THE EFFECT OF A WRITTEN AND PICTORIAL HOME EXERCISE PRESCRIPTION ON ADHERENCE FOR PEOPLE WITH STROKE

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Physiotherapy

Johannesburg, 2015

Declaration

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

_____ (Signature of candidate)

22nd day of May 2015

Dedication

- To God, for allowing me the opportunity and giving me the strength to further my studies.
- To my husband, Shyam, for being my pillar of strength, never giving up on me and always pushing me to reach new heights
- To my parents for instilling priceless values in me and giving me the opportunities to open doors to a bright future.
- To my family and friends for always supporting and encouraging me.
- To my supervisor for always encouraging me and striving for excellence.
- To the participants of this research report, without you I could never have completed this journey.

Acknowledgements

Dr Veronica Ntsiea: Supervisor and Mentor

Prof Witness Mudzi: Mentor

Ms Sameera Haffejee: Research assistant, friend and mentor

Mrs Michelle Dihele, Mrs Nombulelo Sekhu, Mr Aubrey Makhanya, Miss Phumzile Ngobese, Miss Khumo Gopane, Mr Timothy Mathe, Miss Nonjabulo Dladla and Miss Mpumi Masilela: Translators

Neurology teams of Chris Hani Baragwanath Academic Hospital for their continuous support and ever ready helping hands

Prof Witness Mudzi, Ms Lynn Fearnhead, Ms Sameera Haffejee, Ms Nicole Duff and Ms Luschka Dearle: Expert team

Miss Priya Bhana, Mr Atish Rowjee and Mr Prashant Rijhumal: Statisticians

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Abstract

Introduction: In South Africa the prevalence of patients with stroke that need help with at least one activity of daily living is equal to that of high income countries. Care of persons with stroke is essential, as stroke can lead to neurological deficits which in turn lead to functional impairments. Functional recovery for a patient, who has suffered a stroke, begins with rehabilitation. It has been found that supervised rehabilitation in an institution or at home improves the patient's quality of life and fitness. It may not be feasible however, for the physiotherapist to supervise all rehabilitation, especially in a home-environment. Therefore adherence to exercise programmes is important. Adherence to exercise programmes allows for a potential saving in treatment costs, may avoid morbidity and unwanted side effects. The mode of exercise prescription may affect adherence to a home exercise programme. There are studies that show that the use of verbal prescription with an added brochure (a written and pictorial home-exercise programme) improves adherence rates. However none of these studies have been conducted in patients with stroke.

Aim: The aim of this study was to determine the effect of a written and pictorial home exercise prescription on adherence with a home-exercise programme in patients with stroke at the Chris Hani Baragwanath Academic Hospital (CHBAH).

Method: A randomised controlled trial with a blind assessor. Ethical clearance was applied for at the University of the Witwatersrand and permission to conduct the study was also obtained from CHBAH physiotherapy department and the superintendent before the commencement of the research project. Written informed consent was obtained from the patient and the caregiver before being included into the study. Participant's anonymity was kept. All participants' and their caregivers' demographic data was captured on the initial assessment. The control group received a verbal home-exercise programme only and the experimental group received a verbal home-exercise programme with written and pictorial instructions for the exercises. An exercise logbook was completed by the participant's caregivers to monitor adherence for each group. The Modified Rivermead Mobility Index (MRMI) and Barthel Index (BI) were used to establish mobility and activities of daily living functional ability of the patients. The significance of the study was set at 0.05. Between group comparison for the categorical data was carried out using the Chi square test. The Wilcoxon sign rank test was used for the between group comparison for the continuous data, the non-parametric data from the functional outcome measures as well as the adherence

rates. Lastly the Spearman's rank correlation co-efficient was conducted to assess if there is a relationship between the level of adherence and functional outcome in patients with stroke.

Results: The average age of the participants was 60.8 (SD: 15.5) years. The gender distribution of the study population was 52% male and 48% female. Majority (76%) of the caregivers were females. Majority of the study population was living with a stroke for one to three months. The average length of stay in hospital was 14.5 (SD: 8.3) days. Of the study population 64% received in-patient physiotherapy.

There was no significant difference between the intervention and control group for functional change and adherence: MRMI ($p = 0.4$), BI ($p = 0.65$) and adherence ($p = 0.53$). In the intervention group there was a greater increase in the MRMI score compared to the control group. But for the BI score the increase was greater in the control group. The relationship between functional ability (MRMI and BI) and the level of adherence for both the control and intervention group was generally not statistically significant. However, there was a weak relationship ($p = 0.05$, $r = 0.44$) for the intervention group for adherence and BI scores.

Conclusion: The adherence rates were similar for the two groups despite the intervention that was administered. Both groups benefitted from the exercise therapy despite the mode of exercise prescription. Therefore there is no need to change the clinical practice at CHBAH regarding mode of home exercise prescription. Instead focus needs to be placed on interventions that can improve adherence to home exercise programmes e.g. the implementation of a monitoring system such as an exercise logbook.

CHAPTER 1

1. BACKGROUND AND NEED

1.1 INTRODUCTION

In sub-Saharan Africa, age-adjusted stroke mortality in adults seems rather similar to that in high-income regions (Connor et al., 2007). The prevalence of stroke is 114-315 per 100000 for women and 154-281 per 100000 for men. This is less than half compared to high-income regions. However, disabling stroke prevalence may be equal to that of high-income areas (Connor et al., 2007). This is a result of a shift from a high burden of infectious diseases to predominantly non-communicable diseases, particularly vascular diseases. In 2002 the World Health Organisation (WHO) estimated a world-wide incidence of 15.3 million strokes. Of these, one third accounted for stroke mortality (Johnston et al., 2009). In South Africa the prevalence of a patient with stroke that needs help with at least one activity of daily living is equal to that of high income countries (Connor et al., 2004).

Care of persons with stroke is essential, as stroke can lead to neurological deficits which in turn lead to functional impairments. Functional recovery for a patient, who has suffered a stroke, begins with rehabilitation. Rehabilitation involves a multidisciplinary approach. One of the components of the multidisciplinary approach is physiotherapy (Ramas et al., 2007). It has been found that supervised rehabilitation in an institution or at home improves the patient's quality of life and fitness (Touillet et al., 2010). It may not be feasible however, for the physiotherapist to supervise all therapy, especially in a home-environment. Therefore adherence to exercise programmes is important (Taylor et al., 2004).

For therapeutic exercises to be effective, adherence is essential (Schneiders et al., 1998). Adherence to exercise programmes allows for a potential saving in treatment costs, may avoid morbidity and unwanted side effects (Schneiders et al., 1998). Adherence to exercise has been found to have a positive effect on functional outcome of patients who have had a stroke (Duncan et al., 2002).

In 2008 Howard and Gosling defined adherence as, the ability to continue with an activity once it has been initiated. There are two ways to look at adherence. Firstly, as an attitude, in which case the willingness to follow prescribed instructions is assessed. Alternatively, adherence can be viewed as a behaviour, which then relates to the actual carrying out of the

prescription (Schneiders et al., 1998). Adherence to exercise programmes has been identified as a high priority subject for research in physiotherapy (Taylor et al., 2004).

Research has been conducted previously on adherence and various modes of prescription of exercises. In a study conducted by Schneiders et al. in 1998 with patients with lower back pain, it was found that the patients that received verbal instruction plus a brochure (written and pictorial instructions) had a higher adherence rate of 77, 4% versus 38, 1% for patients receiving verbal instruction only.

The above method of prescription was not investigated with patients with stroke. However Touillet et al. in 2010 conducted a pilot study and found that patients with stroke have a low adherence rate to home-exercise programmes, where only one out of the nine participants adhered to the prescribed programme. Therefore it is unclear if various modes of exercise prescription will affect the adherence to home-exercise programs in patients with stroke, but it can be inferred that the addition of a brochure (written and pictorial instruction) to verbal prescription may improve the adherence to home-exercise programmes in patients with stroke.

Adherence or non-adherence can be measured using an exercise diary or log-book. This can be accompanied with a standardised functional outcome measure or self designed questionnaire (Basset and Petrie, 1999; Schneiders et al., 1998; Schoo et al., 2005).

1.2 PROBLEM STATEMENT

At Chris Hani Baragwanath Academic Hospital (CHBAH), the physiotherapy department's neurology outpatient clinic has a problem with patients adhering with prescribed home-exercise programmes. This has been deduced via the patients' verbal admittance to non-adherence to prescribed home-exercise programmes. In a systematic review by Basset in 2003, it was reported that up to 65 percent of patients are non- adherent or partially adherent to their home exercise programmes. This data however was not collected from studies conducted with patients with stroke. The researcher has not come across any studies conducted on adherence to home exercise programmes in patients with stroke.

The standard practice at the Chris Hani Baragwanath Academic Hospital physiotherapy neurology outpatient clinic is verbal prescription of home-exercise programmes. The patients

have follow-up appointments after a 3-4 week interval and are therefore seen on a monthly basis. The large interval between hospital visits, demands for the patients to adhere to prescribed home-exercise programmes.

1.3 RESEARCH QUESTION

The above-mentioned problem and practice prompted the question: Will the addition of a written and pictorial home exercise prescription affect the adherence to a home-exercise programme in patients with stroke?

1.4 HYPOTHESIS

Hypothesis$_0$: The addition of a written and pictorial home exercise prescription will not improve adherence rates to home-exercise programmes in patients with stroke

Hypothesis$_1$: The addition of a written and pictorial home exercise prescription will improve adherence rates to home-exercise programmes in patients with stroke

1.5 AIM OF THE STUDY

This study aimed to determine the effect of a written and pictorial home exercise prescription on adherence with a home-exercise programme in patients with stroke at the Chris Hani Baragwanath Academic Hospital.

1.6 OBJECTIVES OF THE STUDY

1.6.1 To compare the adherence to a home-exercise programme in patients with stroke who received a verbal home-exercise programme and those who received a verbal home-exercise programme and a written and pictorial home exercise prescription over a four week period.

1.6.2 To compare the baseline and follow-up Modified Rivermead Mobility Index and Barthel Index Scores for patients with stroke who received a verbal home-exercise programme and those who received a verbal home-exercise programme and a written and pictorial home exercise prescription over a four week period.

1.6.3 To establish if there is a relationship between the level of adherence and functional outcome using the Modified Rivermead Mobility Index and Barthel Index Scores

1.7 SIGNIFICANCE OF THE STUDY

Adherence to exercise programmes has been identified as a high priority subject for research in physiotherapy (Taylor et al., 2004). This study may impact the way therapy is carried out at Chris Hani Baragwanath Academic Hospital. It may identify gaps in the current practice at the physiotherapy neuro-outpatient clinic. It may also find solutions to these gaps.

This study showed that the addition of a written and pictorial home exercise prescription does not impact adherence to exercise programmes. Therefore there is no need to change clinical practice at CHBAH physiotherapy out-patient neurology clinic. However it did show that there is a positive relationship between higher adherence rates and functional outcome. Therefore more emphasis needs to be placed on interventions that can improve adherence to home exercise programmes e.g. the implementation of a monitoring system such as an exercise logbook. This will save a vast amount of direct therapy time for the patient and the therapist. The therapist will then have more time for direct patient care and therapy for other patients in the outpatient clinic. The waiting times between follow-up treatment sessions may be reduced and therefore the patients will receive more frequent therapy and therefore progress faster.

Patients will save on time and costs with less treatment sessions. It may give patients the opportunity to take responsibility for their own health, if they see measurable functional progression with adherence to the home-exercise programme.

CHAPTER 2

2. LITERATURE REVIEW

2.1 INTRODUCTION

Worldwide, stroke is the third commonest cause of death (Connor et al., 2005). Over two-thirds of these deaths occur in developing regions such as sub-Saharan Africa. According to the Agincourt Health and Population Unit, a rural demographic surveillance site in the Limpopo province, stroke is an increasingly important cause of death in South Africa (Connor et al., 2005). Whether it is in a low, middle or high income country, stroke is a world-wide public health problem (Feigin et al., 2014). In high-income countries stroke has been recognised as an important cause of death and disability for many years (Connor et al., 2004). However, there is now a shift in low-income countries, from a high burden of infectious diseases to predominantly non-communicable diseases (particularly vascular diseases) (Connor et al., 2004). This shift is resulting in a disabling stroke prevalence that may be equal in high-income and low income areas (Connor et al., 2005).

World-wide, stroke is in the top ten causes of disability (Murray and Lopez, 1997); this includes the black population of South Africa (Disler et al, 1986). In South Africa stroke is among the top four causes of death (Bradshaw et al., 2006). However, even with the high mortality rate post stroke, most people survive stroke and about half are disabled (Connor et al., 2005). The person living with stroke, their families and community experience an enormous burden after the stroke (Connor et al., 2005). In a study conducted in South Africa, by Connor et al in 2004, it was found that sixty-six percent of stroke survivors need help with at least one activity of daily living.

In this section of the research report a literature review on the relevant aspects of stroke was conducted. This review starts off with a brief discussion of the epidemiology of stroke so as to determine the magnitude of the burden of stroke. This will be followed by a short discussion about the physiotherapy needed for a patient with a stroke. A detailed insert on the possible prescribed exercises, the adherence to the prescribed therapy and the relevant outcome measures used during physiotherapy will conclude this chapter.

The search engines used to complete this literature review were Google, PubMed and Science direct. The key words included, burden of stroke, stroke prevalence and incidence,

adherence to home-exercise programmes, rehabilitation of a stroke patient, exercise prescription methods, written exercise prescription, Modified Rivermead Mobility Index validity and reliability, Barthel Index validity and reliability and use of exercise logbooks.

2.2 EPIDEMIOLOGY OF STROKE

Whether it is in a low, middle or high income country stroke is a world-wide public health problem (Feigin et al., 2014). The Global Burden of disease study found that over eighty percent of all stroke deaths occur in low-income and middle-income regions of the world, depicting the importance of stroke in developing countries (Connor et al., 2007). In 2002, the World Health Organisation estimated a world-wide incidence of 15.3 million strokes (Johnston et al., 2009).

In Sub-Saharan Africa there is a lack of accurate epidemiological research on stroke (Connor et al., 2007). Small studies carried out in Sub-Saharan Africa, have found that age-adjusted stroke mortality in adults seems similar to that in high-income regions. The prevalence of stroke is 114-315 per 100000 for women and 154-281 per 100000 for men. This is less than half compared to high-income regions (Connor et al., 2007). The prevalence of stroke in South Africa was 300 per 100 000 in a study by Connor et al. (2004). In South Africa, incidence of stroke is not well documented. However in a systematic review conducted by Feigin et al. in 2009, they found that the incidence of stroke in low-middle income countries was 117 per 100 000. When compared to the incidence of 94 per 100 000 in high income countries, this yielded a 20% difference. At the time of the study in 2009, it was noted that this was the first time that the incidence of stroke in low-middle income countries exceeded the incidence in high income countries. The study also noted that from 1970 to 2008 there was more than a two fold increase in the incidence rates of stroke in low to middle income countries. Once again this shows the change in epidemiological trends between low and high income countries (Feigin et al., 2009).

As the epidemiological transition, moves from a pattern of disease dominated by infection, perinatal illness and other poverty related diseases to one dominated by non-communicable diseases including vascular disease, stroke is likely to increase in Sub-Saharan Africa in the future (Connor et al., 2009). There is very little published information on the prevalence of vascular risk factors in Sub-Saharan Africa (Thorogood et al., 2007). Therefore Thorogood et al. in 2007 conducted a study that aimed to describe the prevalence of risk factors for vascular disease in rural South Africa. The study was a cross sectional random sample

survey of adults aged over 35 in Agincourt. A trained nurse went to the participants' homes and administered a questionnaire, took a blood sample and carried out clinical measurements to establish the participants' history of vascular risk, blood pressure, waist circumference, body mass index (BMI), ankle brachial index (ABI), and total and high density lipoproteins (HDL) cholesterol. The researchers found a high prevalence of hypertension, obesity in women, and a suggestion of subclinical atheroma despite relatively favourable cholesterol levels in the population (Thorogood et al., 2007).

This study showed that South Africa is facing the challenge of an emerging epidemic of vascular disease (Thorogood et al., 2007). Strategies to address vascular risk need to be put into place. Due to the fact that limited resources are a reality in Sub-Saharan Africa, innovative interventions are needed to avert this outcome. Therefore cost effective steps whether at a personal level (drugs to reduce risk) or at a social level (health education e.g. dietary intake etc) need to be taken (Thorogood et al., 2007).

Along with the challenge of adapting its health systems to face the coming epidemic of vascular disease, South Africa suffers from a huge burden of Human Immunodeficiency Virus infection / Acquired Immunodeficiency Syndrome (HIV/AIDS) (Connor et al., 2004). In HIV and AIDS, 40% of patients develop neurological signs and symptoms, of which 1.3% is stroke (Dobbs and Berger, 2009). The largest number of HIV infections is in Sub-Saharan Africa, i.e. an estimated 25 000 000 children and adults living with HIV (UNAIDS, 2013). However, South Africa is the country with the most high profile HIV epidemic in the world with an estimated 6 100 000 children and adults living with HIV (UNAIDS, 2013). There are more females that are HIV positive than males in South Africa (Simbay et al., 2014). Females between the ages of 15 – 49 years old are 1.6 times more likely than males to be HIV positive, a difference that is statistically significant ($p<0.001$) (Simbay et al., 2014).

Sub-Saharan Africa is populated by people of different ethnic groups as well as socio-economic categories (Connor et al., 2009). South Africa gives researchers an opportunity to look at these differences. There are wide discrepancies in the socioeconomic status in South Africa, predominantly between the black and white population groups. This may be attributed to the recent political history of the country (Connor et al., 2009). In South Africa the black population mainly suffer from illnesses that are associated with low socioeconomic standing (early epidemiological transition), whereas the white population is similar to that seen in the high-income populations elsewhere (late epidemiological transition) (Connor et al., 2009). With this discrepancy between the ethnic groups in mind, Connor et al. conducted a study in

2009 that aimed to compare stroke in black and white urban patients. When looking at the results from this study, it was found that the black patients with stroke were approximately ten years younger than the white patients with stroke. With this result, the authors confirmed that stroke occurs at an earlier age in populations undergoing epidemiological transition, i.e. the black population. Another difference was that the black patients had a higher number of cerebral haemorrhages. This finding is in keeping with the epidemiological transition that the black population of South Africa is undergoing. The high proportion of cerebral haemorrhage is also a feature that is found in younger patients with stroke (Connor et al., 2009).

Both of these differences are features of populations in early epidemiological transition. This study concluded that the socio-political impact of the past has created the above mentioned different patterns of vascular disease among South Africa's population based on ethnicity (Connor et al., 2009).

World-wide, stroke is in the top ten causes of disability (Murray and Lopez, 1997); this includes the black population of South Africa (Disler et al., 1986). In rural South Africa, the prevalence of disabling stroke is already as high as in high-income countries (Connor et al., 2009) and the prevalence of a patient with stroke that needs help with at least one activity of daily living is equal to that of high income countries (Connor, 2004). Therefore rehabilitation is vital post-stroke in order to minimise high levels of disability.

2.3 REHABILITATION POST STROKE

Stroke is a leading cause of disability (Gordon et al., 2004). Rehabilitation is the stepping stone to functional recovery post-stroke (Ramas et al., 2007). Stroke rehabilitation involves a problem solving process that aims to reduce the disability and functional impairment post stroke (Langhorne et al., 2011). There are four steps that are typically followed during rehabilitation of stroke survivors (Langhorne et al., 2011):

1) An assessment, to identify and quantify the patient's needs
2) Goal setting, to define realistic and attainable goals for improvement
3) Intervention, to assist in the achievement of goals
4) Reassessment, to assess progress against agreed goals.

2.3.1. Assessment to identify and quantify the patient's needs

A full neurological assessment by the physiotherapist allows the therapist to identify the patient's functional limitations (Langhorne et al., 2011). Post stroke there are common impairments that a patient may present with (Langhorne et al., 2011). The most widely

recognised impairment is loss of motor function that results in restriction of function and mobility. Impairments of speech and language, swallowing, vision, sensation and cognition are also common (Langhorne et al., 2011). However, there are other consequences of stroke, including reduced capacity to sustain effort with the main reported causes being confinement, immobility, loss of functional abilities related to motor deficit, and often, cardiovascular or metabolic co-morbidities (Langhorne et al., 2011).

Functional loss after a stroke can be classified using the International Classification of Function (ICF). The following are common impairments, activity limitations and participation limitations that are common post stroke (Rexroth et al., 2005, Alankus et al., 2010, Langhorne et al., 2011, Mudzi 2012c, Horstman et al., 2012):

Most common impairments	**Most common activity limitations**	**Most common participation limitations**
• Consciousness orientation and intellect • Temperament and personality • **Energy and drive** • Sleep, attention, and memory • Psychomotor and perceptual • Cognitive and seeing • **Proprioception and touch** • Voice and articulation • Ingestion, defecation, urinary, and sexual • **Mobility and stability of joints** • **Muscle power, tone, and reflexes** • **Muscle endurance** • **Control of (in)voluntary movement** • **Gait pattern functions**	• Most relevant activities affected • Communicating with and speaking • Reading, writing, and calculating • Solving problems • **Undertake single and multiple tasks** • **Transferring oneself** • **Maintaining body position** • **Walking** • **Mobility** • **Toileting** • **Dressing** • **Driving** • Washing and self-care • **Hand and arm use** • Eating and drinking • Preparation of meals	• **Acquisition of goods and services** • **Doing housework** • **Preparation of meals** • **Basic interpersonal** • **Recreation and leisure activities** • **• Remunerative employment**

	• **Use of transportation**	

The bold points are those that can be trained during motor rehabilitation with a physiotherapist.

2.3.2 Goal setting, to define realistic and attainable goals for improvement

After a full neurological and functional assessment, therapy goals need to be set (Basset et al., 1999). Therapy goals act as a motivational tool for the patient (Basset et al., 1999 and Langhorne et al., 2011). However for goals to be effective they should be challenging, achievable, specific, measurable, meaningful and predict a time to achieve them. Therefore, a goal's appropriateness depends to some extent on its construction as well as its implementation. In a study by Basset et al. in 1999, therapy goals had no significant impact on adherence to home exercise programmes if the physiotherapist set the therapy goals. It was found that collaboration with the patient as well as the family or caregiver to discuss and set therapy goals improved patient adherence (Basset et al., 1999).

Three major goals of therapy post stroke are as follows (Gordon et al., 2004):

1. To prevent complications of prolonged inactivity.
2. To decrease the risk of recurrent strokes and cardiovascular events.
3. Increase aerobic fitness.

Once the goals are set interventions need to be selected to achieve the goals (Langhorne et al., 2011).

2.3.3 Intervention, to assist in the achievement of goals

Exercises that are used during physiotherapy post-stroke must aim to gain joint range of motion (ROM), strength, balance, mobility, endurance and function (Duncan et al., 2003). However, a personalised exercise programme is recommended and each exercise programme must be specifically designed based on the patient's needs and current functional capacity (Howard et al., 2008). The exercise programme needs to incorporate the appropriate frequency, duration and intensity for each exercise. Each exercise also needs to be designed to achieve the desired functional goals (Howard et al., 2008).

Impairment focused therapies lack evidence to show neurological repair in the human brain (Langhorne et al., 2011). However, task specific therapy has strong evidence that shows a natural pattern of functional recovery (Langhorne et al., 2011). Therefore task-specific

therapy was found to have better outcomes in stroke rehabilitation versus generalised therapy (Cifu and Stewart, 1999 and Teasell and Kalra, 2004).

To retrain functional activities post-stroke one needs to look at the specific activity and which muscles are needed to perform the activity (Shepherd, 2001). Active exercises decrease muscle stiffness and hyper-reflexia (if it is present) (Shepherd, 2001). However general exercise should be used to activate muscle contraction and optimise this contraction. Once this is achieved the exercises that are used need to be biomechanically similar to the activity that is being trained (Shepherd, 2001, Dobkin, 2004, Alankus et al., 2010, Langhorne et al., 2011). Practice of the activity allows for motor re-learning. Motor learning allows for the restorative process to occur and this begins the moment the patient attempts the activity or action. When the movement pattern is attempted the effectiveness of it needs to be assessed. If it is reasonably effective, repetition of the movement pattern will allow for learning (Shepherd, 2001, Dobkin, 2004, Alankus et al., 2010). However, if the movement pattern is ineffective and cannot be corrected, compensatory movements may be adopted or alternatives may be considered (e.g. replace walking with wheelchair use) (Shepherd, 2001).

2.3.3.1. Joint range of movement exercises

Range of movement (ROM) exercises target the affected upper limb, lower limb and trunk (Duncan et al., 2003). The use of bilateral passive range of motion upper limb exercises has been found to improve the outcomes in activities of daily living in patients with stroke (Kim et al., 2014). These exercises aim to improve range of motion and flexibility at all joints of the upper limb as well as prevent muscle shortening (Kim et al., 2014).

2.3.3.2. Strength exercises

Strength training of the limbs needs to be progressive (Duncan et al., 2003). The use of proprioceptive neuromuscular facilitation is one way of strength training (Duncan et al., 2003). Another method is the use of isometric and isotonic exercise (Ramas et al., 2007). There are many protocols for strength training, in patients with stroke, and no one protocol is superior. Nevertheless, the most common factor that is found in many of these protocols is progression during strength training (Ramas et al., 2007). One way to progress the strength training programme is the use of theraband to add resistance during the exercise (Duncan et al., 2003).

2.3.3.3. Balance exercises

Balance training starts from the first day that a patient is sat up over the edge of the bed (Knecht et al., 2011). Trunk control in sitting and standing can be trained using various exercises and tools. Examples of exercises include moving within and out of the patient's base of support, wall push-offs with one's trunk in sitting or standing, stepping, step ups in different directions, ball play, step taking, marching etc. The use of transitioning can also improve balance by strengthening the trunk, i.e. lie-to-sit, transfers from bed to wheelchair and sit-to-stand (Duncan et al., 2003).

2.3.3.4 Mobility exercises

Once a patient is transitioning between positions and can tolerate a vertical position for at least ten minutes, mobility training is the next step (Knecht et al., 2011). There are numerous protocols for gait training, namely treadmill training with or without the body weight support (BWS), land training, robotic limbs and the use of obstacles (Ramas et al., 2007). Manual gait re-education can be carried out using motor relearning techniques (Belda-Lois et al., 2011). This involves the therapist guiding and supporting the patient by breaking down the components of the task. To progress the therapy, the functional tasks are introduced and then finally incorporated into ADLs (Belda-Lois et al., 2011). Recently the use of robotic limbs has been widely accepted in gait re-education post stroke (Belda- Lois et al., 2011). These devices allow for safe and intense task-orientated therapy. The use of functional electrical stimulation (FES) can also be incorporated into gait re-education (Belda-Lois et al., 2011). FES can be used in combination with BWS treadmill training to improve stance duration, cadence and cycle length symmetry in hemiplegic gait (Belda-Lois et al., 2011).

2.3.3.5. Endurance exercises

Despite the gain in mobility, patients with stroke face a decrease in their cardiovascular endurance (Ramas et al., 2007). The use of a stationary bicycle has been proven to improve endurance (Duncan et al., 2003 and Ramas et al., 2007).In a systematic review by Pang et al (2011), various modes of endurance training were reported, i.e. A stationary bicycle, treadmill walking, functional activities (e.g. brisk stepping) and water exercises. It was reported that a stationary bicycle does not require as much postural control as compared to treadmill walking, therefore most studies were found to use a stationary bicycle to improve endurance in stroke survivors (Pang et al., 2011). The use of time, resistance and speed can be useful when progressing the treatment (Duncan et al., 2003).

2.3.3.6 Functional exercises

Functional re-training involves the training of activities of daily living (ADLs) (Duncan et al., 2003). The occupational therapist plays the predominant role in teaching the patient how to complete these activities by practicing them, with an emphasis on increasing coordination when doing ADLs such as washing countertops, opening drawers, putting away dishes, folding towels, closing blinds, counting change, writing etc. (Duncan et al., 2003).

Generally a multi-disciplinary team approach is taken, when undergoing rehabilitation post-stroke. This allows for motor, cognitive as well as functional limitations to be addressed during the therapy sessions (Ramas et al., 2007).

2.3.4 Importance of rehabilitation post stroke

Stroke rehabilitation is suggested to begin as soon as the diagnosis is made and the patient is medically stable (Musicco et al., 2003). Evidence also shows that rehabilitation in a controlled multi-disciplinary environment achieves better clinical outcomes. It must be noted that rehabilitation is a dynamic and continuous process that combines different measures of medical, physical, psychological and social outcomes (Musicco et al., 2003).

Alankus et al. (2010) suggest that stroke survivors recover their lost function in three ways: overcoming learned non-use, learning to use existing redundant neural pathways that do not include damaged brain tissue and the development of new neural pathways through brain plasticity. Physiotherapy and Occupational therapy assists patients to overcome the physical disabilities caused by stroke (Alankus et al., 2010). Therapy encourages the use of the affected limbs via exercise, thus, allowing the patient to slowly relearn the ability to use the affected limbs again. However, hundreds of repeated exercises are required every day to make progress towards recovery (Alankus et al., 2010).

Home-based therapy is important, as hospital length of stay in South Africa is short; specifically at Chris Hani Baragwanath Academic Hospital with an average hospital stay of six days (Mudzi et al., 2012a). The reduced length of stay is due to pressure for beds. At Chris Hani Baragwanath Academic Hospital, patients with stroke experience suboptimal exposure to rehabilitation due to the current pressure on in-patient services (Mudzi et al., 2012a). Therefore a substantial number of daily exercises need to be carried out at home. However it is difficult to assess patients' adherence to home-based exercises, especially

when it has been found that both healthy subjects and patients overestimate their level of adherence (Touillet et al., 2010).

2.4 ADHERENCE TO HOME EXERCISES

"Adherence is the extent to which a client completes the active element of treatment effectively following advice and instructions and comprises a wide variety of behaviours including entering into and continuing a treatment programme, attending therapy appointments and performing home-based exercises" (Taylor et al., 2004, pg 57-58).

A study by Shaughnessy et al. in 2006 indicates that only 31% of patients actually perform the exercises that are prescribed to them. The average of patient adherence to home exercises ranges between 30-51% (Howard et al., 2008). Howard et al. (2008) identified the following as reasons for lack of adherence to the prescribed exercises regimens:

- poor social support and patient time constraints due to work, study, family and social obligations
- poor patient motivation
- poor relations between the practitioner and patient
- economic difficulties
- poor patient attitude and lack of knowledge and education
- lack of previous exercise experience
- pain or physical discomfort

2.4.1 Factors that influence adherence

There are various factors that affect adherence. Taylor et al. in 2004 conducted a study that aimed to explore factors that influence adherence to home-based strength exercise programmes. They divided the factors into two main sub-categories, i.e. personal and environmental factors. Figure 1 gives a brief summary of these factors (Taylor et al., 2004).

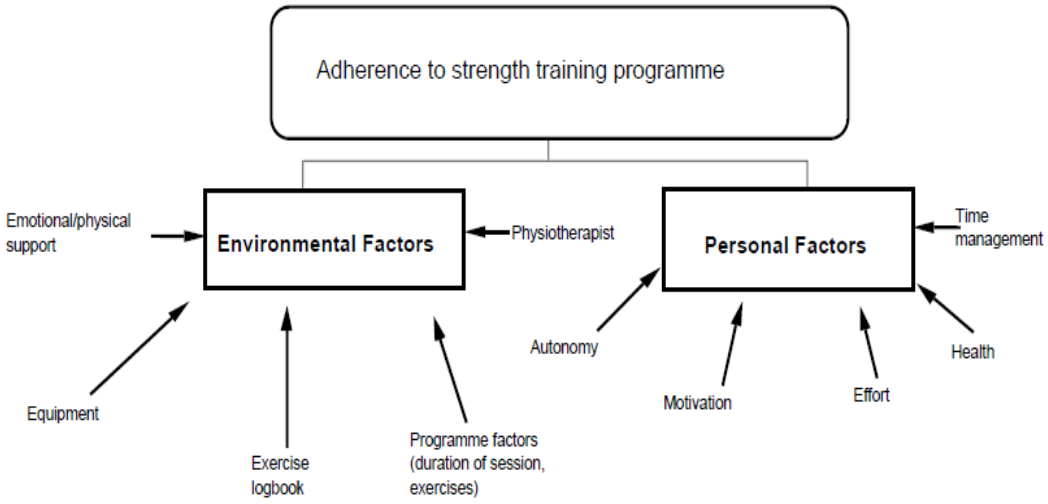

Figure 1: Factors that influence adherence to home-exercise programmes

Factors that influence adherence to home exercise programmes as shown in Figure 1 are as follows: emotional/physical support from family or caregivers was deemed to be one of the most important factors (Taylor et al., 2004). This support gave the patients the encouragement to complete the exercise routine. The equipment needed to complete the exercises played a role, where if the equipment was readily available, the patient was more willing to do the exercise. However, if the equipment is uncomfortable (e.g. poorly fitting strap on weights), that plays a negative role towards adherence. An exercise logbook assists patients to improve their adherence. It contains a description of each exercise as well a log sheet that needs to be filled out regarding the completion of each exercise. It serves as a reminder as well as a motivational track record for the patient.

The exercise programme itself proves to affect adherence. Short programmes with three to four (Schneiders et al., 1998) exercises have been found to play a positive role towards adherence. The physiotherapist designs the exercise programme. Therefore the family/ caregivers report that a supportive physiotherapist assists with adhering to the exercise programme. The physiotherapist plays a role of an educator, coach, leader and support system for the patient and the family/caregiver. The physiotherapist as an environmental factor can influence the personal factors that impact adherence. The physiotherapist can do this by giving the patient a choice in participating in a research study/exercise programme (autonomy) and motivating them to do an exercise programme by explaining the benefits of the programme. However, ultimately the patient has control over their personal factors,

especially those such as time management between exercising and other personal responsibilities (e.g. house chores), general health care and effort that one puts into doing the actual exercise programme (Taylor et al., 2004). When looking at these factors one can deduce that a physiotherapist can use the environmental factors to improve adherence to home-exercise programmes.

There are various modes of prescription of a home-exercise programme. A study conducted by Schoo et al. in 2005 looked at various modes of prescription and the adherence to the exercise program. The participants were randomised into three groups. All groups received face to face verbal instruction. The three modes of prescription that were investigated were a brochure, a brochure with a videotape and a brochure with an audiotape. The study concluded that the addition of a videotape or an audiotape does not increase adherence rates to a home-exercise programme (Schoo et al., 2005).

Another study also looked at mode of prescription of home-exercise programmes (Schneiders et al., 1998), where verbal prescription alone was tested against verbal plus written and pictorial (brochure) prescription. The study concluded a higher adherence rate with verbal and brochure prescription (77.4%) versus verbal prescription alone (38.1%) (Schneiders et al., 1998).

Based on the above literature, it was decided to use a written and pictorial (brochure) mode of prescription for the intervention for the current study.

2.4.2 The use of an exercise brochure to improve adherence to home exercise

When looking at written exercise prescription one needs to consider the implications of comprehension of the prescription (Schoo et al., 2005). By including pictures / illustrations, written information can be adapted to improve comprehension. Another way to improve comprehension is by using a narrative style of writing (Schoo et al., 2005).

These methods of prescription have been found to be effective in patients with conditions such as lower back ache (Schneiders et al., 1998) and knee osteoarthritis (Schoo et al., 2005). There are, however, no studies conducted with patients with stroke regarding the different prescription methods. It must be noted that stroke survivors may not cope with the same methods of prescription due to possible speech and spatial perceptual impairments.

Research has shown a positive relationship between the patient's level of adherence to the home exercise programme and recovery of function (Howard et al., 2008). Stroke survivors must perform a substantial number of daily exercises at home, to experience significant recovery (Alankus et al., 2010).

2.5 CONCLUSION

Stroke is a leading cause of disability (Gordon et al., 2004) and therefore rehabilitation is key step for a stroke survivor's recovery of function. Due to short lengths of stay in hospitals, stroke survivors attend out-patient clinics for rehabilitation. Therefore home-exercise programmes are designed for each patient to be carried out between appointment dates.

However, adherence to home-exercise programmes is a problem. Therefore, the mode of prescription of the home-exercise programme is vital. Verbal instruction plus exercise brochures have been found to improve adherence rates (Schneiders et al., 1998; Schoo et al., 2005). However this has not been investigated in patients with stroke. With the previously mentioned problem statement in mind, this study aimed to determine the effect of a written and pictorial home exercise prescription on adherence with a home-exercise programme in patients with stroke at the Chris Hani Baragwanath Academic Hospital.

CHAPTER 3

3. METHODOLOGY

3.1 STUDY DESIGN

A randomised controlled trial was used to achieve the objectives that have been mentioned above. This study design was chosen as there was a need to test and intervention strategy.

3.2 VARIABLES

3.2.1 Dependant variables:

- Functional score from the Modified Rivermead Mobility Index and Barthel Index
- *Adherence to exercise*

3.2.2 Independent variable:

- The prescribed exercise programmes (verbal and verbal plus written and pictorial)

3.3 SAMPLE SELECTION

3.3.1 Participants

Participants were selected from the CHBAH physiotherapy neurology outpatient clinic. CHBAH is an academic hospital, whose feeder area are an urban township and surrounding informal settlements.

3.3.2 Sample size

There have not been any previous studies that have looked at adherence to home exercise programmes in stroke patients. Touillet et al. in 2010 conducted a pilot study and found that patients with stroke have a low adherence rate to home-exercise programmes, where only one out of the nine participants (11%) adhered to the prescribed programme. Based on these results, the effect size of the current study was set at 11% and the standard deviation at 10. The drop out and non-compliance values were set at 15% respectively. Lastly the significance of the study was set with the alpha value at 0.5 ($p = 0.05$).

All of this information was then applied to a sample size calculator and yielded a sample size of 21 participants per group.

3.3.3 Inclusion Criteria

- Patients with stroke, attending the CHBAH physiotherapy neurology outpatient clinic for the first time
- Patients who have a caregiver present for physiotherapy sessions
- Patients above the age of 18

3.3.4 Exclusion Criteria

- Patients who were dependent in activities of daily living or had physical impairments before the stroke
- Patients who have suffered a previous stroke

3.3.5 Ethical considerations

Ethical clearance was applied for before the commencement of the research project. This clearance was applied for at the University of the Witwatersrand (Appendix 1). Permission to conduct the study was also obtained from CHBAH physiotherapy department and the superintendent (Appendix 2). Written informed consent was obtained from the patient and the caregiver before being included into the study (Appendix 3 and 4). Participants' anonymity was kept by allocating each participant a research number. All data collected was kept in a locked cupboard in a secure place chosen by the investigator.

Re-imbursement for patients on the days of their follow-up appointment was given in the form of transport fees. This was only rendered if the patient's follow-up appointment fell on a day that the patient was not scheduled to come to CHBAH for any other appointments.

3.4 OUTCOME MEASURES

As indicated earlier, therapy post-stroke aims to improve the patient's level of mobility and function (Lennon and Johnson, 2000). In order to assess progression of the patient during therapy one needs to use valid and reliable functional outcome measures. The outcome measure needs to measure performance in functional activities that are relevant to the aims of therapy. Lennon and Johnson in 2000 quoted that only thirteen percent of physiotherapists use functional outcome measures to monitor their treatment progression. This could be due to the lack of available scales that meet the key criteria for their routine use in the clinical setting such as reliability, validity, sensitivity to change and user-friendliness (Lennon and Johnson, 2000).

3.4.1 Demographic questionnaire

A demographic questionnaire was used to capture each patient's details (Appendix 5). The questionnaire captures data regarding the patient's and caregiver's age and sex, contact details, date of stroke and admission, site of lesion and if the patient received in-patient physiotherapy. All of this data was obtained from the patient's file and subjective history taken from the patient and caregiver. This questionnaire was used in conjunction with a list of the prescribed home-exercises for each patient (Appendix 6).

3.4.2 Self-designed exercise logbook

A self designed exercise logbook (Appendix 7) was used. The logbook spanned over a four week period with the specific dates and days for daily record of the prescribed exercises. There were columns next to each exercise for the patient and the caregiver to sign a completed exercise.

Home based adherence studies most commonly use patient diaries and self-report questionnaires to measure adherence (Basset, 2003). With self report in an exercise log book, there may be an over- or under- report of adherence (Basset, 2003, Schoo et al., 2005). In a study conducted with overweight women, it was found that 40-60% of the participants over-reported their adherence to an exercise programme (Jakicic et al., 1998).
Despite the shortcomings of self report, it is commonly used to measure adherence (Sneiders et al., 1998; Basset and Petrie, 1999; Basset, 2003; Taylor et al., 2004; Schoo et al., 2005). Self report methods such as an exercise log book, is frequently used due to their practicality, low cost, low participant burden, and general acceptance (Prince et al., 2008). However self report poses the problems of lack of validation and reliability as well lack of accuracy (Prince et al., 2008).

To improve accuracy, one can request specific information to be documented (Schoo et al., 2005). In the study conducted by Schoo et al. (2005) the participants completed a log book where they recorded home exercise performance for each day of the home exercise programme. They were required to document the duration for each exercise as well as whether all exercises, some exercises or no exercises had been performed on that particular day. Therefore in this self designed exercise logbook, there were also columns for the time that the exercise was started and ended for the caregiver to complete so as to log the time it takes the patient to complete the home exercise programme.

As mentioned above, it has been found that self report is not a reliable and valid source for data collection (Prince et al., 2008). As mentioned previously, adherence to exercise has been found to have a statistical positive effect on a stroke survivor's functional outcome clinically (Duncan et al., 2002). Therefore to overcome the shortfalls of an exercise logbook, the two functional outcome measures (i.e. MRMI and BI) will be used alongside the exercise logbook.

3.4.3 The Modified Rivermead Mobility Index

The Modified Rivermead Mobility Index (MRMI) (Appendix 8) was used to assess the patient's mobility functional ability. This is an eight item, six-point scale mobility measuring tool.

The MRMI looks at the patient's level of mobility (Lennon and Johnson, 2000). This scale was adapted from the Rivermead Mobility Index (RMI) by Lennon and Hastings in 1996. The RMI was developed by Collen et al. in 1991. However Lennon and Hastings (1996) highlighted a major problem with the RMI, that it was scored on a `yes' (1) or `no' basis (0). Therefore the RMI failed to be sensitive to small changes that occur during the patient's recovery. Therefore to increase the sensitivity of the scale an extended six point scoring system was proposed for the RMI. This tool was then known as the MRMI (Lennon and Johnson, 2000).

Lennon and Johnson (2000) report on how the MRMI was tested for its reliability and validity. When evaluating outcome tools, there are different types of validity and reliability that need to be considered (Lennon and Johnson, 2000). The process used to test the reliability and validity of the MRMI was broken into two phases. Phase one looked at the face and content validity. Face validity looked at the ability of the tool to assess the desired attributes of mobility. Whereas content validity looked at the ability of the tool to include all of the important attributes of mobility. The results of this phase were as follows; the highest level of agreement was for the assessment of standing and the lowest level of agreement was for walking indoors. However there was no consistent bias related to the comments on walking. At the end of phase one the tool was named the MRMI and the scoring was changed from 0 to 1 to 0 to 5.

The second phase confirmed the MRMI's test-retest reliability, inter-rater reliability, responsiveness, and internal consistency of the items (Lennon and Johnson, 2000). For the test-retest reliability, a paired t-test was conducted. The scores were $p = 0.732$ and $p = 0.47$,

showing that the scores were stable with no significant difference. Inter-rater reliability was good; for 83% of the sample, there was no more than a two point difference between raters. The reliability was high 0.98 ($p<0.001$). The internal consistency was found to be high using the Cronbach's alpha (alpha = 0.93).

This study found that the MRMI is a valid and reliable tool that can be used to assess the rehabilitation of a patient with stroke (Lennon and Johnson, 2000). The tool was found to be simple and quick (10 to 15 minutes) administer. However, more importantly, the MRMI targets items that are relevant to the aims of physiotherapists working in stroke rehabilitation. Due to its simplicity the MRMI requires minimal training before its administration (Lennon and Johnson, 2000).
However, before the MRMI could be used clinically or in a research study, its concurrent validity needed to be established (Johnson and Selfe, 2004). Concurrent validity can be established by comparing the scores on the MRMI and a previously validated measure of the same construct (Johnson and Selfe, 2004).

In a study by Johnson and Selfe (2004), concurrent validity of the MRMI was tested against the Motor Assessment Scale (MAS). The MAS is a seven-point ordinal scale that measures motor impairment and mobility in patients with stroke (Johnson and Selfe, 2004). It measures five mobility-related activities that are similar to the MRMI activities. The results of the concurrent validity study were as follows; the mean difference between scores on the MAS and MRMI was a mean of 3 points (S.D 2 points) (i.e. a mean of 7% (S.D. 4.8%)). This difference between the scores was small enough, therefore at the end of the study it was found that the MRMI can be used by clinicians when measuring motor impairment and mobility in patients with stroke (Johnson and Selfe, 2004). The MRMI has been successfully used in a South African context in a master's degree thesis (Dearle, 2009).

3.4.4 The Barthel Index

The Barthel Index (BI) was used to establish activities of daily living functional ability (Appendix 9).

In 1965 Mahoney and Barthel introduced the BI (Hartigon and O'Mahony, 2011). Originally, in 1955, it was known as the Maryland Disability Index. The BI measures a patient's independence in completing activities of daily living (ADLs). It is a ten item tool, which address bowel and bladder management, grooming, toilet use, feeding, transfers, mobility, bathing and dressing. Each item is scored on a grid and patients are scored depending on

the time and their level of independence or dependence when doing a specific activity. The total score for the original BI was 100 and the higher the sum total is the higher the patient's functionality is (Mahoney and Barthel, 1965).

However the original BI was modified due to its limited sensitivity (Shah et al., 1989). This version now has a total score of 20, with improved sensitivity. The BI with a total score of 20 was chosen for this study due to its high reliability coefficient of 0.9 as compared to the original BI with a reliability coefficient of 0.87 (Shah et al., 1989). In a study conducted by Loewen and Anderson in 1988, The BI was found to be a reliable tool. In this study they compared the BI to the Modified Motor Assessment scale. Both scales had excellent results for both inter- and intra-rater reliability. This shows that the BI can be used as a tool to assess the effects of a treatment program by quantitatively delineating a patient's progress and outcome (Loewen and Anderson, 1988). In a more recent study by Duffy et al. in 2013, inter-rater reliability of the BI was found to be excellent.

Green et al. (2001) conducted a study investigating the test-retest reliability of the BI and found that the mean difference between testing was only 0.4 and a reliability coefficient of 2.0 was found, indicating good reliability with little bias. The 20-point BI has been shown to be completely valid, reliable, appropriate and clinically significant. It has been successfully used in stroke research in a South African context; therefore it was used in the current study (Mudzi et al., 2012a, b)

3.5 PROCEDURE

3.5.1 Pilot Study

3.5.1.1 Aim of the pilot study

The aim of the pilot study was to establish the correct administration of the exercise log book and the written and pictorial home exercise prescription method, as well as to establish the patients' understanding of the correct completion of the exercise log book. The MRMI, BI and demographic questionnaire were also administered, so as to familiarise the investigator with the administration of the tools and to establish the time it takes to administer the tool.

3.5.1.2 Methodology of the pilot study

The pilot study was conducted with five patients with stroke that met the inclusion criteria. Each patient was given an information sheet to read before signing a consent form. All the

patients and caregivers that participated in the pilot study opted for the English version of the information sheet and written and pictorial home exercises despite the availability of the IsiZulu and Sesotho versions. The pilot study participants were assessed using the MRMI and BI to assess their level of function. Therapy was carried as per usual at CHBAH. At the end of the initial therapy session, each participant was then given a home exercise programme that included prescribed written and pictorial home exercises. The participants' caregivers were also given instructions to complete the exercise log book over a two week period. At the two week follow-up appointment, the patients and caregivers were given the opportunity to feedback any difficulties or misunderstandings regarding the entire process followed.

Results of the pilot study

Table 1 shows the time taken to administer the MRMI and BI for each patient as well as the average time for each outcome measure.

Table 1: Time taken to administer the MRMI and BI

Patient research no	Time for MRMI (hour:min:sec)	Time for BI (hour:min:sec)
P001	00:22:12	00:05:21
P002	00:15:48	00:05:25
P003	00:15:34	00:04:18
P004	00:10:42	00:03:01
P005	00:10:17	00:02:56
Average	**00:14:54**	**00:03:55**

Min = minutes; sec = seconds

The MRMI has a longer average time (14 minutes and 54 seconds) to administer each item on the scale as it needs to be observed by the therapist, whereas the BI has a shorter administration time (three minutes and 55 seconds), because the scale is completed via interview. When each patient and their caregiver were interviewed to assess the ease or difficulty of using the exercise logbook and the written and pictorial home exercise prescription, they were asked two specific questions:

1. Did you experience any problems with completing the exercise logbook? If yes, what were these problems?
2. What are your comments on the use of the written and pictorial home exercise sheets?

Table 2 below is a brief summary of the answers to the above questions.

Table 2: Comments on the use of the exercise logbook and written and pictorial exercise tool

Patient research no	Comments on Exercise logbook	Comments on exercise sheets
P001	No problems	They helped to remind me of the exercises
P002	It helped us to track the exercises	They were easy to understand
P003	We had no problems	The pictures are nice
P004	No, we filled it out with ease	The instructions are clear and the pictures make it easy to remember
P005	The book encouraged us to exercise	The pictures help you to remember what to do

From the comments in Table 2, the general consensus was that both items were easy to understand and use. Therefore no changes were made to the tools for the main study.

Conclusion

The investigator was able to familiarise herself with the outcome measures. The exercise logbook and the written and pictorial home exercise prescription tool were deemed user friendly and no changes were needed for the main study.

3.5.2 The written and pictorial exercise prescription method

A compilation of common exercises that are prescribed for stroke rehabilitation in reference to the current literature (Duncan et al., 2003, Ramas et al., 2007, Belda-Lois et al., 2011, Knecht et al., 2011, Pang et al., 2011, Kim et al., 2014), usual practice at Chris Hani Baragwanath Academic Hospital and in consultation with experts in the field of stroke rehabilitation, was compiled (Appendix 10). The experts that were consulted all had at least a Masters degree in physiotherapy focused in the field of neurological rehabilitation. Each expert was requested to review the written and pictorial exercise prescription and comment on the compilation. These comments were then filtered by the investigator and applied relevant where appropriate. The final compilation was then reviewed by the experts for content validity before being implemented in the study.

To prevent the exercises from being too complex to understand, each exercise had a name, an accompanying picture(s) and a basic set of instructions (Schoo et al., 2005). All the wording was translated and back translated into IsiZulu and Sesotho. The translators were selected from professional staff in the therapeutic sciences.

3.5.3 Main study procedure

The investigator recruited the participants in the physiotherapy neurology out-patient clinic. The stroke survivors that met the inclusion criteria were given an information sheet to read before signing a consent form. All the patients and caregivers that participated in the main study opted for the English version of the information sheet and written and pictorial home exercises despite the availability of the IsiZulu and Sesotho versions.

The investigator was blind to group allocation. Therefore a research assistant randomised the subjects, using simple random allocation, and concealed their allocation using an envelope. Once the investigator obtained informed consent from the participants, they were randomly allocated by the research assistant into two groups, the control group and the experimental group.

The investigator then carried out a full physiotherapy neurological assessment on the first appointment. This involved an in depth history taking followed by an objective assessment which involves a neurological assessment and a functional assessment. For the functional assessment the investigator used the MRMI and the BI which served as the baseline measurement of the patient's function. The patients' intervention was then carried out by the research assistant in an isolated therapy room which included exercise therapy and a home exercise programme. The research assistant prescribed the home-exercise programme according to group allocation, i.e. the control group received home-exercise programmes prescribed with the standard verbal instruction format and the experimental group were prescribed home-exercise programmes with verbal instruction and an added written and pictorial prescription of the home exercises to take home. Home-exercise programmes were documented in each patients file and on the prescription sheet that was attached to each patient's demographic information.

Both groups were given an exercise logbook with instruction to the caregiver to document the adherence to the home-exercise programmes.

The home-exercise programs were not standardised as each patient presents differently. Home-exercise programs were drawn up in accordance with the patient's clinical

presentation and the patient's as well as the caregiver's main concerns. However the exercises were selected from the compilation of exercises so as to maintain some level of control. These exercise programmes were aimed at optimising the patient's functional status.

Participants were followed up after four weeks. Participants were telephonically reminded of their follow-up appointment by the investigator. At the follow-up appointment the investigator retrieved the completed exercise logbook and also administered the MRMI and BI again for a follow-up score. As the data was collected, it was entered onto an excel spread sheet. Once all data was collected it was analysed.

3.6 STATISTICAL ANALYSIS

The significance of the study was set at 0.05

3.6.1 Demographic data

The continuous data, i.e. participant and caregiver ages, length of in-patient stay, time from discharge to commencement of out-patient physiotherapy and number of patients that received in-patient physiotherapy; were compared between the groups using a Wilcoxon sign rank test. However it must be noted that the length of stay and, time from discharge to commencement of out-patient physiotherapy were not calculated with all 42 participants details, as the details of admission were captured in retrospect of data collection. Therefore these variables were calculated using 29 patient's (69.05%) details, i.e. 15 (71%) participants in the intervention group and 14 (67%) participants in the control group. Also it must be noted that one participant from the intervention group was not admitted to hospital after being consulted at casualty and therefore the patient was allocated not applicable for these two variables as well as in- patient physiotherapy.

The categorical data i.e. time living with a stroke, participant and caregiver gender and site of lesion; were compared using a Chi square test.

3.6.2 Functional outcome measures

The non-parametric Wilcoxon match pair test was conducted for each group to compare the baseline and follow-up scores for the MRMI and the BI.

Once these results were generated a between group comparison for functional changes was conducted. However, a variance test was conducted prior to the between group comparison, to assess if the baseline values of function for each group was similar. The variance test

yielded p = 0.7708 for the MRMI and p= 0.3980 for the BI, therefore the variance was similar between the two groups. A Wilcoxon sign rank test was conducted to compare the change in function between the groups.

3.6.3 Adherence rates

The adherence rate for each participant was calculated individually using the formula below:

[A + (B x 0.5) / 140 – C] x 100 = Adherence percentage

Key: 140 = Total amount of exercise slots to be completed over four weeks

A = Total amount of **completed** slots

B x 0.5 = Total amount of **half completed** slots

C = Total amount of slots eliminated by investigator for various reasons (e.g. The patient felt ill, one day earlier follow-up appointment)

Before a between group comparison could be conducted, the variance of the adherence data needed to be tested to assess if the data comes from the same population. The result of the variance test yielded p = 0.3904 (p > 0.05), therefore the variance is similar between the two groups. Therefore to conduct the comparison test between the two groups' adherence rates a Wilcoxon sign rank test was used.

3.6.4. Correlation between adherence and function

Lastly a correlation study was conducted to assess if there is a relationship between the level of adherence and functional outcome in patients with stroke. A Spearman's Rank correlation co-efficient was conducted. If there is a +1 result it shows that there is a perfect direct relationship between the two variables. If there is a -1 result it shows that there is a perfect indirect relationship between the two variables.

CHAPTER 4

4. RESULTS

4.1. INTRODUCTION

Data for this study was collected from September 2013 to the end of June 2014.

The objectives of this study were as follows: to compare the adherence to a home-exercise programme in patients with stroke who received a verbal home-exercise programme and those who received a verbal home-exercise programme and a written and pictorial home exercise prescription over a four week period, to compare the baseline and follow-up MRMI and BI Scores for participants in each group, and to establish if there is a relationship between the level of adherence and functional outcome.

The presentation of these results will be as follows: demographic information (patient and caregiver gender and age, and length of in-patient stay), site of lesion, rehabilitation services received while in hospital), time taken to commence out-patient physiotherapy, scores for each functional measure, adherence percentages, comparison of adherence rates and functional outcomes between the intervention and control group and lastly, correlation between adherence and functional outcomes.

4.2 DEMOGRAPHIC INFORMATION

The distribution of the study sample over the course of the study is displayed in Figure 2

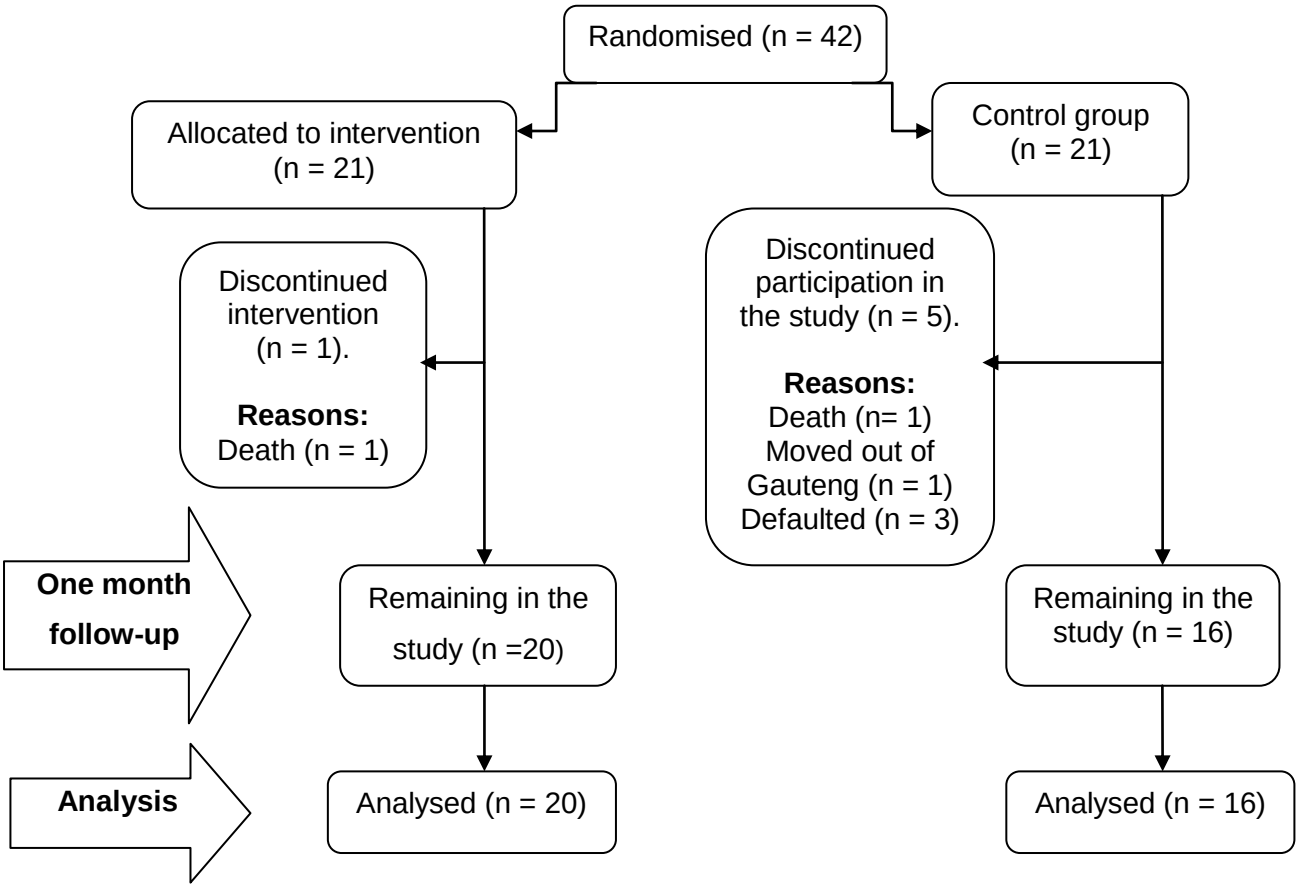

Figure 2: Distribution of the study sample over the course of the study

The total sample was 42 participants, with 21 in each group. However there were six patients that were lost for follow up assessments. In the intervention group there was one patient who passed away. In the control group three patients defaulted, despite the investigator telephonically reminding the patients of the follow-up appointments; one patient passed away and one patient relocated to another province and was unable to come to the follow up session.

Table 3 and 4 below summarises all of the demographic information for each group

Table 3: Demographic information of the participants (Continuous Data) (n = 42)

	Total (n = 42) Mean (SD)	Intervention group (n = 21) Mean (SD)	Control group (n = 21) Mean (SD)	p value
Average age of participants (years)	60.8 (15.5)	62.4 (16.5)	59.3 (14.7)	0.71
Minimum and Maximum age (years)	29 - 94	35-94	29 – 84	
Average age of caregivers (years)	45.6 (13.0)	47.1 (12.3)	44.0 (13.9)	0.64
Minimum and Maximum age (years)	19 - 75	25-75	19-64	
Length of in-patient stay (LOS) (days)	14.5 (8.3)	12.4 (6.4)	16.7 (9.7)	0.28
Minimum and Maximum LOS (days)	2 - 31	3-28	2-31	
Time from discharge to commencement of out-patient physiotherapy (days)	22.24 (15.7)	23.3 (11.5)	20.9 (20.3)	0.27
Minimum and Maximum (days)	1 - 67	3 -44	1 – 67	

There were no significant differences between the intervention group and the control group for ages of the participants ($p = 0.71$) and the caregivers ($p = 0.64$). There was also no significant difference between the groups regarding length of stay ($p = 0.28$) and time from discharge to commencement of out-patient physiotherapy ($p = 0.27$). The minimum length of hospital stay was two days and the maximum 31 days. The time from discharge to commencement of out-patient physiotherapy was between one to 67 days after discharge.

Table 4: Demographic information of the participants (Categorical Data) (n = 42)

	Total (n = 42) n (%)	Intervention group (n = 21) n (%)	Control group (n = 21) n (%)	p value
Time living with stroke				
1: 1 week	2 (4)	1 (5)	1 (5)	
2: 1- 2 weeks	3 (7)	1 (5)	1 (5)	
3: 2 -3 weeks	7 (17)	5 (23)	2 (9)	
4: 3 - 4 weeks	18 (42)	10 (48)	8 (38)	
5: 2-3 months	10 (24)	4 (19)	6 (29)	
6: 4-6 months	2 (4)	0 (0)	2 (9)	
7: 1 year	1 (2)	0 (0)	1 (5)	
8: > 1 year	0 (0)	0 (0)	0 (0)	0.55
Number of patients that received in-patient physiotherapy	27 (64)	13 (62)	14(67)	0.5
Gender of participants				
Male	20 (48)	11 (52)	9 (43)	
Female	22 (52)	10 (48)	12 (57)	0.77
Gender of caregivers				
Male	10 (24)	4 (19)	6 (29)	
Female	**32 (76)**	17 (81)	15 (71)	0.12

Most participants lived with a stroke for one month before attending out- patient physiotherapy. There were no patients that lived with stroke for more than one year. There was no significant difference between the two groups (p = 0.55) for time living with stroke. Just over 60 percent of the participants of each group received in-patient physiotherapy (p = 0.5). Gender for the participants and caregivers was not significantly different with p values of 0.77 and 0.13 respectively, even though majority of the caregivers were female.

Figure 3 shows the site of lesion distribution for the study population.

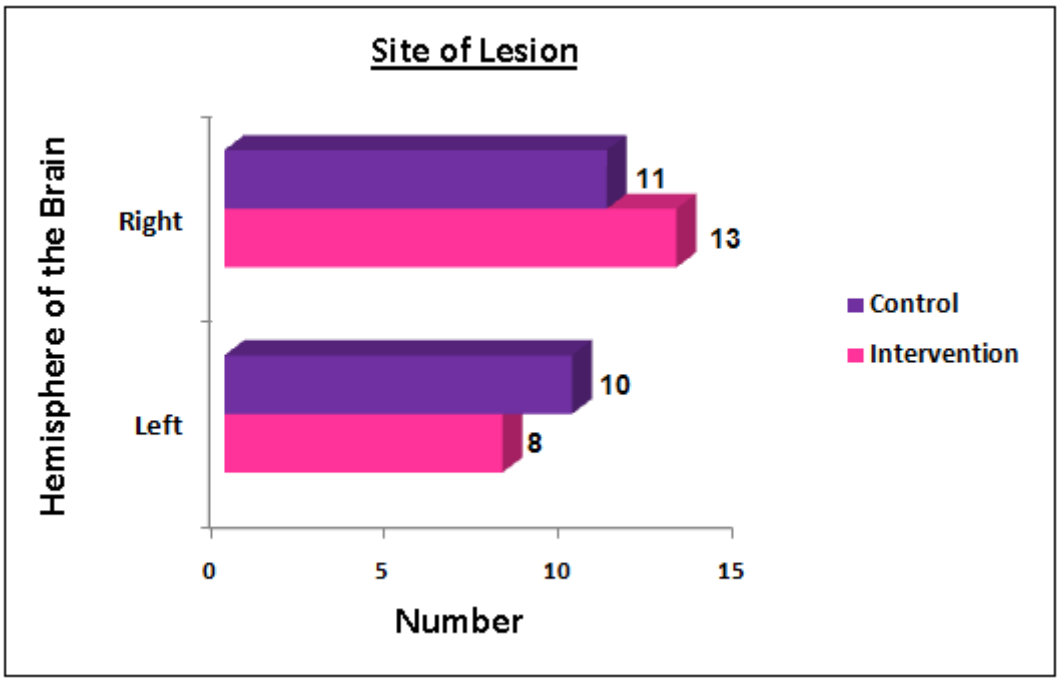

Figure 3: The site of lesion of all the patients (n=42).

There were 18 patients (43%) in the sample that suffered a cerebrovascular accident (CVA) on the left hemisphere of the brain and 24 patients (57%) on the right hemisphere. In the intervention group there were eight patients (38%) with a left CVA and 13 patients (62%) with a right CVA. The control group consisted of 10 patients (48%) with a left CVA and 11 patients (52%) with a right CVA. There was no significant difference between the groups when it came to site of lesion ($p = 0.33$).

4.3 FUNCTIONAL OUTCOME MEASURES

The table below shows the baseline (B/L) and follow-up (F/U) scores, for each group for the MRMI and BI.

Table 5: Function and activities of daily living

	Baseline Assessment		**One month follow-up**	
	Intervention (n = 21)	Control (n = 21)	Intervention (n =20)	Control (n = 16)
MRMI score /40				
Mean (SD)	26.3 (11.7)	29.7 (10.0)	32.6 (9.9)	34.3 (8.8)
Mean change score (SE)*			5.2 (2.0)	5.0 (1.6)
Group comparison	**p = 0.50**		**p = 0.4**	
BI score /20				
Mean (SD)	11.1 (5.6)	12.4 (6.9)	14.8 (5.7)	15.4 (5.6)
Mean change score (SE)*			3.1 (0.9)	3.2 (1.2)
Group comparison	**p = 0.38**		**p = 0.65**	

**Mean change score = the change in mean score from baseline to one month follow-up. SE = Standard error of the mean; BI = Barthel Index; MRMI = Modified Rivermead Mobility Index*

The mean change for the MRMI and the BI shows that there was a positive change between the baseline and follow up scores. However the change was not significantly different between the intervention and control group. In the intervention group, there was a greater increase in the MRMI score compared to the control group. But, for the BI score the increase was greater in the control group.

Scores for the MRMI and BI are presented in Table 6 and 7.

Table 6: Participants' functional level: MRMI item score

	Baseline Assessment			One month follow-up		
	Intervention (n = 21) Mean (SD)	Control (n =20) Mean (SD)	p value	Intervention (n =20) Mean (SD)	Control (n = 16) Mean (SD)	p value
Turning over (5)	4.2 (1.7)	**5 (0.2)**	0.13	4.7(0.9)	**4.9 (0.3)**	1.00
Lying to sitting (5)	**4.2 (1.5)**	4.5 (1.1)	0.62	**4.7 (0.9)**	4.7 (0.9)	0.86
Sitting balance (5)	**4.5 (1.3)**	5 (0)	0.07	**4.9 (0.4)**	5 (0)	1.00
Sitting to standing (5)	**3.2 (1.9)**	3.5 (1.7)	0.70	**4.1 (1.6)**	4.2 (1.3)	0.85
Standing (5)	3.0 (1.9)	3.3 (1.9)	0.61	4.1 (1.6)	4.2 (1.6)	0.61
Transfers (5)	2.9 (1.7)	3.4 (1.7)	0.35	3.9 (1.6)	4.3 (3.5)	0.42
Walking indoors (5)	2.3 (2.0)	2.8 (2.1)	0.58	3.5 (1.9)	3.8 (2.0)	0.34
Stairs (5)	1.9 (1.7)	**2.2 (2.0)**	0.53	2.8 (2.1)	**3.3 (2.1)**	0.47

The MRMI item scores generally increased over the study period for both the intervention and control groups. However, the intervention group scores generally had a larger difference between the baseline and follow-up scores. This can be noted in lying to sitting, sitting balance and sitting to standing. The control group had a higher difference in the baseline and follow-up scores for stairs. The only score that dropped was turning over in the control group.

Table 7: Participants' activity of daily living functional level: BI item score

	Baseline Assessment			One month follow-up		
	Intervention (n = 21) Mean (SD)	Control (n = 21) Mean (SD)	p value	Intervention (n =20) Mean (SD)	Control (n = 16) Mean (SD)	p value
Bowels (2)	1.8 (0.6)	1.5 (0.8)	0.14	1.9 (0.4)	1.8 (0.6)	0.22
Bladder (2)	1.8 (0.6)	1.5 (0.9)	0.24	1.9 (0.5)	1.8 (0.6)	0.47
Grooming (1)	0.5 (0.5)	0.5 (0.5)	0.76	0.8 (0.4)	0.7 (0.5)	0.68
Toilet use (2)	**0.9 (0.8)**	1.2 (0.8)	0.19	**1.3 (0.8)**	1.6 (0.6)	0.34
Feeding (2)	1.0 (0.6)	1.2 (0.5)	0.42	1.3 (0.7)	1.4 (0.5)	0.59
Transfers (3)	**1.9 (0.9)**	2.1 (.1)	0.35	**2.5 (0.8)**	2.6 (0.7)	0.94
Mobility (3)	**1.7 (1.3)**	2.0 (1.3)	0.26	**2.3 (1.1)**	2.4 (1.2)	0.36
Dressing (2)	**0.7 (0.7)**	1.0 (0.7)	0.09	**1.3 (0.8)**	1.4 (0.8)	0.59
Stairs (2)	0.6 (0.6)	0.8 (0.8)	0.51	1.1 (0.9)	1.2 (0.9)	0.59
Bathing (1)	0.3 (0.5)	0.4 (0.5)	0.34	0.6 (0.5)	0.7 (0.5)	0.41

The BI item scores generally increased over the study period for both the intervention and control groups. However the intervention group scores generally had a larger difference between baseline and follow up. This can be noted in toilet use, transfers, mobility, and dressing.

4.4 ADHERENCE RATES

The mean adherence score for each group can be viewed in Table 8.

Table 8: Adherence scores

	One month follow-up	
	Intervention (n =20)	Control (n = 16)
Adherence score /100		
Mean (SD)	59.02 (32.14)	60.56 (39.49)
Minimum and maximum (%)	0 – 97.8	0.69 - 100
Group comparison	p = 0.53	

There was no significant difference between the intervention and control group (p = 0.5346) for the mean values of adherence.

4.5. CORRELATION BETWEEN ADHERENCE AND FUNCTION

Table 9: Correlation between adherence and function

	MRMI		BI	
	R	p	r	p
Intervention group adherence	0.22	0.36	**0.44**	**0.05**
Control group adherence	0.25	0.36	-0.21	0.44

r = Spearman's rho

There was a statistically significant weak direct relationship for the intervention group for adherence and BI scores.

4.6 SUMMARY OF RESULTS

The average age of the participants was 60.8 (SD: 15.5) years. The gender distribution of the study population was 52% male and 48% female. Majority (76%) of the caregivers were females. Majority of the study population was living with a stroke for one to three months. The average length of stay in hospital was 14.5 (SD: 8.3) days. Of the study population 64% received in-patient physiotherapy.

There was no significant difference between the intervention and control group for functional change and adherence: MRMI ($p = 0.4$), BI ($p = 0.65$) and adherence ($p = 0.53$). In the intervention group there was a greater increase in the MRMI score compared to the control group. But for the BI score the increase was greater in the control group. The relationship between functional ability (MRMI and BI) and the level of adherence for both the control and intervention group was generally not statistically significant. However, there was a weak relationship ($p = 0.05$, $r = 0.44$) for the intervention group for adherence and BI scores.

CHAPTER 5

5. DISCUSSION

5.1 INTRODUCTION

The aim of this study was to determine the effect of a written and pictorial home exercise prescription on adherence with a home-exercise programme in patients with stroke at the Chris Hani Baragwanath Academic Hospital. The objectives of the study were to compare the adherence to a home-exercise programme between the control and intervention group, as well as to compare, for each group, the baseline and follow-up scores of the functional outcome measures and lastly, to establish if there is a relationship between the level of adherence and functional outcome post stroke. The objectives will be discussed in this section based on the key findings from the results section as well as determine similarities and differences between the findings in this study to those found in the literature. Conclusions will be made based on the main discussion items.

5.2 DEMOGRAPHIC INFORMATION

There was no statistically significant difference for the demographic information between the intervention and control group at baseline.

The average age of the participants in the intervention group was 62.4 (SD: 16.5) and for the control group 59.3 (SD: 14.7). The average age is less than 65 years, confirming what was reported in the review conducted by Connor et al. (2007), that stroke incidence is higher in those younger than the age of 65 in Sub Saharan Africa. This is further confirmed in the following studies all conducted in Gauteng: Connor et al. (2009) had an average age 51 years of the black stroke patients and Mudzi et al. (2012a), had an average age of 53 years for stroke survivors.

There were slightly more females than males in the study. This is in keeping with what was reported in the review conducted by Connor et al. (2007). They reported that in South Africa the prevalence of stroke for men was reported as 281 per 100 000 (200–362), and in women 315 per 100 000 (243–387) over the age of 15 years. Mudzi et al. (2012a) also had more female than male participants in their study. This similar trend in gender distribution between this study and the study conducted by Mudzi et al. (2012a) may be due to the similar

average age of the participants in these studies which were 60.8 years and 53.2 years respectively. Both of these studies did not have an exclusion criterion for age, thus they included patients with stroke from the age of 18 years and above. However, Ntsiea et al. (2014) had more male participants. The discrepancy with this study may be attributed to the fact that Ntsiea et al. (2014) excluded stroke survivors above the age of 60 years. Therefore these participants were of a younger mean age. In a systematic review by Appelros et al. (2009) on the sex differences in stroke epidemiology, it was established that as females age and progress to the stage of menopause the risk for stroke increases (Appelros et al., 2009). They attributed this to the possibility that the females' higher oestrogen levels play a protective role against stroke. This is a possible explanation for the difference in gender between the study by Ntsiea et al. (2014) and this current study as they had a younger sample population with more males than females.

There were slightly more patients with a left sided cerebrovascular accident (CVA) (57%) than those with a right sided CVA (43%), however there was no significant difference between the groups when it came to site of lesion. Individuals with stroke have similar abilities to perform activities of daily living despite the side of the CVA (Rexroth et al., 2005). Similarly there is no difference in functional outcomes of patients with left CVAs and those with right CVAs (Fink et al., 2008). Therefore it can be said that site of lesion would not have been a factor that influences the outcomes of the current study, especially because there was no significant difference between the two groups.

There were more female caregivers (76%) than males (24%) in this study with an average age of 45.6 years. The caregivers in the intervention group had a mean age of 47.1 (SD: 12.3) years and in the control group 44.0 (SD: 13.9) years. The high number of female caregivers may be due to the traditional assumption that females are available for care giving (Jaffe and Blackley, 2000). Jaffe and Blackley (2000) found on top of caregiving, female caregivers do household chores as well, including laundry, cleaning, cooking, grocery shopping etc. The female caregivers that were interviewed in Jaffe and Blackley (2000)'s study reported having to be a caregiver because no one else wanted to do the job.

The minimum length of inpatient stay was two days and the maximum 31 days. The average length of stay was not significantly different for the two groups, where the intervention group had a mean of 12.4 (SD: 6.4) days and the control group 16.7 (SD: 9.7) days. This study's mean length of stay is double that of Mudzi et al. (2012a). They reported an average of six days at Chris Hani Baragwanath Academic Hospital (CHBAH). The discrepancy may be due

to the time interval of three years between the study conducted by Mudzi et al. (2012a) and the current study's data collection period of 2013 to 2014. In their study they found that early discharge from CHBAH put an enormous burden on the caregivers as the patients had poor functional status. Having worked at CHBAH and having the knowledge of the results from the study conducted by Mudzi et al. (2012a); the physiotherapists working at CHBAH discuss with the medical doctors and motivate for the patients to stay longer to receive more contact physiotherapy sessions. This practice is carried out due to the lack of stroke rehabilitation units in South Africa. Therefore discharge is delayed, attributing to increased length of stay that is found in this study compared to Mudzi et al. (2012a)'s study which was carried out at the same hospital.

Of the total sample, 27 (64%) stroke survivors received in-patient rehabilitation; however it is not certain how many physiotherapy contact sessions the participants received while admitted to hospital. Mudzi et al. (2012a) found, at Chris Hani Baragwanath Academic Hospital, 50% of the stroke survivors did not receive physiotherapy. Those who did receive physiotherapy had an average of one contact session during an average length of stay of six days. This 14% in-patient rehabilitation discrepancy between this current study and Mudzi et al. (2012a)'s study may be attributed to the difference in patient recruitment method of each study. Mudzi et al. (2012a) recruited patients from the hospital wards. These patients may not have been referred for physiotherapy. However in this study patients were recruited from the out-patient physiotherapy neurology clinic. The sample included patients that were treated by physiotherapists while admitted to CHBAH. Therefore the possibility, that the patients did receive in-patient physiotherapy, would be greater than patients in Mudzi et al. (2012a)'s study as they were referred from the ward therapists to the out-patient clinic where the patients were then included into this study.

Most of the patients were living with stroke between one and three months. Of the patients, 42% was living with a stroke for one month and 24 % for two to three months. The average time living with stroke for each group was not significantly different. Thus, patients in this study were in a stage of most rapid functional recovery as most functional recovery occurs in the first six months after stroke (Wade and Hewer, 1987; Horstman et al., 2012). In a study conducted by Bonita and Beaglehole (1988) it was reported that there was a substantial rate of early spontaneous recovery of motor function post stroke. The participants of this study had the most overall improvement within the first month post stroke; although improvement continued among the participants for up to six months. Most of the patients in the current

study were within the timeframe of early spontaneous recovery. Therefore the functional recovery that was found in this study may have been influenced by the phenomenon of spontaneous recovery post stroke. This is a possible reason for the similar functional recovery that was found in both the intervention and control group.

5.3 FUNCTION AND ADHERENCE

The MRMI item scores generally increased over the study period for both the intervention and control groups. There has to be a greater than 4.5 change in score for there to be change in the stroke survivors' mobility level (Lennon and Johnson, 2000). Both groups had a clinically significant change, where the intervention group had a change of 5.2 and the control group 5.0. Even though the difference between the groups was not statistically significant ($p = 0.4$), the intervention group had a higher change in score.

The mean change for the BI shows that there was a positive change between the baseline and follow up scores for both groups. The minimal clinically important difference of the BI in stroke patients was estimated to be 1.85 points (Hsieh et al., 2007). Thus both groups had a clinically significant change, where the intervention group had a change of 3.1 and the control group 3.2.

The mean follow-up MRMI and BI scores were similar for both groups. This may be attributed to the fact that most of the patients were living with stroke for two to four months. This is within the time frame when most functional recovery occurs (Wade and Hewer, 1987; Bonita and Beaglehole, 1988; Horstman et al., 2012). The current study can be compared to the study conducted by Mudzi et al. (2012c) because of the similar time living with stroke for both studies. For the three month follow-up in Mudzi et al. (2012c)'s study the patients were living with stroke for three months. When comparing the mean change in BI scores from baseline to follow-up for the intervention group of the current study, to the study conducted by Mudzi et al. (2012c), the mean change in scores are similar. The mean BI score change for the current study's intervention group was 3.1 and for Mudzi et al. (2012c) was 3.5. This similarity may be attributed to the fact that in both studies, caregiver education on the importance of exercise was carried out. This shows that caregiver education played a greater role in recovery for the intervention group of this study, than the actual intervention (the written and pictorial home-exercise programme).

The control groups were not similar for the two studies. The current study's control group had a mean change of 3.2 in the BI score, whereas in Mudzi et al. (2012c)'s study the mean

change in BI score was 2.6. Unlike in this current study, there was a statistically significant difference between the intervention and control group's mean BI follow-up scores ($p = 0.01$) in Mudzi et al. (2012a)'s study. This difference between the current study and Mudzi et al. (2012c)'s study may be attributed to use of the logbook in the current study. Mudzi et al. (2012c) did not have a logbook and therefore this may be a reason for the statistically significant difference between the intervention and control group. In the current study the logbook was given to both the intervention and control group in addition to education about exercise. The adherence rate was high for both the intervention and control group which was more than 30 – 51% and 11% reported in Howard et al. (2008) and Jakicic et al. (1998)'s studies respectively. These may be possible reasons for no statistical difference between the intervention and control group's functional ability in this current study.

Similarly the lack of a statistically significant difference in function between the intervention and control group in this current study may be due to the fact that both groups showed similar adherence rates ($p = 0.53$). The intervention group had a mean adherence of 59.02 (SD: 32.14) and the control group had an adherence of 60.56 (SD: 39.49). When looking at the factors that affect adherence, this study had many factors other than the intervention (written and pictorial home-exercise programme) that may have played a role in adherence in both the intervention and control group.

The factors that may have influenced the adherence rates in both the intervention and control group are namely: the caregiver, the exercise logbook and the exercise programme. The caregiver played an active role in both the intervention and control group. The caregiver was educated and sensitised to the importance of exercises by the investigator. The emotional/physical support from family or caregivers is deemed one of the most important factors to improve adherence to home-exercise programmes (Taylor et al., 2004). Therefore the role that the caregiver played in both groups may explain the similar adherence rates that each group produced. Family and caregivers were reported to facilitate activity participation in a study conducted by Mudzi et al. (2012b). All participants were given an exercise logbook to document their adherence. Taylor et al. (2004) reported that the log sheet that needs to be filled out regarding the completion of each exercise serves as a reminder as well as a motivational track record for the patient and assists patients to improve their adherence. The exercise programme that was given to all the participants in the intervention and control group consisted of three short personalised exercises and these may have played a positive role towards adherence (Schneiders et al., 1998).

The correlation between adherence and function for this study showed a weak direct relationship for both functional measures for the intervention group. The MRMI had a positive value, showing a positive relationship between the patient's level of adherence to the home exercise programme and recovery of function. The BI had a statistically significant ($p = 0.05$) weak direct relationship with adherence. This confirms that there is a direct relationship between adherence and functional recovery (Howard et al., 2008). This may be another possible reason for the similar functional outcomes and adherence rates found in both groups. This weak direct relationship between adherence and function could motivate therapists to emphasise focus on strategies that may improve adherence, e.g. the implementation of a monitoring system such as an exercise logbook.

5.4 CONCLUSION OF DISCUSSION

The adherence rates had no statistically significant difference between the intervention and control group. There were many possible factors that may have contributed to this, namely the caregiver, the exercise logbook and the short and personalised exercise programme.

There was also no statistically significant difference in functional change between the two groups. This can possibly be attributed to the similar adherence rates, and that most of the study participants were living with stroke for less than six months (optimal timeframe for functional recovery). The similarity in functional change and adherence between the two groups shows that the clinical practice on the mode of prescription for home exercise programmes does not have to change. There was a weak direct relationship between adherence and activities of daily living for the intervention group.

5.5 LIMITATIONS OF THE STUDY

The exercise logbook may have acted as a cue or reminder for patients to do their exercises at home and therefore a true measure of the patients' adherence may not have been obtained.

CHAPTER 6

6. CONCLUSION AND RECOMMENDATIONS

6.1 GENERAL CONCLUSIONS

The first objective of this study was to compare the adherence to a home-exercise programme between the control and intervention group. The adherence rates were similar between the intervention and control group. There were many possible factors that may have contributed to this, outside of the written and pictorial home-exercise programme. These factors are as follows:

- The exercise logbook as a reminder as well as a motivational track record for the patient.
- A short and personalised exercise programme.

The second objective was to compare the baseline and follow-up scores of the functional outcome measures for each group. The functional change was similar for both groups. However it must be noted that the functional change was higher than that compared to the literature. This can possibly be attributed to the similar adherence rates and the factors that contributed to adherence, as well as the fact that most of the study participants were living with stroke for less than six months (optimal timeframe for functional recovery).

From the above objectives the conclusion that both groups benefitted from the exercise therapy despite the mode of exercise prescription can be drawn. Therefore there is no need to change the clinical practice at CHBAH regarding mode of home exercise prescription.

Even though the adherence rates were similar for the intervention and control group, the influence of adherence on function was not similar for both groups. Therefore we cannot conclude that adherence has a direct effect on function, in this study. However the weak positive relationship between adherence and function can motivated therapists to place focus on interventions that can improve adherence to home exercise programmes e.g. the implementation of a monitoring system such as an exercise logbook

6.2 CLINICAL RECOMMENDATIONS

There is a need for physiotherapists to implement the use of exercise logbooks as a monitoring system to assess adherence. This may improve adherence to home-exercise programmes and in turn improve functional outcomes post stroke.

6.3 RESEARCH RECOMMENDATIONS

There is a need to investigate the factors that affect adherence to home-exercise programmes in patients with stroke.

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Appendices

Appendix 1

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Miss Sheetal Rowjee

CLEARANCE CERTIFICATE	**M110706**
PROJECT	The Effect of a Written and Pictorial Home Exercise Prescription on Adherence for People with Stroke
INVESTIGATORS	Miss Sheetal Rowjee.
DEPARTMENT	Department of Physiotherapy
DATE CONSIDERED	28/08/2011
DECISION OF THE COMMITTEE*	Approved unconditionally

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

DATE 29/08/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Ms Veronica Ntsiea

DECLARATION OF INVESTIGATOR(S)

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

Appendix 2

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL
Directorate: PHYSIOTHERAPY DEPT.
Tel. number: (011) 933 -8309/8927
E-MAIL: Prisha.Khelawon@gauteng.gov.za

PERMISSION FOR RESEARCH

DATE: 26 April 2012

NAME OF RESEARCHER: Sheetal Rowjee

TITLE OF RESEARCH PROJECT: The effects of a written and pictorial home exercise prescription on adherence for people with stroke

OBJECTIVES OF STUDY (briefly or include a protocol): see attached proposal

METHODOLOGY (briefly or include a protocol): see attached proposal

CONFIDENTIALITY OF PATIENT MAINTAINED: Yes.

COSTS TO HOSPITAL: Nil

APPROVAL BY UNIVERSITY ETHICS (attach proof): Yes-proof attached

COMMENTS: For optimal sensory and proprioceptive input, the subjects should be advised to exercise without shoes.

APPROVAL OF HEAD OF PHYSIOTHERAPY(Prisha Khelawon):

RECOMMENDED	✓
NOT RECOMMENDED	

SIGN: ..... DATE: 26/4/12

SUBJECT TO ANY RESTRICTIONS: The applicant must translate information sheet, consent form and home exercise programs to appropriate language as outlined in proposal.

Chris Hani Baragwanath Hospital
Chris Hani Road
DIEPKLOOF Ext. 6
SOWETO

PO Bertsham
2013

Appendix 3

Information Sheet

The effect of a written and pictorial home exercise prescription on adherence for people with stroke

Good day, my name is Sheetal Rowjee. I am a physiotherapist at Chris Hani Baragwanath Academic Hospital. I am currently doing my Masters degree at the University of Witwatersrand. One part of my degree is to find answers to a question.

Therefore I would like to invite you to participate in a research study that is looking for answers regarding exercise at home.

In this study there will be two groups. If you choose to participate in this study you will be put into one of these two groups. If you are in group one you will be told what exercises to do at home. If you are in group two you will be told what exercises to do at home plus you will be given pages of the exercises that have written instructions and pictures. Both groups will receive a diary where they will record the exercises that have been done at home. At the next month's appointment the diary will be collected from all the participants so that we can see if the exercises were completed.

All treatment sessions will be carried out as per normal practice at Chris Hani Baragwanath Academic Hospital. There are no risks or benefits to participating in this study.

Participation in this study is completely voluntary. If you choose not to be a part of the study, there will be no penalty or loss of treatment. If you choose to partake in the study, it is important to remember that you may choose to withdraw at any time without any penalty or loss of treatment.

Please note that all the information that is taken from this study will be kept safe and all personal information will be kept confidential. Please take this time to ask me any questions regarding this information.

For further information during the study please don't hesitate to contact me at 011 933 8309 or 072 870 7804.

If you have any complaints please contact Prof Stewart of the University of Witwatersrand (Physiotherapy department) at 011 717 3718 or Prof Cleaton-Jones of the Witwatersrand, Human Research Ethics Committee established to help protect the rights of research participants at 011 717 2301.

Thank you

Sheetal Rowjee

Appendix 4

Consent Form

I _____, have read the information sheet. I was given the opportunity to ask questions and fully understand the information. I agree/disagree to partake in this study

Patient's name: _____ [PRINT]

Patient signature: _____

Date: _____ Time: _____

Caregiver's name: _____ [PRINT]

Caregiver signature: _____

Date: _____ Time: _____

Investigator's name: _____

Investigator's signature: _____

Date: _____ Time: _____

Appendix 5

Demographic Questionnaire Research no.: ____

Patient's name: _____ Age: _____ Gender: F/M

Caregivers's name: _____ Age: _____

Telephone number: _____

Date of stroke: _____

Date of admission: _____

Site of lesion: _____

Did you receive physiotherapy in the hospital: Y/N

Date of discharge: _____

Appendix 6

Prescription Sheet

Patient research number: _____

Date of first physiotherapy out-patient session: _____

Prescribed exercises

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Date of follow-up session: _____

Appendix 7

All the days had the same log sheet. The logbook was labelled for each day of the week from Monday to Saturday

Exercise logbook

Patient Name: _____

Research No.: _____

Queries: Sheetal Rowjee 011 933 8309

Month: _____ Date: _____

Monday

Prescription	Time start	Time end	Exercises completed YES	Exercises HALF completed	Exercises NOT completed	Patient Signature	Caregiver Signature
Exercise 1							
• Morning and							
• Afternoon/ Night							
Exercise 2							
• Morning and							
• Afternoon/ Night							
Exercise 3							
• Morning and							
• Afternoon/ Night							

Appendix 8

The Modified Riverermead Mobility Index

Patient's name: **Test date:**

Assessor's name: **Test location:**

Scoring:

0 unable to perform

1 assistance of 2 people

2 assistance of 1 person

3 requires supervision or verbal instruction

4 requires an aid or an appliance

5 independent

Item	Score
1. Turning over	
Please turn over from your back to your ..... side	....
2. Lying to sitting	
Please sit up on the side of the bed	....
3. Sitting balance	
Please sit on the edge of the bed	....
(The assessor times the patient for 10 seconds)	
4. Sitting to standing	
Please stand up from your chair	....
(The patient takes less than 15 seconds)	

5. Standing ....

Please remain standing

(The assessor times the patient for 10 seconds)

6. Transfers ....

Please go from your bed to the chair and back again

(The assessor places the chair on the patient's unaffected side)

7. Walking indoors ....

Please walk for 10 meters in your usual way

8. Stairs ....

Please climb up and down this flight of stairs in your usual way

Scoring of items

(1) If the patient turns over in bed by pulling himself/herself over with his/her unaffected arm, this counts as using an aid. The patient should be asked to roll onto his unaffected side first. Both sides can be tested if appropriate.

(2) The patient should be asked to sit up while lying on his/her unaffected side first. Pulling himself/ herself up on the edge of the bed with the unaffected arm counts as using an aid.

(3) The use of the hands to hold on constitutes an aid.

(4) The use of the hands to push up into standing constitutes an aid.

(5) The patient should start the transfer towards the unaffected side.

(6) Using a railing constitutes using an aid.

(7) Supervision or verbal instruction excludes any physical contact.

Appendix 9

The Barthel Index

Bowels
0 = incontinent (or needs to be given enemata)
1 = occasional accident (once/week)
2 = continent — *Patient's Score:*

Bladder
0 = incontinent, or catheterized and unable to manage
1 = occasional accident (max. once per 24 hours)
2 = continent (for over 7 days) — *Patient's Score:*

Grooming
0 = needs help with personal care
1 = independent face/hair/teeth/shaving (implements provided) — *Patient's Score:*

Toilet use
0 = dependent
1 = needs some help, but can do something alone
2 = independent (on and off, dressing, wiping) — *Patient's Score:*

Feeding
0 = unable
1 = needs help cutting, spreading butter, etc.
2 = independent (food provided within reach) — *Patient's Score:*

Transfer
0 = unable – no sitting balance
1 = major help (one or two people, physical), can sit
2 = minor help (verbal or physical)
3 = independent — *Patient's Score:*

Mobility
0 = immobile
1 = wheelchair independent, including corners, etc.
2 = walks with help of one person (verbal or physical)
3 = independent (but may use any aid, e.g., stick) — *Patient's Score:*

Dressing
0 = dependent
1 = needs help, but can do about half unaided
2 = independent (including buttons, zips, laces, etc.) — *Patient's Score:*

Stairs
0 = unable
1 = needs help (verbal, physical, carrying aid)
2 = independent up and down — *Patient's Score:*

Bathing
0 = dependent
1 = independent (or in shower) — *Patient's Score:*

Total Score: **/20**

Appendix 10

Exercise Brochure (English)

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Rolling	1. Bend __ knee and take __ arm over body.  2. Roll over to ___ side 	_____ Times Morning / Afternoon/ Night	Caregiver on the side that patient rolls to	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Lie to sit	1. Roll onto __ side. 2. Push legs over the edge of the bed.   3. Push up with ___ arm. of the bed 4. Sit up over the edge  	_____ Times Morning / Afternoon/ Night		

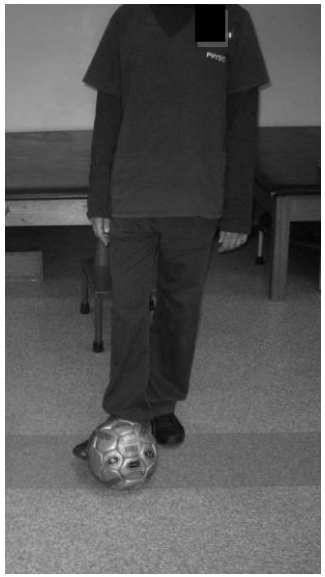
Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Sitting balance (Static)	1. Sit on the edge of the bed and put hands on knees for as long as possible  3. Then hold hands together and lift arms to shoulder level. Hold for _____ secs 	_____ Times Morning / Afternoon/ Night	Caregiver present for support if needed	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Sitting balance (Dynamic)	1.Sit on the edge of the bed and reach for objects placed further than an arm's length away. Reach with your _____ hand 1.1. On the side of you  1.2 On the side of you  1.3 Below you  1.4 Above you 	_____ Times Morning / Afternoon/ Night	Must have caregiver there for safety and for support if needed	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Sit to stand	1. Sit on the edge of the bed. 2. Rock front and back 2 times    3.On the third time stand up.  	_____ Times Morning / Afternoon/ Night	Must have caregiver there for safety and for support if needed	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Standing balance (Static)	1. Stand in front of a stable surface.  2. Then hold hands together and lift arms to shoulder level. Hold for __ seconds 	_____ Times Morning / Afternoon/ Night	Must have a chair behind patient	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Standing balance (Dynamic)	1.Stand in front of a surface and reach for objects placed further than an arm's length away. Reach with your _____ hand 1.1. In front of you  1.2. On the side of you   1.3. Behind you	_____ Times Morning / Afternoon/ Night	Must have caregiver there for safety and for support if needed Must have a chair behind patient	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Standing balance (Dynamic)	1. Stand and kick a ball to someone  	_____ Times Morning / Afternoon/ Night	Must have caregiver there for safety and for support if needed	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Lower limb strengthening and upper limb function	1.Stand against the wall and hold your hands together back on the wall.  2. Bend both knees while keeping  3. Reach for objects in front of you  4.stand up straight  5. Place object on a high surface. 	_____ Times Morning / Afternoon/ Night	Always keep back on the wall	

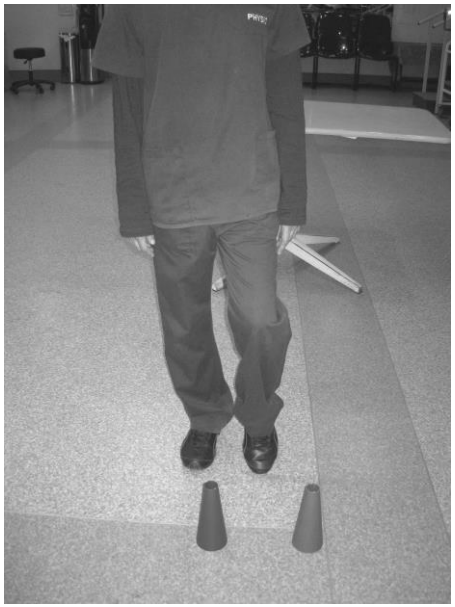
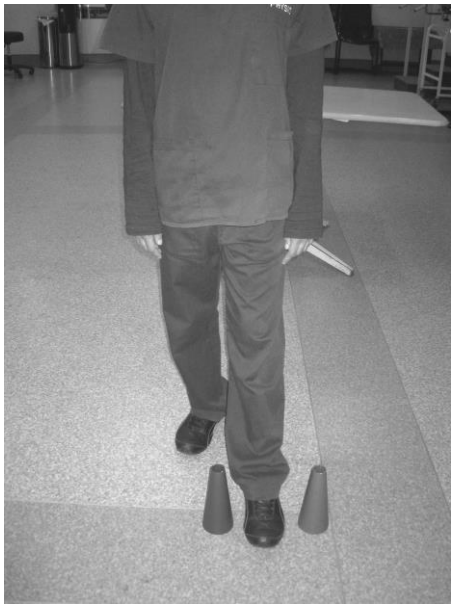
Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Shoulder stretch (a)	1. Lie on your back and hold hands together  2. Lift your arms straight up above your head and then bring your hands down. 	_____ Times Morning / Afternoon/ Night	Keep the thumbs facing up, do not turn the arm or the hand to the sides as this may cause shoulder pain	

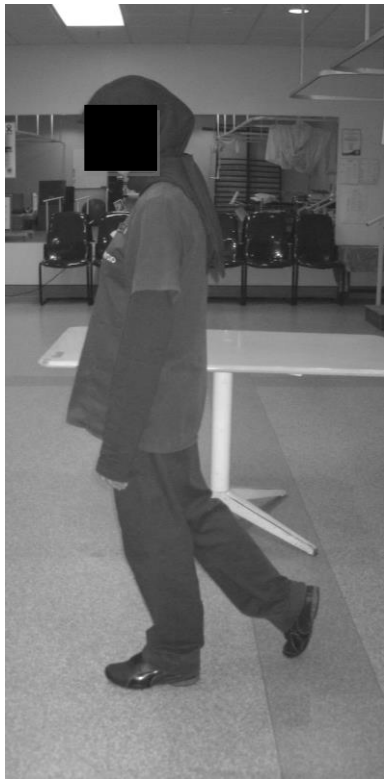
Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Knee control exercise in sitting	1. Sit on a chair  2. Roll a 2L bottle under your _____ foot front and back  	_____ Times Morning / Afternoon/ Night		

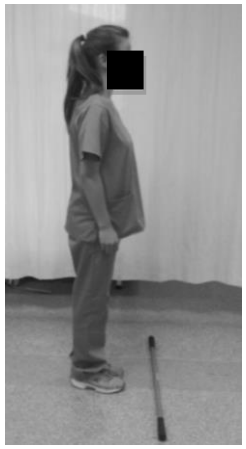
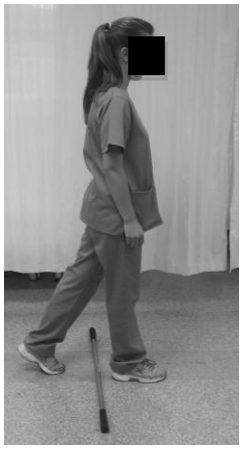
Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Knee control exercise and weight bearing exercise in standing	1. Stand at a step top of the step.  2. Lift _____ foot on the  3. Then bring _____ foot down.  4. Repeat with other leg.	_____ Times Morning / Afternoon/ Night	Hold onto a chair or railing? (Yes)____ or (No) ____	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Bridging	1. Lie on your back and bend both knees.  2. Lift buttocks up in the air and back down 	_____ Times Morning / Afternoon/ Night	Caregiver: Support the affected leg	

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Step education	1. Stand with/ without support of caregiver, chair or table  2. Move _____ foot, front and back.  3. Repeat with other foot 	_____ Times Morning / Afternoon/ Night		

Exercise Name	Instruction and Picture	Do the exercise	Precaution	Caregiver present
Step education and standing dynamic balance training	Step between two objects that are placed in front of you and step back  	_____ Times Morning / Afternoon/ Night		

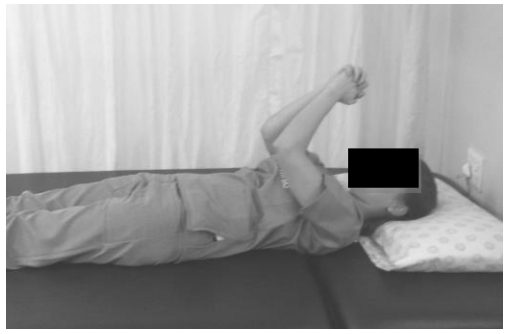
Walking	Walk _____m everyday  	_____ Times Morning / Afternoon/ Night	May use a walking aid if needed	

Walking around, over and into and out of objects	Set up the following exercises as an obstacle course 1.Walk over a stick    2. Walk side ways over a stick   	_____ Times Morning / Afternoon/ Night	May use a walking aid if needed	

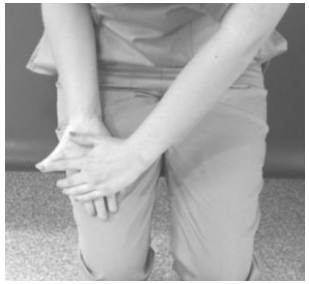
	3.Walk around objects    			

	4. Walk onto and off a step/ book  5. Step over a step/book 			

	6. Step into and out of a tyre 			

Elbow stretching	1.Lie on your back and hold your hands together  2. Stretch out your elbow to make it straight  	_____ Times Morning / Afternoon/ Night		

Shoulder stretch (b)	1. Lie on your back and hold hands together  2. Move your arms to the right and then to the left  	_____ Times Morning / Afternoon/ Night		

Hand stretch	 1.SIt with your hands on your lap  2. Take your __ hand and place it on top of your __ hand  3. Use your _____ hand to open your fingers on your _____ hand  4. Stretch out the thumb	_____ Times Morning / Afternoon/ Night		

Wrist stretch	 1.Hold hands together and place on the table 2.Move wrist to the right and then to the left  	_____ Times Morning / Afternoon/ Night		

Hand strengthening	1.Place sock in hand  2.Squeeze sock tightly  	_____ Times Morning / Afternoon/ Night		

Sitting static balance	 1. Hold hands together. Sit in front of a table and rest your arms on the table.   2. Move arms from the center to the right 3. Move arms from the center to the left 	_____ Times Morning / Afternoon/ Night		

Assisted upper limb exercises	1.Place ___ hand on a table, in front of you, on top of a cloth  2. Slide the cloth to the right and then to the left.  	_____ Times Morning / Afternoon/ Night	Do NOT lean on the table during the exercise	

Side stepping	1) Stand close to a stable surface 2)Step out to the side with your __leg   3) Bring your ____ leg close to the ____ leg  4) Keep walking sideways	_____ Times Morning / Afternoon/ Night	Do NOT lean on the table during the exercise

Tandem walking	1)Stand in front of a line  2)Walk on the line, one foot in front of the other   	_____ Times Morning / Afternoon/ Night		

Standing on one leg	1) Stand close to a stable surface  2) Lift ___ leg and stand for ___ seconds 	_____ Times Morning / Afternoon/ Night	You may hold onto the firm surface	

Catching a ball when standing on leg	1) Stand close to a stable surface  2) Lift ___ leg  3) Catch and throw a ball to someone  	_____ Times Morning / Afternoon/ Night		