh and Rhoda, 2013). It is also an expected finding that as stroke severity increases, ADLs function decreases showing consistency with previous studies (Parekh and Rhoda, 2013). However, what is inconsistent with literature is that the longer patients were treated per day, the poorer the functional outcome in ADLs. This outcome did not match the time spent, which could be as a result of the stroke severity indicating that patients with more severe stroke may have had longer hospital length of stay, thus resulting in minimal observed change in function, despite spending longer duration with them.

In the relationship test between mobility scores and independent variables, age and treatment duration were found to have been weak, significant and negative relationship with mobility outcomes. Stroke severity, similarly to that of ADLs, was found to have a moderate, significant and negative relationship with mobility outcomes. The negative direction relationship between treatment duration and mobility could be attributed to the severe nature of a few of the participants in this study who required specialised, intensive rehabilitation early on to improve functional outcome.

Univariate analysis for each outcome measure with independent variables was performed. Independent predictors for ADLs outcome were age, treatment duration, length of stay and stroke severity. Independent predictors for mobility were age, treatment duration, stroke severity and gender.

The influence of age on stroke outcome was examined by assessing neurological recovery and ADLs gains in the community setting by Nakayama et al. (1994). An independent negative relationship was found between age and ADL outcome where neurological recovery was not influenced by age (Nakayama et al., 1994). This finding supports the outcome of univariate analysis for both ADLs and mobility in this study. Age has an independent influence on stroke outcome in this sample; with each year increase in age, ADLs function decreases.

Increased treatment duration, specifically by occupational therapists, has been found to be associated with greater ADLs independence post stroke when assessed at discharge from a

Canadian rehabilitation setting and six months post-stroke. This was found using the functional independence measure and BI outcome measures (Foley et al., 2012). The BI was used in this study. It should be noted that ADLs gains were higher in the study by Foley et al. (2012), as function was assessed at an inpatient rehabilitation setting, suggesting that more time had lapsed; more spontaneous recovery could have occurred and more rehabilitation could have been provided. Maximal functional gains in the acute stage are therefore not expected as the main aim in this period is to stabilize the patient. The current study participants, thus, still have an opportunity to improve in their ADLs performance over time. Influence of individual disciplines on functional outcome was not established in this study. Despite treatment duration not determined to influence broad functional outcome at discharge in this study following step-wise regression, a significant relationship was found between treatment duration and functional outcome in both ADLs and mobility in linear regression. This finding is consistent with the findings by Kwakkel, Kollen and Lindeman (2004) who established dose-response relationships through randomised controlled trials.

Length of stay variability in studies can be a reflection of various factors such as pressure for bed availability, thus shorter LOS or intensive rehabilitation (Jette et al., 2005) provided over a short period for those with strokes of milder severity. These factors, which increase length of hospital stay, provide an opportunity for patients to achieve functional independence prior to discharge (Wilson, Houle and Keith, 1991). The study sample had a lower than most commonly seen in literature mean age (Cawood and Visagie, 2016; Owolabi et al., 2015). This may have been used to justify an increased length of stay in this study sample as younger persons with stroke have the potential for better functional outcome (Mamabolo et al., 2009). An independent relationship between LOS and functional outcome was found in this study.

Women have been found to have reduced functional outcome, particularly in the acute phase following stroke and struggle with ADLs such as dressing, grooming and in the mobility domain, struggle with transfers (Petrea et al., 2009). This study found that gender has an independent impact in reducing mobility and not reducing performance of ADLs as found by (Petrea et al., 2009). The influence of specific gender was not identified in this study.

Following stepwise regression, for both BI and MRMI, stroke severity was the only factor to influence functional outcome at discharge. This is consistent with Kwakkel and Kollen (2013) who found that that severity assessed within the early stage post stroke predicted final ADLs outcome at three months post stroke. Paolucci et al. (1998) found stroke severity to be an influencing factor on outcome in a rehabilitation setting. It can be deduced that stroke

severity is the main influencing factor of functional outcome in the acute and rehabilitation stages post stroke.

Functional recovery, as measured by the BI, was achieved within different time frames depending on the severity of stroke as reported by Jørgensen et al. (1995). Functional recovery of those with mild strokes, the most frequent stroke severity observed, was achieved by 95% of the population within two months post stroke onset and within three months for those with moderate stroke severity. Those who had severe initial stroke severity achieved functional recovery within five months (Jørgensen et al., 1995). It is within this same time frame, zero to five / six months, that patients have the advantage of spontaneous neurological recovery facilitating functional return (Jørgensen et al., 1995).

Stepwise regression also showed that with a combined increase in age and stroke severity, both factors act together in decreasing ADLs and mobility scores at discharge. This should be taken into consideration when addressing prognosis, discharge destination planning and family education post stroke.

Studies aiming to establish functional outcome at discharge and the influencing factors thereof have shown that stroke severity (De Villiers et al., 2011) age (Abdul-sattar and Godab, 2013) and initial disability (Parekh and Rhoda, 2013) are strong predictors of functional outcome. However, in the current study stroke severity was the only independent influencing factor at discharge. This could be due to the sample being much younger, with moderate stroke severity and length of stay much longer, thus greater opportunity to achieve more independence in ADLs and mobility by discharge. These functional gains are beneficial for long-term outcome, especially when rehabilitation is continued following discharge (Bryer et al., 2010). Initial functional disability was not established upon admission.

Despite achieving fair total functional score, study participants still required assistance in performing ADLs and mobility at discharge from this acute inpatient hospital setting. As length of stay was relatively short but longer than most tertiary settings, most patients were discharged home with follow up appointments at various out patient facilities. Rehabilitation duration, length of stay, stroke type, onset to treatment and age were not found to influence functional outcome in both ADLs and mobility following stepwise regression. It should be noted that independently, some of these factors had an influence on outcomes at discharge.

5.5 Limitations

This study was conducted in a tertiary hospital setting which admits patients on referral basis for specialised stroke work up, which can take some time to complete. This implies a longer length of stay with more rehabilitation and a higher chance of independence at discharge. Functional outcomes at this institution are inconsistent with other acute settings as the main aim in the acute care setting is medical stabilisation and not functional recovery. The sample was heterogeneous, meaning that patients did not have the same distribution of weakness in their limbs, which could have influenced the functional outcome in ADLs for those affected more in their upper limb and in mobility for those with greater impairment found in their lower limb. Rehabilitation duration may have been incorrectly captured and underrepresented as total rehabilitation was divided by length of hospital stay consisting of weekdays and excluding public holidays and may have included days on which patients were not yet referred or no treatment was given. Using valid and reliable outcome measures eliminated bias.

5.6 Funding

This study was not funded.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

In this study investigating the functional outcome at discharge from an acute in-patient hospital setting following first-time stroke, basic ADLs and mobility were achieved at discharge by patients with stroke. Difficulty in tasks requiring the use of the affected upper limb was most prevalent at discharge. In the mobility domain, walking and stair climbing were most affected. Initial stroke severity was the only influencing factor of functional outcome of both ADLs and mobility at discharge in this study. Participants achieved fair functional gains during acute hospitilisation in this study which was achieved within the first 30 days following stroke. This suggests good functional outcome within the first year of recovery, particularly with continued rehabilitation prescribed.

The overall functional outcome can be seen as positive as most patients were able to perform tasks with minimal assistance and were discharged home. This leads to greater opportunities of independence in the long term. It is important to consider factors that have an independent association with functional outcome at discharge, particularly for those who had stroke of moderate severity. This information can be used for protocol development to further reduce onset to treatment time, strengthen co-ordination and provision of rehabilitation and commence early discharge planning, particularly for those with severe strokes. In an environment with reduced capacity to admit patients for long-term rehabilitation, early initiation of treatment and a prolonged length of stay with longer duration of therapy for each allied disciplines should be considered and could be achieved in a stroke unit.

Despite literature recommending up to one hour of therapy per discipline per weekday (total of ten hours), the total combined treatment duration per week in this study was much lower (two and a half hours). Patients with stroke could benefit from more rehabilitation in the early phase post stroke.

The feasibility of developing a stroke unit in this setting should be investigated in further studies to relieve pressure on the acute care hospital to avail beds for new admissions. Protocols should be developed to improve the structure of rehabilitation services in this setting for maximum therapeutic intervention prior to discharge with efficient and effective discharge planning in light of current reduced availability for intensive rehabilitation services in the city.

Stroke is a disabling condition which is occurring in the younger adult population more frequently. It would be of particular interest to investigate the functional outcome of patients with stroke who are HIV positive, particularly in the South African context. Reduced

independence in ADLs and mobility impacts the patient in their personal capacity and various societal roles, including their ability to work. Improvement of functional outcome in the early phase post stroke allows one to predict the patient's overall functional outcome at plateau from recovery. A collaborative effort between the medical and rehabilitation team is needed to improve the overall functional outcome of patients with stroke. Thus, in the acute setting, to enhance the impact of spontaneous neurological recovery, safe maximum therapeutic intervention tailored to the patient's needs is required for maximum functional gains. Therapeutic intervention should be prioritised and continued post discharge from the acute in-patient hospital setting following first time stroke for long-term functional independence.

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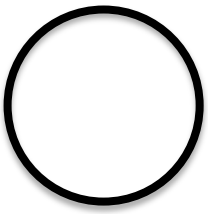
8. APPENDICES

Appendix 1: Screening tool



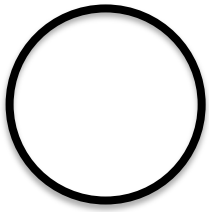
Date: ___/____/_____

Researcher: Thameenah Solomon
Study: Functional outcome at discharge from an acute inpatient hospital setting following first-time stroke

Patient Name:_____

Qualify: Y N

Indicator	**Y / N**
Over 18 (age)	**( )**
First time stroke	
Dependent in ADLs / mobility prior to stroke	



Appendix 2: Barthel Index (BI)

Date:

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 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 = wheelchiar 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	**/100**

Appendix 3: National institute of Health Stroke Scale (NIHSS)

STROKECARE NOW network

NIH Stroke Scale		
Instructions	**Scale Definition**	**Score**
1a. Level of consciousness: The investigator must choose a response, even if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A "3" is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.	0 = Alert; keenly responsive 1 = Not alert, but arousable by minor stimulation to obey, answer, or respond 2 = Not alert, requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped) 3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, areflexic	_____
1b. LOC Questions: The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score "2." Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthia from any cause, language barrier or any other problem not secondary to aphasia are given a "1." **It is important that only the initial answer be graded and that the examiner not "help" the patient with verbal or non-verbal cues.**	0 = Answers both questions correctly 1 = Answers one question correctly 2 = Answers neither question correctly	_____
1c. LOC Commands: The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. Substitute another one-step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness**. If the patient does not respond to commands, the task should be demonstrated to them (pantomime)** and score the result (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly	_____
2. Best Gaze: Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored but calorie testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be "1." If a patient has an isolated peripheral nerve paresis (CN, III, IV or VI) score a "1." Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness or other disorder of visual acuity or fields should be tested with reflexive movements and a choice made by the investigator. Establishing eyes contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.	0 = Normal 1 = Partial gaze palsy. This score is given when gaze is abnormal in one or both eyes, but where forced deviation or total gaze paresis are not present 2 = Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver	_____
3. **Visual:** Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat as appropriate. Patient must be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrant anopia is found. If patient is blind from any cause, score "3." Double simultaneous stimulation is performed at this point**. If there is extinction, patient receives a "1" and the results are used to answer question #11.**	0 = No visual loss 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia (blind, including cortical blindness)	_____

(Continued)

NIH Stroke Scale - Continued

4. Facial Palsy: Ask, or use pantomime to encourage the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barrier obscures the face, these should be removed to the extent possible.	0 = Normal symmetrical movement 1 = Minor paralysis (flattened nasolabial fold, asymmetry on smiling) 2 = Partial paralysis (total or near total paralysis of lower face) 3 = Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)	_____
5 & 6. Motor Arm and Leg: The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) and the leg 30 degrees (always tested supine). Drift is scored if the arm falls before 10 seconds or the leg before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder or hip may the score be "9" and the examiner must clearly write the explanation for scoring as a "9".	0 = No drift, limb holds 90 (or 45) degrees for full 10 seconds 1 = Drift, Limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support 2 = Some effort against gravity, limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity 3 = No effort against gravity, limb falls 4 = No movement 9 = Amputation, joint fusion explain:_____ 5a. Left Arm…… 5b. Right Arm……	 _____ _____
	0 = No drift, leg holds 30 degrees position for full 5 seconds. 1 = Drift, leg falls by the end of the 5 second period but does not hit bed. 2 = Some effort against gravity; leg falls to bed by 5 seconds, but has some effort against gravity. 3 = No effort against gravity, leg falls to bed immediately. 4 = No movement 9 = Amputation, joint fusion explain:_____ 6a. Left Leg…… 6b. Right Leg……..	 _____ _____
7. Limb Ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, insure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion may the item be scored "9", and the examiner must clearly write the explanation for not scoring. In case of blindness test by touching nose from extended arm position.	0 = Absent 1 = Present in one limb 2 = Present in two limbs	_____
8. Sensory: Sensation or grimace to pin prick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas [arms (not hands), legs, trunk, face] as needed to accurately check for hemisensory loss. A score of 2, "severe or total," should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will therefore probably score 1 or 0. The patient with brain stem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic score 2. Patients in coma (item 1a=3) are arbitrarily given a 2 on this item.	0 = Normal; no sensory loss 1 = Mild to moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected s side; or there is a loss of superficial pain with pinprick but patient is aware he/she is being touched 2 = Severe to total sensory loss; patient is not aware of being touched in the face, arm and leg	_____

NIH Stroke Scale - Continued

9. Best Language: A great deal of information about comprehension will be obtained during the preceding sections of the examination. The patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet, and to read from the attached list of sentences. Comprehension is judged from responses here as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in coma (question 1a=3) will arbitrarily score 3 on this item. The examiner must choose a score in the patient with stupor or limited cooperation but a score of 3 should be used only if the patient is mute and follows no one step commands.	0 = No aphasia, normal 1 = Mild to moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided material difficult or impossible. For example in conversation about provided materials examiner can identify picture or naming card from patient's response. 2 = Severe aphasia; all communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response. 3 = Mute, global aphasia; no usable speech or auditory comprehension	_____
10. Dysarthria: If patient is thought to be normal an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barrier to producing speech, may the item be scored "9", and the examiner must clearly write an explanation for not scoring. Do not tell the patient why he/she is being tested**.**	0 = Normal 1 = Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty 2 = Severe; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric 9 = Intubated or other physical barrier, explain	_____
11. Extinction and Inattention (formerly Neglect): Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglector anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.	0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneousstimulation in one of the sensory modalities 2 = Profound hemi-inattention or hemi-inattention to more than one modality. Does not recognize own hand or orients to only one side of space.	_____
	Total NIHSS Score:	

Time of NIHSS Assessment:_____

Date of NIHSS Assessment:_____

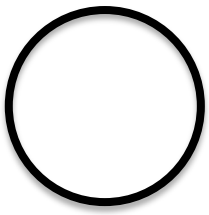
Physician/NIHSS Certified Individual Signature:_____

Appendix 4: Modified Rivermead Mobility Index (MRMI)

Date:	**Score**
Turning over Please turn from your unaffected side on to your back	_____
Lying to Sitting Please sit up on the edge of the bed from your unaffected side	_____
Sitting balance Please sit on the edge of the bed for 10 seconds	_____
Sitting to Standing Please stand up from your chair (*should take less than 15 seconds*)	_____
Standing Please remain standing for 10 seconds	_____
Transfers Please go from bed to the chair and back again towards your unaffected side	_____
Walking Indoors Walk 10metres in your usual way	_____
Stairs Please climb up one flight of stairs in your usual way	_____
Total Score	**/40**

MRMI - Scoring System: **0** - Unable; **1**- Assistance of 2; **2** - Assistance of 1;
3 - Supervision or verbal cueing; **4** - Requires an aid or appliance; **5** – Independent

Appendix 5: Demographic Questionnaire



Date: _____ /_____/_____

Ward: _____

Date of Admission		Date of Birth	/ /
Age		Gender	
Date of Admission		NIHSS	
Physiotherapist			
Occupational Therapist			
Date of Onset of symptoms	/ /	Date of initiation of Rehabilitation	/ /
Diagnosis (Ischaemic / haemorrhagic)			
Next of kin			
Relationship to Patient			
Contact details	h)	w)	
	c)		
Address			

Appendix 6: Ethical Approval

R14/49 Ms Thameenah Solomon

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160531

NAME: (Principal Investigator)	Ms Thameenah Solomon
DEPARTMENT:	Physiotherapy Steve Biko Academic Hospital
PROJECT TITLE:	Functional Outcome at Discharge from an Acute Inpatient Hospital Setting Following First-Time Stroke
DATE CONSIDERED:	27/05/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr MV Ntsiea and Mrs N Comley-White
APPROVED BY:	Professor P. Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	25/07/2016

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

DECLARATION OF INVESTIGATORS

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

Principal ~~Investigator~~ Signature

Date 27/07/2016

UNIVERSITY OF THE WITWATERSRAND
OFFICE OF THE DEPUTY VICE CHANCELLOR RESEARCH
02 AUG 2016
RESEARCH OFFICE
HREC (Medical)
RECEIVED
JOHANNESBURG

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 7: Permission from Steve Biko Academic Hospital CEO

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

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

Dr E. Kenoshi

From: The Investigator

Miss T. Solomon

Re: Permission to do the following research at Steve Biko Academic Hospital

I, Thameenah Solomon, am a researcher working at the Department o Physiotherapy at Steve Biko Academic Hospital. I am requesting permission on to conduct a study on the Steve Biko Academic Hospital grounds that involves access to patient records.

The title of the study is: Functional outcome at discharge from an acute inpatient hospital setting following first-time stroke

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

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

I undertake not to proceed with the study until I have received approval from the Faculty of Health Sciences Research Ethics Committee, University of Witwatersrand

Yours sincerely

Signature of the Principle Investigator

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

Chief Executive Officer

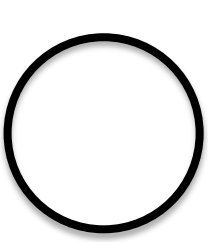
Steve Biko Academic Hospital

Dr T S Mantshwabiwe

Signature of the CEO

GAUTENG PROVINSIALE REGERING
DEPT VAN GESONDHEID
STEVE BIKO AKADEMIESE HOSPITAAL
STEVE BIKO ACADEMIC HOSPITAL
2016 -05- 05
Hospital Official Stamp
PRIVAATSAK/PRIVATE BAG X160
PRETORIA 0001
GAUTENG PROVINCIAL GOVERNMENT
DEPT OF HEALTH

Appendix 8: Information Letter



Information Letter

Name of researcher: Thameenah Solomon

Names of supervisors: Dr. Veronica Ntsiea & Mrs. Nicolette Comley-White

Institution: University of the Witwatersrand, Division of Physiotherapy

Title of study: Functional outcome at discharge from an acute in-patient hospital setting following first-time stroke

Good day,

I, Thameenah Solomon, a postgraduate student at the University of the Witwatersrand, will be conducting research at Steve Biko Academic Hospital. It forms part of my Master of Science in physiotherapy degree. The research project aims to establish the level of function at discharge from Steve Biko Academic Hospital following first-time **stroke*. As you have met the inclusion criteria, you are therefore invited to participate.

Please note: you will not be forced to take part in this study and will be doing so of your own free will. You are free to withdraw your participation at any time if you so wish.
* Stroke is bleeding in or lack of blood supplied to (an) area(s) of the brain resulting in weakness of one side of the body (face and / or arm and / or leg).

Purpose of the study

Stroke survivors are often discharged early from the acute inpatient hospital setting. They may, however, only be able to perform some activities of daily living on their own. This research project aims to determine the functional outcome of stroke survivors following their first stroke at discharge from Steve Biko Academic Hospital.

What you will be invited to do?

Complete the assessment process:

- With your permission, your stroke details, including the type and severity, will be obtained from the Doctor's medical notes and investigations.
- You will undergo individual rehabilitation from your ward (physiotherapist, occupational therapist and speech therapist as needed) for the duration of your hospital stay.
- At discharge, I will perform two functional assessments namely: the Barthel Index (BI) which assesses your ability to perform activities of daily living (ADLs) and the

Modified Rivermead Mobility Index (MRMI) which assesses your ability to move in bed and walk. Both assessments will each take up to twenty minutes to complete. Your physiotherapy and occupational therapy treatment in hours will be calculated from therapists' daily statistics.

If you require additional therapy to further improve your function, you will be referred to your nearest physiotherapist in a hospital, rehabilitation centre or clinic. This process may assist you to become more independent. If there is a need for you to be referred for services beyond the scope of the researcher, please discuss this with your doctor at your medical follow up outpatient appointment.

What are the risks involved?

- Your assessments (BI and MRMI) may involve a lot of energy and you may feel tired afterwards

What are the benefits of participating?

- Your contribution will form part of the body of research which aims to improve the function and lives of future stroke survivors.

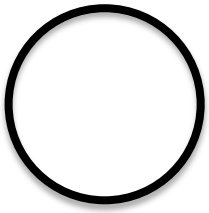
Thank you for your interest in participating in this research project.

Kind Regards,
Thameenah Solomon
(Primary researcher)

For further information please contact:
Miss Thameenah Solomon
E-mail: thameens@gmail.com
Tel: 0829527603

To report any complaints please contact:
The University of the Witwatersrand
Human Research Ethics Committee
Prof. Cleaton-Jones
Tel: 011 717 2301

Appendix 9: Informed Consent



Informed Consent

Name of researcher: Thameenah Solomon

Names of supervisors: Dr. Veronica Ntsiea & Mrs. Nicolette Comley-White

Institution: University of the Witwatersrand, Division of Physiotherapy

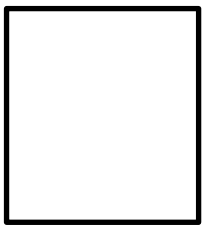
Title of study: Functional outcome at discharge from an acute in-patient hospital setting following first-time stroke

Declaration

I have read (or had read to me by _____) the information letter. I understand what is required of me and I have had all my questions answered. I hereby grant the researcher permission to access my medical records for this study.

I do not feel that I am forced to take part in this study and I am doing so of my own free will. I know that I can withdraw at any time if I so wish.

Name:……
Signed:……Date……
Time.....Place……..
Tel Number:…… Cellphone:……...
Name of contact person:……..……



Left thumbprint

Witness:.....
Signature:..... Date:……...
Time:…….. Place:……..

Researcher name:.....
Signature:.....
Date:...…../…../…… Time:..……Place: ……..

Appendix 10: Discharge Summary

Date: _____/_____/_____

Assessing therapist		
Number of days between stroke onset and rehabilitation		
Length of stay in days		
Total units of treatment (OT)		Hours:
Total units of treatment (PT)		Hours:
Total units converted into hours		
Requires additional therapy	Y	N
Referred to (Name of facility) *(If yes ticked above)*		
Transfer to rehabilitation centre	Y	N
BI and MRMI scores upon discharge	BI: / 100	MRMI: / 40

Therapist:

Signed: _____

Appendix 11: Plagiarism Declaration

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Thameenah Solomon (Student number: 866138) am a student registered for the degree of MSc Physiotherapy in the academic year 2018.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: Solomon Date: 30 September 2018