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Dearle, Luschka Anne

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Physical abilities of community-dwelling adults more than six months post stroke: a cross-sectional survey

Luschka Anne Dearle

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

Johannesburg, 2009

DECLARATION

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

…….. [Signature of candidate]

……. day of ……., 2009

DEDICATION

In loving memory of my grandparents:

Anthony Robert Newby – Fraser

(1921 – 2006)

Frederick James Botes

(1931 – 2003)

and

Patricia Botes

(1940 – 1997)

Who always believed that I would be blessed to do great things, and taught me to see greatness in even the small things.

ABSTRACT

Background and purpose of the study

The length of stay for patients with stroke in some South African government hospitals has been shown to be inadequate and there is little information on the physical impairments and functional abilities of this population once they return to the community. An assessment was done of the strength, range of movement and the presence of pain experienced by patients with stroke in the Daveyton community and the relationship between these impairments and the functional abilities of these patients was established.

Research methods and procedures employed

This was a quantitative study using a descriptive cross sectional study design. Thirty-four conveniently sampled patients with stroke were assessed in their Daveyton homes. The functional measures used were the Modified rivermead mobility index (MRMI) and Barthel index (BI). The strength was assessed using a hand-held dynamometer, range of movement (RoM) with a standard universal goniometer and pain with the Eleven faces pain scale. The significance of the study was set at 0.05 and the relationships between impairments and functional abilities were expressed using the Spearman's rank correlation coefficient.

Results

Significant differences were found between the strength, as well as the RoM of the affected and unaffected sides ($p < 0.05$). The muscles most affected by were: Biceps, Gastrocnemius and Tibialis Anterior. The smallest strength difference was found in Gluteus maximus. The ranges of movement most affected were: shoulder flexion and elbow extension. The smallest difference was found in knee extension. Eighty-five percent of the sample attained scores indicating that they were independently mobile (measured by the MRMI), and 82% were independent in activities of daily living (measured by the BI). There were good correlations between the patients' strength impairments and their functional abilities ($r = 0.54$ to 0.79) and mobility ($r = 0.51$ to 0.76). Functional abilities and mobility had moderate to good

relationships with active range of movement of shoulder flexion, lateral shoulder rotation and dorsiflexion. The percentage of patients experiencing pain was 73%, but pain displayed no relationship with functional ability (r = 0.14) and mobility (r = 0.15).

Conclusion

Most people living with stroke in the Daveyton community are functionally independent despite the high prevalence of pain. Stroke results in significant strength and active range of movement deficits on the affected side. Most strength impairments correlated well with the functional ability and mobility of this sample, but active range of movement impairments that influenced functional measures were mainly shoulder and ankle movements.

Key words: stroke, community, goniometer, dynamometer, impairments, function, mobility, strength, and pain

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LIST OF ABBREVIATIONS

11 – FPS	Eleven faces pain scale
ADL	Activities of daily living
BI	Barthel index
CBR	Community-based rehabilitation
CBF	Community-based rehabilitation facilitators
CPSP	Central post-stroke pain
FIM	Functional independence measure
HHD	Hand-held dynomometer
ICC	Intraclass correlation coefficient
LHSP	Left hemisphere stroke patient
MRMI	Modified rivermead mobility index
NRS	Numerical rating scale
PDAS	Portable dynamometer anchoring station
SEM	Standard error of measurement
SRD	Smallest real difference
SUC	Standard universal goniometer
RHSP	Right hemisphere stroke patient
RMI	Rivermead mobility index
RoM	Range of movement
USA	United states of America
VAS	Visual analogue scale
VRS	Verbal rating scale

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CHAPTER 1

1. INTRODUCTION

1.1 Background and need

In a commentary on the health care system in the United states of America with the introduction of managed health care, it was noted that many stroke survivors have their stay in rehabilitation facilities cut short. They are discharged home with low functional abilities and are expected to continue with their rehabilitation in the community (Rimmer, 1999)**.** Many South African stroke survivors are discharged from hospital before they become medically stable (Hale and Eales, 1998). It has also been found that people with stroke living in the community have little improvement between one-month and one-year post stroke (Lincoln et al., 2000)**.** In a study by Slot et al. (2007), it was found that patients with an admission Rankin score of four or five (the dependency range of the scale) had a five year survival rate of 45%, which the authors noted as being worse than most malignancies. It makes sense that the more independent the patients are, the more likely their chance of, not only survival, but better quality of life.

The responsibility then lies with the community therapists to initiate or continue some sort of rehabilitation (Rimmer, 1999). The challenge of rehabilitation in the community is that the time spend with the patient is limited due to transport constraints for the patients and the high patient to therapist ratio (Hale and Wallner, 1996). This challenge becomes even more evident when you consider the enormity of the problem of stroke worldwide. “In 1999, the number of deaths due to stroke reached 5.54 million worldwide, with two-thirds of these deaths occurring in less developed countries**.** Stroke is a major cause of long-term disability and has potentially enormous emotional and socioeconomic results for patients, their families, and health services” (Feigin et al., 2003: 43).

In order for the challenge of limited time with the patient to be met, clinicians need to find the most effective way of assisting patients with stroke to become independent. Cameron et al. (2003: 332) suggests that “relevant patient problems must be identified” and that this “requires an examination of functional limitations and relevant impairments”.

Many studies have been done which focus on the degree to which specific impairments affect the abilities of patients with stroke (Ada et al., 2003; Cirstea and Levin, 2000; Colebatch et al., 1986; Gowland et al., 1992; Lamontagne et al., 2002; Lum et al., 2003; Neckel et al., 2006; O’Dwyer et al., 1996; Thilmann et al., 1991; van de Port et al., 2006; Yang et al., 2006). Hsu et al. (2003) conducted a study in which it was found that weakness of the hip flexors and knee extensors played a role in determining the comfort and pace at which a patient walked and that spasticity in the affected plantar flexors contributed to the disruption of gait symmetry. Lin et al. (2006) found that dorsiflexor strength was the most important determinant in gait velocity and temporal asymmetry. Impaired joint position sense and dynamic plantar flexor spasticity also played a role in these two parameters, while passive ankle stiffness appeared not to be a determinant.

Kamper et al. (2002) examined the effect of impairments that occur following stroke on functional reach. They concluded that a reduction in the active range of movement (RoM) in the upper-limb was more significant in terms of functional reach than the movement control.

In a study by Andersen et al. (1995) on the incidence of central post-stroke pain, it was found that eight per cent of patients with stroke suffer from this pain in one form or another. This study also found that patients who presented with somatosensory deficits (pain was included among these deficits) were more disabled one month after the stroke had occurred than patients with no sensory abnormalities.

None of the literature that was found examined impairments and function post-stroke in a South African community. The purpose of this study was to

determine the extent to which the most common impairments that affect patients with stroke, impact on these patients' functional abilities in terms of activities of daily living (ADL) and mobility.

1.2. Research question

What are the impairments and physical abilities of patients with stroke living in the community more than six months post stroke?

1.3. Aim of the study

To assess the impairments and physical abilities of patients with stroke living in the community more than six months post stroke.

1.3.1. Objectives of the study

- To establish the prevalence of pain in patients with stroke living in the community.
- To establish the physical impairments (strength and RoM) of patients with stroke living in the community and to compare the affected and the unaffected sides.
- To establish the levels of mobility of patients with stroke living in the community.
- To establish the activities of daily living functional ability levels of patients with stroke living in the community.
- To establish if there is a relationship between the patients' strength, RoM and pain (presence) and their functional abilities.

1.4 Significance of the study

This study will serve to provide valuable information in two areas: Firstly, it will provide some insight into the degree to which the physical impairments studied are affected and also establish the ones that are prominent in determining the functional outcome of a patient with stroke. This information would enable the physiotherapist to focus his or her treatment on the impairments making the biggest contribution to the patients' condition when treating at the impairment level.

Secondly, it will provide an idea of the functional abilities of people with stroke living in the Daveyton community. This information can be used to adjust the training given to community care-givers so that the patients' specific needs are met.

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

In the United States of America (USA), someone has a stroke every 40 seconds and, while the rate of deaths due to strokes is declining, stroke still accounts for 1 in every 17 deaths in the USA (Rosamond et al., 2008).

A recent investigation into stroke survivors in rural South Africa revealed that the prevalence of stroke was approximately 300 in every 100 000 people (SASPI project team, 2004) and it was estimated that in 2003 the average 60 year old sub-Saharan man spent at least 53% of his remaining lifetime with a disability (Murray and Lopez, 1997b). Murray and Lopez also stated that stroke was the second most common cause of death across the globe (Murray and Lopez, 1997a) and it has been reported that more than half of all strokes worldwide either result in death or permanent disability (Lemogoum et al., 2005).

A search of the literature was conducted in order to determine the reported conditions of people living in the community with stroke as well as the most appropriate methodology for the study. The following databases were searched for literature: Cochrane, PeDRO, Pubmed and EBRSR. The following keywords were used in the search: stroke, community, goniometer, dynamometer, impairments, function, mobility, strength, and pain. The literature regarding the functional abilities of patients with stroke at discharge from hospital and in the community was considered, as well the rehabilitation received post discharge. The impairments affecting function were then examined with regard to what the literature disclosed about them and finally, the methodology of this study was examined to ensure that all methods used were the most valid, reliable and appropriate for the study.

This literature review will be written following this format:

2.2 Functional ability of patients with stroke at the time of discharge from the hospital.

2.3 Post discharge rehabilitation of patients living with stroke in the community.

2.4 The level of mobility and activities of daily living functional ability of patients living with stroke in the community.

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- 2.6.1 The Modified rivermead mobility index (MRMI)
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2.2 Functional ability of patients with stroke at the time of discharge from the hospital

It is important to consider how our patients with stroke living in the community arrive at the functional level that we find them at. In a study by Wolfe et al. (2005) it was found that 85% of the people who were affected by stroke between January 1995 and December 2002 (as listed by The South London stroke register) were admitted to hospital, but only 29% were admitted to stroke specific units. Lincoln et al. (2000) found that patients with stroke who had not been admitted to hospital displayed high levels of disability one month post stroke, with little to no improvement after a year. They used these results

to motivate for the importance of rehabilitation in order to improve the patients' functional levels. A study conducted in Bangkok by Manimmanakorn et al. (2008) revealed that patients with stroke of various ages, who had undergone rehabilitation, were discharged with Barthel index scores ranging from 12.54 to 16.53 with age being the main determining factor of the difference in scores. The study did not, however, specify the length of the rehabilitation period and only mentioned that patients were discharged as soon as they had reached their independence goals or their Barthel score had remained unchanged for two weeks.

In 1996 Hale and Wallner noted that South African patients received inadequate rehabilitation due to "the tendency for patients to be discharged from hospital before an acceptable level of function had been achieved. For example, due to chronic bed shortages, cerebral vascular accident victims spend an average of 12 days in South African government hospitals" (Hale and Wallner, 1996: 156). In 1998, a study by Hale and Eales found that the average length of stay in South African government hospitals had actually decreased to 8 –11 days, with the younger patients with stroke benefiting from a slightly longer inpatient period. In a study conducted by Mamabolo et al. in 2009, they found that 47% of the patients discharged from Chris Hani Baragwaneth Hospital, in South Africa, had a Barthel index score of less than 12. This indicates that just under half of all the patients discharged from the Chris Hani Baragwaneth Hospital are still not functionally independent. An explanation for this may be found in the unpublished study by Mudzi et al. (2009) in which they found that the average length of hospital stay in the same hospital setting was six days, with half of their sample not receiving any inpatient physiotherapy. In addition, it was found that the care-givers, who would now have to take care of these patients discharged with limited functional abilities, received no carer training prior to discharge.

It is, therefore, also important to consider the effect that the functional status of these patients has on those who need to care for them. In a study conducted by Blake et al. (2003) in the United Kingdom, they concluded that 42% of the patients with stroke had spouses that served as care-givers and

that 35% of these spouses were under significant strain six months post stroke. If the patient with stroke is significantly affected by his/her disability, the strain of the situation undeniably spills over to affect the life of his/her caregiver. Long term depression, disharmony in relationships and poor social relations are the result for spouses of patients with stroke who take on the caregiver role and are unable to implement active coping strategies (Visser-Meily et al., 2009). Thus the disability of the person with stroke directly affects the wellbeing of his/her care-givers.

One could conclude that, given the restricted length of stay, the functional ability of South African patients with stroke at discharge is less, and consequently the strain of their care-givers is more than that found in the Thai patients examined by Manimmanakorn et al. in 2008. This serves to confirm that South African patients are discharged from hospital before they are at an acceptable level of independent functioning.

2.3 Post discharge rehabilitation of patients living with stroke in the community

In 1996 Hale and Wallner suggested four possibilities for community orientated rehabilitation as solutions for the insufficient inpatient rehabilitation for patients with stroke. Domicilliary visits were reportedly impractical due to the high patient to therapist ratio and the high transport costs in terms of time and finances. The suggestion of group community classes had merit, but concerns were raised regarding the non-individualised treatment and its level of safety and efficacy. ‘Rehabilitation villages were proposed as a way to train the caregiver and the patient in a simulated home environment, but care-givers were unable to be away from home for the extended period recommended. The final suggestion was that of community-based rehabilitation (CBR). Hale and Wallner (1996: 157) said of CBR in 1996 that “for CBR to be successful in South Africa, the health infrastructure and the community itself would need to be further developed. This would ensure support for CBR workers and an acceptable standard of service. CBR workers

need to be trained in greater numbers and the intersectoral referral systems needs to be effective".

Gummow et al. (1990) found that the leading reason for patients refusing to attend outpatient cognitive therapy was the distance they needed to travel to do so. The most commonly cited second reason for not attending outpatient services was the absence of a care-giver. Given the physical limitations of the population considered in this study, it is likely that these factors would also play a large role in the decision regarding attendance of rehabilitation services.

Saffran et al. (1994) raised the interesting concern of "ex post moral hazard" which describes a concern regarding the improvement of services to the community, so that services previously provided for by the family or friends of patients are now externally provided. The concern is that there would be a new wave of public spending on these newly supplied services and as such, families who were previously providing the services may reduce or remove their assistance or require monetary compensation for these services. The author goes on to emphasise that, while the professional skills and knowledge in question cannot be replaced by caregiver assistance, the caregiver may be able to facilitate the utilisation of such services (i.e. assisting with transport, ensuring appointments are made and kept etc.). Saffran et al. (1994) found that while social support does not act as a predictor for the utilisation of outpatient rehabilitation services, it does increase the utilisation of community-based services. Thus the solution seems to lie in a community-based approach which incorporates the training of patient care-givers to provide continuation of care.

A number of these community-based alternatives have consequently been studied . Community exercise group effectiveness was studied by Lord et al. (2008) and proved that assistant led community rehabilitation can be as effective as hospital outpatient physiotherapy in achieving independent community ambulation. Pang et al. (2005) examined the effect of a community-based exercise program, aimed at patients older than 50 years

living with stroke. The results suggested that a community-based exercise program decreases the incidence of progressive weakness and osteoporosis in the paretic leg. A study by Mamabolo et al. (2009) on South African stroke patients living in the community, they found that all the patients included in their study were receiving post discharge rehabilitation. Ninety-three per cent of the patients were attending stroke groups, while the remaining seven per cent were receiving home based rehabilitation. This post discharge rehabilitation was a possible reason for the sharp increase in the number of patients who were functionally independent from discharge (47%) to more than six weeks post discharge (93%).

In a randomised control trial, Lincoln et al. (2004) assessed the value of a multidisciplinary community rehabilitation team. Their control group continued to make use of the available services in the area such as outpatient services, support groups etc, but their experimental group had a dedicated multidisciplinary team attending to them in their homes and meeting regularly to discuss the best treatment options for the patients. Not surprisingly, the experimental group showed significantly greater independence in activities of daily living, mood, quality of life and knowledge of stroke. The care-givers also showed significantly lower levels of strain.

South Africa has attempted to address this need for community-based rehabilitation, and in 2007 there were already 200 trained community rehabilitation facilitators functioning in South Africa (Chapell and Johannsmeir, 2009). In a qualitative study by Chapell and Johannsmeir (2009) on the impact of community-based rehabilitation facilitators (CRF) in South Africa, the authors found that the implementation of this project resulted in physical and psycho-social improvements for the person with disability, group of persons with disabilities and the parents of children with disabilities. They did, however, identify two major areas of concern in the process. The CRFs had trouble identifying the clients' needs and the clients misunderstood the role of the CRFs and so, felt that some of their responsibilities were not fulfilled.

In conclusion, the studies make it clear that most interventions aimed at rehabilitating patients with stroke in the community are effective. The determining factors of which interventions to employ are unique to each country in terms of its infrastructure and funding to support such initiatives. While the CRF system still has some details that need to be refined, it definitely seems to be the most plausible option for South Africa.

2.4 The level of mobility and activities of daily living functional ability of patients living with stroke in the community

Lord et al. (2008) concluded that it was improbable that patients with stroke who had residual gait impairment would be able to ambulate in the community. This was partially confirmed in a study conducted in Canada by Rand et al. (2008) where they made use of accelerometers to measure the activity levels of persons living with stroke in the community. The results of this study showed that persons living with stroke in the community were less active than the recommended minimum level of activity. They did, however, not specify the presence or extent of residual gait impairments.

Another study (Donovan et al., 2008) found conflicting results reporting that patients who had residual gait impairments were managing to walk in the community for six minutes at a speed of 20 to 25 m/min. Their study showed that patients were able to manage challenging conditions without significant changes in their gait parameters. The conflict between these two studies could be as a result of the difference between what patients with stroke are able to do, and what they choose to do. Rand et al. (2008) commented that their sample were recorded as walking slower and less symmetrically than their healthy counterparts, but that they were among the more independently mobile group of patients with stroke. They asked their sample to ‘go about their normal day’ and then measured the activity. It is apparent that while Donovan et al. (2008) studied the abilities of patients with stroke in the community, Rand et al. (2008) examined the voluntary levels of activity of the same group.

All these studies were conducted in first world countries and bearing in mind the increased environmental demands in the South African context, one would have to consider how patients in less developed countries are coping in the community.

A study by Hale and Eales in 1998 assessed the functional abilities of persons with stroke living in a South African community. They found that 55% of their patients over 50 years of age (the older group) and 88% of their patients under 50 years (the younger group) were able to walk without assistance. Of these independently mobile patients in the older group 66% walked outside 'many times a day' and 39% could climb stairs independently. Of the younger group 94% walked outside 'many times a day' and 56% could climb stairs independently. Twenty-four per cent of both groups were able to walk the length of the road near their homes. The measure used to determine 'handicap of gait' was the ability to catch a taxi, 46% of the older group and 69% of the younger group were able to manage this activity.

Hartman-Maeir et al. (2007) found that in Israel one year post incident patients with stroke were still moderately dependent. Less than half of the patients in their sample were independent in dressing, bathing and climbing stairs and most of the patients (77%) assessed were unable to manage chores in the home. Only one of the patients was able to return to work and while the average satisfaction with family life was good (84%), satisfaction in all the other life areas assessed was poor in more than half the group. The more active the patients were, the higher their satisfaction levels were ($p=0.007$). Approximately three to six months post-stroke, patients tend to experience a plateaux in recovery (Toschkea et al., 2009). It is thus difficult to predict day to day recovery prior to this period, but that does not mean that all recovery ceases after this time. Carod-Artal et al. (2000) found in a Spanish population that 52% of their subjects were functionally independent one year post stroke. Ninety-three per cent of a sample of South African patients living with stroke in the community scored above 12 on the Barthel index, indicating that they were functionally independent, more than six weeks post discharge (Mamabolo et al., 2009).

An interesting result from the study by Carod-Artal et al. (2000) was that, despite the fact that more than half their sample were scored as independently functional, their quality of life scores remained low because they felt that they were still not at their pre-morbid level of ability with regards to activities of daily living (ADL). This concept, that merely being able to perform ADL independently does not necessarily ensure life satisfaction, was echoed in the results of the study conducted by Sveen et al. in 2004. They found that the only ADL directly linked to enhanced satisfaction with life, was the ability to participate in leisure activities. Pohjasvaara et al. (1997) examined yet another aspect of ADL independence. They divided the subjects in their sample into a younger (55 to 71 years) and an older (71 to 85 years) group, and found that the older group displayed a significantly greater decrease in ADL ability than the younger group.

Despite the limited length of hospital stay by South African patients, they appear to be surprisingly more mobile and functionally independent than their international counterparts. Age remains a significant determining factor in functional independence with the young coping better, but there still remains an element of dependence post stroke which needs to be addressed.

2.5 Impairments which affect functional ability after stroke

An important determinant of participation is the person's activity level, which is influenced by his/her impairments (ICF, 2001). Chae et al. (1995) found that physical impairments of persons with stroke on admission were accurate indicators of physical independence post rehabilitation. Han et al. (2002) also found that motor and somato-sensory impairments and hemianopia all contributed significantly to functional outcome post stroke**.**

2.5.1 Muscle strength

The literature is fairly clear as to which muscles contribute predominantly to functional abilities associated with the lower limbs (i.e. mobility). Weakness of the dorsiflexors alters gait and interferes with the swing phase of walking

(Neckel et al., 2006; Lamontagne et al., 2002). Lin et al. (2006)‘s study also found that dorsiflexor strength was the most important determinant in gait velocity and temporal asymmetry. Plantarflexor weakness was found to result in slower walking speed (Neckel et al., 2006; Lamontagne et al., 2002; Yang et al., 2006) while weakness of knee extensors results in poor weight bearing through the hemiparetic knee (Yang et al., 2006) and knee flexor weakness limits the swing through phase of gait (Neckel et al., 2006).

The hip extensors are important in standing from sitting and in propelling the body forward during the stance phase (Neckel et al., 2006). The hip flexors are essential during the swing phase of gait and thus are important for gait performance (Yang et al., 2006). The hip abductors are important in stabilising the pelvis during walking (Neckel et al., 2006). One study found that the affected knee extensors of patients with stroke were stronger than those of unaffected people and rationalised that this may be because their population were all fairly ambulant and may have been using the knee extensors extensively in order to lock their knees during the stance phase of gait (Neckel et al., 2006).

Cameron et al. (2003) attributed the inability to climb curbs and to move from sitting to standing to weakness of the hip flexors, knee flexors and dorsiflexors. In another study, Hsu et al. (2003) examined the effect of weakness of the hip flexors, knee extensors and ankle plantar flexors; the level of motor and sensory recovery (as determined by the Fugl-Meyer Assessment (FMA) and the degree of spasticity in the ankle plantar flexors (according to the modified Ashworth Scale) on the gait parameters. They found that weakness of the hip flexors and knee extensors played a role in determining the comfort and pace at which a patient walked, but that spasticity in the affected plantar flexors contributed to the disruption of gait symmetry.

Harris and Eng (2007) found that activities involving the upper-limbs were most significantly related to the strength of the paretic upper-limb. This relationship was greater than that demonstrated by tone and grip strength.

The most common functional upper-limb agonists were listed by Gowland et al. (1992) as being: biceps; triceps; pectoralis major; middle deltoid and anterior deltoid. It was also established that patients with stroke who had the greatest torque in typically spastic muscles (i.e. internal rotation and adduction of the shoulder) showed the greatest strength deficits in the muscles responsible for the opposing movements (i.e. external rotation and abduction) (Lum et al., 2003). The investigation into the biceps and triceps strength following stroke showed that triceps strength is less affected than biceps strength (Colebatch et al., 1986; Andrews and Bohannon, 2000). This is in contradiction to historical (Andrews and Bohannon, 2000) and clinical observations. Ada et al. (2003) found that the ratio of muscle actions differed depending on the portion of the range of movement that they were being tested in. When muscle strength was tested at 100 degrees elbow flexion, triceps were found to be less affected than biceps. However, when the testing was done at 20 degrees elbow flexion, the converse was found to be true. Thus muscles generally test weaker in their shortened ranges (Ada et al., 2003; Ada et al., 2000).

Thus, based on the available literature, the following muscles appear to be important to gait and upper-limb function: gastrocsnemius; tibialis anterior; quadriceps; hamstrings; gluteus maximus; gluteus medius; illiopsoas; biceps; triceps and the middle deltoid. (Ada et al., 2000; Ada et al., 2003; Andrews and Bohannon, 2000; Cameron et al., 2003; Colebatch et al., 1986; Gowland et al., 1992; Lamontagne et al., 2002; Lum, 2003; Neckel et al., 2006; Yang et al., 2006).

2.5.2 Active Range of Movement

There is a dearth of literature when it comes to the specific loss of active range of movement that affects function in patients with stroke. The minimal ranges of movement required to function normally are: 30 to 130 degrees elbow flexion; ten degrees of wrist flexion; 35 degrees of wrist extension; 90 degrees knee flexion; 30 degrees of hip flexion; five degrees of hip abduction; ten degrees of hip extension and 20 degrees of dorsiflexion (Norkin and Levangie, 1992). It was shown that following stroke, the range of movement

for elbow extension (O'Dwyer et al., 1996) and dorsiflexion (Thilmann et al., 1991) are commonly limited. Lin et al. (2006), however, found that passive ankle stiffness appeared not to have any effect on gait velocity and temporal symmetry. One can reason from these results that limitation in range of movement, and not stiffness, may have an effect on function. Kamper et al. (2002) determined that limited active range of movement in the upper-limb was a significant contributing impairment in terms of functional reach post stroke.

Given the limited nature of the literature on this subject, the choice of which ranges of movement would be considered important in function was based partly on the literature available and partly on clinical experience. The ranges of movement which appear to be important to functional ability are: shoulder flexion; shoulder lateral rotation; elbow extension; hip flexion; knee extension and dorsiflexion.

2.5.3 Pain

Central post-stroke pain is described in the Head and Holms hypothesis as a process whereby "…discriminative sensory deficits in post-stroke central pain (CPSP) produce the disinhibition, which gives rise to spontaneous pain and allodynia." (Greenspan et al., 2004: 357). Andersen et al. (1995) found that eight per cent of patients with stroke suffer from pain in one form or another. The same study also found that patients who presented with somatosensory deficits (pain was included among these deficits) were more disabled one month after the stroke than patients with no sensory abnormalities. Lundstrom et al. (2009) identified a much higher incidence of post-stroke pain. Their results suggested that 21% of patients with stroke, experience post-stroke pain. Central post-stroke pain only accounted for 3% of the incidence, with the remaining portion being made up of lower limb and shoulder pain.

Shoulder pain occurs in approximately 70% of the stroke population (Bender and McKenna, 2001). Post stroke shoulder pain occurs within six months after the incident and occurs more commonly in patients with shoulder subluxation (Suethanapornkul et al., 2008). In a systematic review, limited external

shoulder rotation was the common biomechanical deficit found in all patients with post-stroke shoulder pain, but whether this condition was musculoskeletal, sympathetic or neurological in origin was undecided. The recommendation was made that a differential diagnosis be made initially to determine which of these three possible systems was most likely responsible (Bender and McKenna, 2001).

Reflex sympathetic dystrophy is another common cause of post-stroke pain as shown by its prevalence of 30.5% in a study by Gokkaya et al. (2006). This cause of pain in patients with stroke was strongly related to flaccidity, shoulder subluxation and poor recovery post stroke (Gokkaya et al. 2006).

Jönsson et al. (2006) found that self-reported post-stroke pain was commonly found in both the early and late phases of the stroke condition. The prevalence of post-stroke pain was however higher in the early phase and the severity of the pain was worse in the late phase. Their study also found that the patients' post-stroke pain had an effect on the level of activity. Price and Pandyan (2001) state that post stroke shoulder pain has been implicated in a number of disabling impairments, such as upper-limb weakness, abnormal upper-limb tone and abnormal upper-limb sensation and the systematic review by Bender and McKenna (2001) found that shoulder pain limits the patient even to the activity (ADL) and participation levels. Post-stroke pain has also been linked to persistent paresis and sensory impairments as well as depression in patients living with stroke (Lundstrom et al., 2009). Thus, should post-stroke pain persist into the chronic phase, it is likely to be severe and as such will be an impairment to the person, hindering his/her ability to function in the community.

2.5.4 Tone

Increased tone (or spasticity) plays a role in the weakness, pain and loss of range of movement experienced by patients living with stroke and these impairments can, in turn, result in decreased functional ability (Sommerfield et al., 2004). The prevalence of this phenomenon is reported to increase with

time, starting at 19% at three months post stroke to 38% after one year (Watkins et al., 2002).

There are three commonly used measures that aim to quantify spasticity. They are: the modified Ashwood Scale, resistance to passive movement and muscle activity (Malhotra et al., 2008). The literature on tone, however, revealed that no outcome measure used to assess tone has been found to be adequately valid or reliable (Pandyan et al., 2001; Pandyan et al., 2003; Salter et al., 2005a, Malhotra et al., 2008). As a result of this apparent lack of appropriate outcome measures to assess this physical impairment, tone was not included as one of the impairments considered in this study.

2.6 Review of methodology

2.6.1 The Modified Rivermead Mobility Index (MRMI)

The MRMI assesses eight aspects of mobility ranging from turning over in bed to managing stairs. If the patient is unable to perform the aspect of mobility they score a zero, if they are able to perform it independently they score a five.

The original Rivermead Mobility Index (RMI) was shown to be valid and reliable in a study by Chen et al. (2007). The standard error of measurement (SEM) and smallest real differences (SRDs) were used to determine the absolute reliability of the RMI. SEM is used to quantify the "threshold that indicates a real improvement (beyond measurement error) for a group of individuals and SRD represents the threshold indicating a real improvement for a single individual" (Chen et al., 2007: 348). Thus the lower the scores the more reliable the measure. The RMI scored 0.8 and 2.2 respectively. As such, Chen et al. (2007)'s study found the RMI to have absolute reliability. Relative reliability was also demonstrated in this study with an Intraclass Coefficient (ICC) of 0.96.

It has been suggested in the literature that the MRMI is more responsive due to its 6 point scoring system as opposed to the dichotomous scoring of the RMI (Hsueh et al., 2003).

Lennon and Johnson (2000) tested the MRMI for face/content validity and found that it had responsiveness (effect size =1.15), test-retest reliability (r = 0.731), inter-rater reliability (ICC = 0.98) and internal consistency (Cronbach's alpha = 0.93). The results showed that the MRMI also had good to excellent validity and reliability, regardless of the experience of the testers. In an effort to determine a comprehensive measure of mobility, the decision was made to use the Modified Rivermead Mobility Index.

2.6.2 The Barthel index (BI)

The BI analyses ten aspects of activities of daily living ranging from feeding and self-care to bowel management and mobility. The original and modified BI consists of a maximum score of 100, whereas the Barthel index developed by Collin and his colleagues consists of a maximum score of 20 (Occupational Therapy Program: University of Western Sydney, 2006). In a comprehensive summary of the literature regarding the Barthel index and all its variations, the aforementioned program found that the Barthel index (Collin 20 point) was found to be valid, reliable, appropriate and clinically significant, The modified Barthel index (100 point) was lacking in evidence for its construct validity, intra-rater reliability and ability to detect a clinically important change. A five-item Barthel index was also developed but this was found to have lower internal consistency than the ten-item Barthel index as well as considerable floor effects in the initial stages of rehabilitation (Hsueh et al., 2002). The (20-point) Barthel index was thus chosen to be utilised in this study.

Green et al. (2001) investigated the test-retest reliability of the BI. The mean difference between testing of the BI was only 0.4 and a reliability coefficient of 2.0 was found - indicating good reliability with little bias.

Hsueh et al. (2002) set out to compare two of the most commonly used ADL measures: The BI and the Functional Independence measure (FIM). They found that the BI was in no way inferior to the motor subscale of the FIM and,

in fact, was preferable to the FIM in measuring ADL in that it took less time and was less complicated.

The same was found in a study by van der Putten et al. (1999) which aimed to compare the appropriateness and responsiveness of the FIM and BI when used to assess patients with stroke and patients with multiple sclerosis. In a study by Salter et al. (2005b), the BI was also assessed and found to have excellent test- retest (regardless of the skill of the rater) and inter-observer reliability as well as excellent internal consistency. In terms of validity, the researchers stated that the "BI is often used as the gold standard criterion for assessment of validity of other measures." (Salter et al., 2005b: 321). The BI also displayed good responsiveness with the only noteworthy ceiling effect of 27% being seen post discharge from rehabilitation facilities.

2.6.3 A Calibrated Hand-held Dynamometer

A calibrated dynamometer is found to be valid and reliable in the measuring of strength in a number of different types of patients. One study assessed the reliability (in terms of the inter-correlation coefficient and standard error of measurement values) of the hand-held dynamometer measurements on children with cerebral palsy (Berry et al., 2004). Intra and Intersession reliability was determined. However, the measurement of certain movements was found to be more reliable than others. Hip flexion strength measures had the smallest errors, followed by knee extension, hip abduction and finally knee flexion, which showed the biggest error variance (Berry et al., 2004).

In a study that was done by Scott et al. (2004) in which the hand-held dynamometer (HHD) and the portable dynamometer anchoring station (PDAS) were compared when testing the strength of hip flexion, abduction and extension, the ICC scores for the HHD and the PDAS were: 0.89; 0.84; 0.59 and 0.81; 0.67; 0.79 for hip flexion, abduction and extension respectively. It is apparent that while the HDD was better than the PDAS for testing hip flexion and abduction, the PDAS was better for assessing hip extension.

In a similar correlation study by Hayes et al. (2002) a comparison was made between the reliability of the spring-scale dynamometer, hand-held dynamometer and manual muscle strength testing in symptomatic shoulders. The hand-held dynamometer faired the best, with ICC values of 0.79 to 0.92. In addition to its preferential reliability, the hand-held dynamometer was also considered the easiest instrument to use of the three and the authors thus recommended it as the instrument of choice for muscle strength testing.

In 1988, Bohannon found that the make and break tests in hand-held dynamometry were equally reliable, but did state that this depended upon the researcher having sufficient strength to overcome the subjects' strength. The make test was a preferred method in a study by Andrews et al. (1996). The make test was thus the method of choice when using the hand-held dynamometer in this study.

2.6.4 The Eleven faces pain scale (11 - FPS)

There is a dearth of literature on an outcome measure which has been shown to be valid and reliable when testing pain levels in patients with stroke. An article published in 1999 by Price et al. asked the provocative question "Can Stroke Patients Use Visual Analogue Scales?" The study that followed detailed the many cognitive deficits that occur post stroke rendering the patients unable to use the Visual Analogue Scale (VAS) (Price et al., 1999).

A possible solution could be found in a study by Benaim et al. (2007) in which they assessed the use of the Faces Pain Scale (FPS), the Visual Analogue Scale and the Verbal Rating Scale (VRS) in pain measurement of patients with stroke. The findings were that patients with left hemisphere stroke (LHSP) preferred the faces scale and good reliability of the scale was shown with the use of this scale in these patients. However, patients with right hemisphere stroke (RHSP) struggled to recognise the relevance of the faces and as such, preferred the visual analogue scale. It is important to mention, however, that after it had been explained to the patients that the faces represented different levels of pain, there was good correlation between FPS, VAS (r = 0.82 and 0,72) and VRS (r = 0.65 and 0.72) for both LHSP and

RHSP respectively. Thus, if the faces scale is explained properly to the patient, then there is little difference in the responsiveness to the different pain scales by patients with stroke.

Kim and Buschmann (2006) conducted a study in which they tested an eleven faces version of the faces pain scale for validity and reliability when used in elderly patients with mild to moderate cognitive impairments. This Eleven faces pain scale (11 - FPS) appeared to be the closest to the ideal combination mentioned above. The sample group in this study conveniently consisted of subjects from different socio-economic backgrounds and cultures. A large number of the subjects (29.4%) had never been schooled. Incidentally, they also noted that the aetiology of the pain in the majority (29.3%) of their subjects was stroke. They used the Numerical Rating Scale (NRS) as the gold standard and found that the 11 - FPS correlated well (r = 0.73) with the NRS and the VAS in cognitively impaired patients. This confirmed the validity of the 11 - FPS. The test-retest correlation coefficient for the 11 - FPS was 0.74 for the cognitively intact subjects (good correlation, therefore good reliability) but did decrease to 0.60 when the cognitively impaired patients were added. The reliability of the scale was thus, as with many pain scales, found to be less in the population with cognitive deficits, but was found to be reliable in normal elderly subjects.

In the absence of an obvious choice of pain scale for use with patients with stroke the 11 – FPS was used to determine the presence and severity of pain. As examined by Benaim et al. (2007) the FPS, once explained, was a valid and reliable tool to use with LHSP as well as RHSP. The fact that the scale offers a greater number of choices makes it more statistically useful as it limits the patients' choices less, than the four faces of the FPS.

2.6.5 A standard universal goniometer

Literature regarding the use of goniometers in patients with stroke is limited. In 1998, Armstrong et al. conducted a study which assessed the reliability of the standard universal goniometer, the computerised goniometer and the mechanical rotation-measuring device. They found that the inter-tester

reliability for the computerised goniometer was excellent, but for the standard universal goniometer, it was moderate. However, it was also found that of the 60 intraclass-correlation coefficients obtained in the intra-tester reliability assessment, 57 of them were above 0.89. This indicates that the intra-tester reliability for all the instruments was excellent regardless of the tester's expertise.

A Systematic review by Gajodosik and Bhoannon in 1987 examined the reliability and validity of standard goniometry. The clinical validity of goniometric measurements is confirmed but it is cautioned that physiotherapists must remember that goniometry only measures range of movement and cannot be used to determine stiffness, spasticity, or anything other than range of movement. They found that reliability of goniometry was dependent on a number of factors. The first and most important was that a standardised method must be used. The joint being tested can also influence the reliability. Wrist flexion, medial shoulder rotation and shoulder abduction are the most difficult movements to test reliably with a goniometer. Passive range of movement measures are more likely to have poor reliability than active range of movement measures.

In a prior study by Boone et al. (1978) reliability was similarly found to be different depending on the joint being tested. They found that measuring the range of movement of the lower limb joints ($r = 0.58$) was less reliable than that of upper-limb joints ($r = 0.86$) and that intra-rater reliability (7% total variation) was far greater than inter-rater (34% total variation) reliability. They concluded that one measurement per session is as reliable as taking the average of a number of measurements in a session.

It is clear from the literature that computerised forms of goniometry are more accurate than the use of the standard universal goniometer (SUG) (Armstrong et al., 1998). It is, however, also clear that the SUG is a valid and reliable method of measuring range of movement when using a standardised method. While the inter-rater reliability is not as good as its computerised counterpart, the intra-rater reliability of the SUG has been seen to be excellent (Armstrong

et al., 1998). The standard universal goniometer has the added benefit of being conveniently portable, thus making the measurement of ranges of movement in the community possible. The active range of movement measurements done in this study were therefore done using a standardised universal goniometer with a standardised method.

2.7 Conclusion

This literature review was conducted to determine the current situation with regards to patients living with stroke in the community and their ability to function independently. The literature has confirmed that many people who are discharged from hospital after having a stroke are not functional enough to be independent in the community. In addition to this many people do not continue with rehabilitation after their discharge (for a variety of reasons) and, remain largely un-functional in the community. We have seen that function is largely affected by the impairments that the person with stroke has to deal with and that muscle strength, active range of movement, pain, and tone abnormalities play a large part in determining how functional they can be. This study was designed to assess the presence of these impairments (muscle strength, active range of movement and pain) and to determine the extent that each of them affects the person with stroke's functional ability. A review of the literature was conducted focussing on each of the outcome measures used in order to ensure that the appropriate measures were chosen for the study.

CHAPTER 3

3. METHODOLOGY

3.1 Study Design

This was a cross sectional study.

3.2 Subjects

3.2.1 Source of subjects

Subjects for the study were patients with stroke residing in the Daveyton area. Daveyton is a township on the east of Ekurhuleni. Literature on the socio-economic conditions of this community is limited. In 1984 Basson et al. found that the mean family income in Daveyton was R405 per month, approximately 20% of the Daveyton population owned a home and persons per house (pph) varied between 2.7 pph during the week and 5.2 pph on the weekends. A more recent census was done for the greater Ekurhuleni area and revealed that 12% of the metropolitan population reside in Daveyton, a historically disadvantaged community. Despite the fact that per capita income, unemployment, poverty and average wages, Ekurhuleni is similar to the rest of Gauteng, it has been noted that Daveyton is among the poorer, peripheral areas of the Ekurhuleni metropolitan area (www.ekurhuleni.com). The John Wesley Community Center is a center committed to improving the quality of life of the Daveyton people in general, but specifically the increasing number of families infected and affected by HIV and AIDS. The John Wesley Community Center was approached to act as a point of contact in the community for the researcher. Members of the community who were living with stroke and the people caring for them were identified with the assistance of the John Wesley Center employees and they were approached to take part in the study.

3.2.2 Sampling and Sample Size

According to Nunnaly et al. (1978: 230 - 245) for every factor which may influence functional ability, the researcher would need 10 patients. Thus, the minimum number of patients required for this study would be 30 because of the three factors being used. Consecutive sampling was used.

3.2.2.1 Inclusion and Exclusion Criteria

i) Inclusion Criteria

- All patients with a stroke for the first time aged 18 to 85 years.
- Any type of stroke
- At least 6 months post stroke (after expected plateaux)
- Living in Daveyton at the time of the study

ii) Exclusion Criteria

- Any concurrent form of physical disability or debilitating illness at the time of the study

3.3 Ethical Considerations

The researcher obtained ethical clearance from the Committee for Research on Human Subjects of the University of the Witwatersrand (clearance number: M080956; Appendix A)

Permission was obtained from the Northfield Methodist Church (Appendix B) and the John Wesley Community Center (Appendix C). The patients and their care-givers were required to complete an informed consent form prior to taking part in the study. English, IsiZulu and Sesotho versions of the information letter were made available (Appendices D to F)

A translator was present for the informed consent, the demographic questionnaire and all the outcome measures. Data collected were kept safe and confidential and were only used for the intended purposes.

3.4. Measuring Instruments

The following instruments were used for the data collection process.

- The Modified Rivermead Mobility Index (MRMI): to determine the patients' level of mobility. (Appendix G)
- The Barthel index (BI): to determine the patients' activities of daily living functional level. (Appendix H)
- A Calibrated Hand-held Dynamometer: to test muscle strength (Calibration certificate – Appendix I)
- The Eleven faces pain scale: to determine the presence and severity of pain. (Appendix J)
- A standard universal goniometer: to test the range of movement in the joints that lacked full range of movement.
- A demographic questionnaire: A demographic questionnaire was designed for completion by each patient. The demographic questionnaire identified the basic demographic variables of the patients i.e. age, gender, and home language. It also determined their length of hospital stay, whether or not they received rehabilitation and, if they were receiving any home based care and what it consisted of. (Appendix K)

3.5 Procedure

3.5.1. Pilot Study

The purpose of the pilot study was to ensure that the researcher and interpreter were familiar with the questionnaire, instruments and process prior to the study. It also assisted in determining the approximate time required to complete the informed consent document, the questionnaire and all the testing per patient, to check the length of time required. The pilot study was also used to identify any unforeseen problems for the data collection process.

The pilot study was conducted on five patients in the Daveyton area. A translator was coached on the use of the questionnaire, the instruments and measures, to ensure accurate translation during the study. Each patient went

through the exact procedure, which was used in the main study in order to familiarise the researcher and interpreter with the procedure.

The pilot study revealed that the entire process took on average 45 minutes per patient and by the end of the pilot study both the researcher and interpreter were familiar with the questionnaire, instruments and process. An interesting observation that was made during the pilot study was that two thirds of the patients, including those who spoke IsiZulu and Sesotho, requested the English version of the information document. A section of repetition was discovered in the information document and removed and some additional information was added to the demographic questionnaire (inpatient rehabilitation, outpatient rehabilitation and time since the stroke). This information was identified as useful for discussion purposes once the data had been analysed.

The way in which the data were captured was refined to indicate clearly whether the result denoted a positive or negative value with regards to range of movement. For measurements of extension, zero was taken as full extension and any limitation in extension of that joint was notated as a negative number of degrees into flexion. The last change that was made was that a disposable cover was provided for the head of the dynamometer for hygiene purposes. A new cover was applied as the testing of each patient commenced, and discarded at the end of the strength testing.

Intra-rater reliability for the dynamometer and goniometer was established using four inpatients at the Netcare Rehabilitation Hospital. The patients were tested for strength and range of movement as per the procedure to be used in the main study. They were then re-tested the following day to ensure as similar readings as possible. A difference of five degrees of range of movement was set as the maximum acceptable difference in consecutive readings. This was based on the goniometry validity and reliability study done by Armstrong et al. (1998). The maximum acceptable difference in consecutive readings for the dynamometry was set at 5 lbs according to the converted results from the study by Berry et al. (2004) on the validity and

reliability of dynamometry with neurologically impaired individuals. The first intra-rater reliability testing revealed a 45% similarity between the two testing sessions. This required the testing to be repeated. A new set of patients was tested after the researcher had practiced the use of the instruments and developed the procedures to be more standardised. The second round of the intratester reliability testing yielded a result of 71% similarity which was considered acceptable.

3.5.2 Main Study

Permission was requested in writing from the Northfield Methodist Church, which runs the John Wesley Community Center in Etwatwa.
Members of the community who are served by the Center and who were living with stroke were approached to seek their permission to participate in the study. A caregiver from the Community Center was approached to be employed as a translator. Employees of the John Wesley Community Center assisted in identifying and locating potential candidates for the study from the community.

The study participants were visited in their homes by the researcher and the translator. Once the caregiver/patient had welcomed the researcher and translator into their home, the information sheet was explained and interpreted where necessary. The caregiver and the patient with stroke were each requested to sign an informed consent form. This was done to ensure that even if the patient did have mild cognitive deficits, which would impact their understanding of the information document, the consent was still provided by a second person who was able to make an informed decision regarding consent. The demographic questionnaire was translated where necessary and completed.

The patients were then required to perform the various tests of the Modified Rivermead Mobility index (using a standardised set of portable steps) and were interviewed regarding the components of the Barthel index.

The Eleven faces pain scale was then explained and translation was done where necessary. The partients were then requested to mark the pain scale themselves to indicate the degree of pain that was experienced.

The following physical impairments were then assessed:

3.5.2.1. Strength Measurements

Prior to the measurement of each muscle strength the movement was explained to the patient as described and the movement facilitated once. The patient was then asked to demonstrate the desired movement. A calibrated hand-held dynamometer was used to assess the strength of the following muscles bilaterally:

Middle Deltoid

The patient was positioned in sitting with his/her feet supported on the ground. The elbow of the arm being tested was flexed to 90 degrees and placed on the waist of the patient. The dynamometer was positioned immediately superior to the lateral epicondyle of the elbow. The patient was then requested to “Lift the elbow away from the body” maximally and the reading taken at mid-range.

Biceps

The patient was positioned in sitting with his/her feet supported on the ground. The elbow of the arm being tested was flexed to 90 degrees and placed on the waist of the patient. The forearm was then supinated and the dynamometer was placed immediately proximal to the crease of the wrist on the ventral aspect of the forearm. The patient was then requested to “bend the elbow” maximally and the reading taken at mid-range.

Triceps

The patient was positioned in sitting with his/her feet supported on the ground. The elbow of the arm being tested was flexed maximally and placed on the waist of the patient. The forearm was then supinated and the dynamometer was placed immediately proximal to the wrist on the dorsal aspect of the forearm. The patient was then requested to “straighten the elbow” maximally and the reading was taken at mid-range.

Illiopsoas

The patient was positioned in sitting with his/her feet supported on the ground. The patient was requested not to hold onto the bed or lean backwards during the test. The dynamometer was placed immediately proximal to the patella on the anterior aspect of the thigh. The patient was then requested to “lift the whole foot off the ground” maximally and the reading was taken at mid-range.

Quadriceps

Patient was positioned in sitting with his/her feet supported on the ground. The patient was requested not to hold onto the bed or lean backwards during the test. The dynamometer was placed immediately superior to the ankle joint on the anterior aspect of the tibia. The patient was requested to “straighten the knee” maximally and the reading was taken at mid-range.

Gluteus Medius

The patient was positioned in side lying with one leg lying exactly on top of the other one, hips and knees slightly flexed. The dynamometer was placed immediately proximal to the lateral epicondyle of the femur of the top leg. The patient was then requested to “lift the whole leg off of the bottom leg” maximally and the reading was taken at mid-range.

Gluteus Maximus

The patient was positioned in prone with the knee of the leg being tested flexed to 90 degrees. Where possible, this was done actively. In cases where active knee flexion was not possible, the knee was stabilised by the researcher in 90 degrees flexion. The dynamometer was placed immediately proximal to the popliteal crease. The patient was requested to “lift the knee off the bed” maximally and the reading was taken at mid-range.

Hamstrings

The patient was positioned in prone with both knees extended. The dynamometer was placed immediately proximal to the Tendon Achilles. The patient was then requested to “bend the knee” maximally and the reading was taken at mid-range.

Tibialis Anterior

The patient was positioned in supine with both knees extended. The dynamometer was then placed immediately proximal to the metatarso-phalangeal joints on the ventral aspect of the foot. The patient was then requested to “lift the toes using the ankle” maximally and the reading was taken at mid-range.

Gastrocnemius

The patient was positioned in supine with both knees extended. The dynamometer was placed on the ball of the foot. The patient was then requested to “push down with the ankle” maximally and the reading was taken at mid range.

3.5.2.2 Range of Movement Measurements

Prior to the measurement of each range of movement, the movement was explained to the patient as described and the movement facilitated once. The

patient was then asked to demonstrate the desired movement independently and hold the position at maximal range for the goniometer to be positioned. The patient was then encouraged to “take it as far as you can” and the reading was taken at maximal range of movement.

A standard universal goniometer was used to assess the range of movement of the following movements bilaterally:

Shoulder Flexion

The patient was positioned in sitting with his/her feet supported on the ground. The patient was requested to “lift your hand to the front as high as you can”. The goniometer axis was then placed on the acromion process, the fixed arm held parallel to the trunk and the moving arm bisected the upper arm.

Shoulder Lateral Rotation

Patient was positioned in sitting with his/her feet supported on the ground. The elbow of the arm being tested was flexed to 90 degrees, supinated and placed on the waist of the patient. The patient was then requested to “move your hand away from your body without separating your elbow from your waist”. The goniometer axis was placed on the olecranon process, the fixed arm was held perpendicular to the coronal plane of the body and the moving arm was held along the medial edge of the ulna.

Elbow Extension

The patient was positioned in sitting with his/her feet supported on the ground. The shoulder of the elbow being tested flexed to 90 degrees (where possible) and the patient was then requested to “straighten the arm with your palm facing up”. The goniometer axis was placed on the lateral epicondyle of the elbow, the fixed arm bisected the upper arm and the moving arm was held along the medial edge of the ulna.

Hip flexion

The patient was positioned in side-lying with the hips and knees slightly flexed and the upper most arm rested behind the patient. The patient was requested to “pull your knee up to your face without moving the rest of your body”. The goniometer axis was placed on the greater trochanter of the Femur, the fixed arm was held parallel to the trunk and the moving arm bisected the thigh.

Knee extension

The patient was positioned in side-lying with the hips and knees slightly flexed. The patient was requested to “Straighten your knee as much as you can”. The goniometer axis was placed on the lateral knee joint cleft, the fixed arm bisected the thigh and the moving arm was held along the lateral edge of the fibula.

Dorsiflexion

The patient was positioned in supine with the knees extended. The patient was requested to “lift the toes using the ankle”. The goniometer axis was placed inferior to the lateral malleolus, 1 cm from the plantar surface of the foot, the fixed arm was held along the lateral edge of the fibula and the moving arm was held against the fifth (little) toe.

The researcher explained the components of each measure and translation was done where necessary. Once the research was complete, a feedback meeting was arranged in the John Wesley Center in order to inform all those who participated in the study of the results.

3.5.2.3 Mobility and Activities of Living Functional Ability Measures

A score of 12 on the Barthel index represents the 60% mark and is used as the cut-off disability.

A specific source could not be found which detailed the cut-off score for the Modified Rivermead Mobility Index in terms of dependency/independency of the patients, so the 60% cut-off of the Barthel index was applied to the MRMI resulting in a score of 24 being used a point to distinguish mobile from immobile patients.

3.6. Data Analysis

Of interest in this study was the correlation between the impairment parameters and the Barthel index and Rivermead Mobility Index scores of functional ability. Since most of the parameters observed were on a continuous scale, the observed data were summarised using descriptive statistics i.e. mean, standard deviation, median, range, 95% confidence interval and graphical displays such as histograms.

The strength of the linear relationships between the parameters of interest was expressed using the Spearman's rank correlation coefficient due to the distributional properties of the data. The significance of the study was set at the 0.05 level of significance.

CHAPTER 4

4. RESULTS

4.1 Introduction

The objectives of this study were to establish: the prevalence of pain; the impairments in terms of strength and range of movement; the levels of mobility and the functional abilities of the patients living with stroke in the Daveyton community. The last objective was to establish if a relationship existed between the impairments (strength, RoM and presence of pain) and the patients' functional abilities.

The results will first describe the sample size, then consider the demographic data which may have an influence on the results regarding the abovementioned objectives and finally consider the results with regards to each specific objective.

4.2 Sample Size

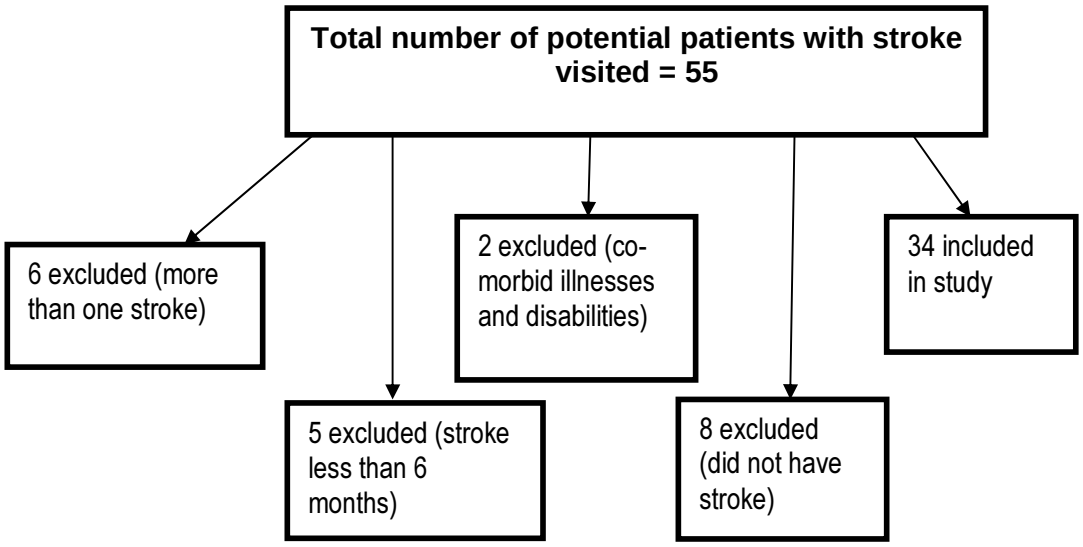

Figure 4.1 Sample collection process

From an initial total of 55 patients visited, 34 fitted the inclusion criteria and thus made the study sample.

4.3 Demographic Information

4.3.1 Gender Distribution

Figure 4.2 below shows the gender distribution of the study sample.

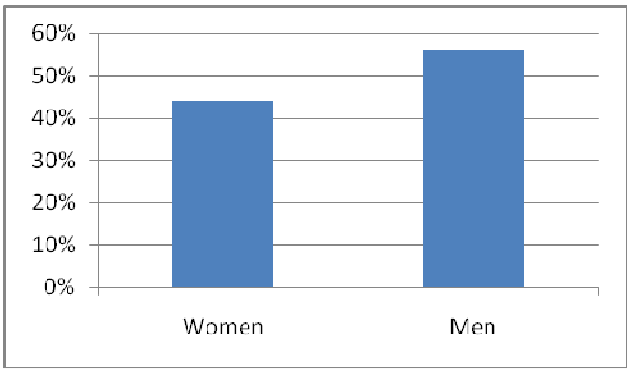

Figure 4.2 Gender distribution (n = 34)

There were more male (56%) than female (44%) patients.

4.3.2 Age of Sample

The average age of the sample was 56 years with the youngest patient being 30 years and the oldest 83 years.

4.3.3 Affected Side

There was little difference between the number of patients with affected right versus left side. There were slightly more patients with left sided signs at (58.8%) than those with right sided signs (41.2%).

4.3.4 Length of hospital stay

Table 4.1 below shows the distribution of the patients' length of hospital stay

Table 4.1 Patients' length of hospital stay (n = 34)

Duration of Hospital stay (Weeks)	n(%)
No admission	10(29.4)
< 1week	3(8.8)
1- 3 weeks	7(20.6)
3 – 6 weeks	7(20.6)
>6 weeks	7(20.6)

About 29% of the patients were never admitted to hospital. The distribution of the patients was evenly spread between those who spent "one to three weeks", "three to six weeks" and "more than six weeks" in hospital following the stroke.

4.3.5 Time since Stroke

Table 4.2 below shows the distribution of the length of time since the patients' stroke

Table 4.2 Time since stroke (n=34)

Time since Stroke	n(%)
Six months to one year	2(5.9)
1 year	3(8.8)
2 years	3(8.8)
3 years	4(11.8)
4 years	2(5.9)
5 years	7(20.6)
6+ years	13(38.2)

The majority of the patients (65%) had experienced their stroke more than three years prior to the study with the category containing the largest number of patients being that of patients who had experienced their stroke six or more years ago (38.2%).

4.3.6 Rehabilitation

Figure 4.3 describes the distribution of the different types of rehabilitation received by the sample group.

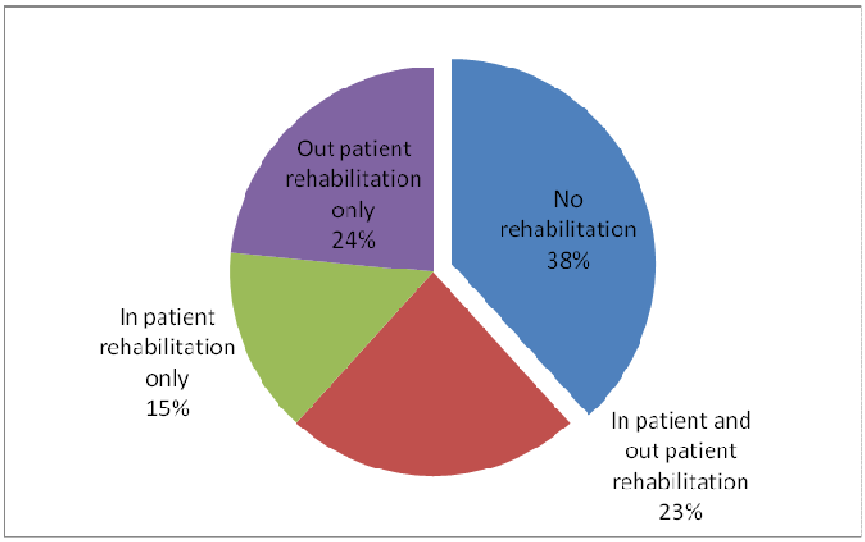

Figure 4.3 Rehabilitation received by the sample group (n = 34)

Thirty eight per cent of the patients examined had never received any form of rehabilitation. In general, 38% of the population had received inpatient rehabilitation and 47% received outpatient rehabilitation.

4.4 Prevalence of Pain

Figure 4.4 below details the distribution of the levels of pain reported by the patients included in the sample.

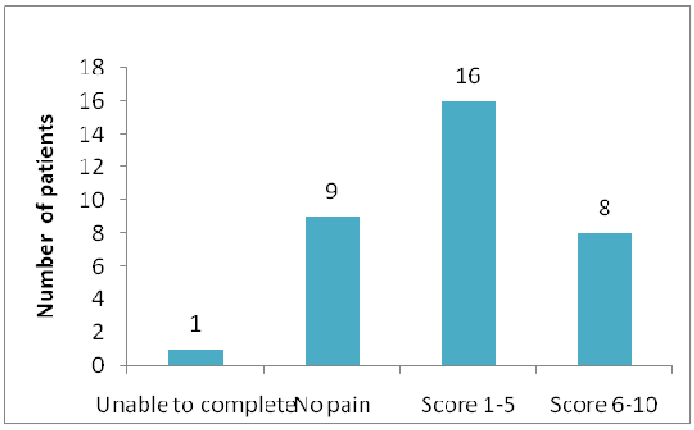

Figure 4.4 Distribution of Eleven faces pain scale scores (N = 34)

Of the patients visited, one could not comprehend what was being requested of her in the scale, and thus was unable to complete it. Of the remaining 33 patients, 24 patients reported experiencing pain. Thus 72.7% of the patients who were able to complete the scale reported experiencing pain. Most patients (16) reported pain levels in the lower half of the scale (score one to five). The mean for pain experienced by the patients was 3.3 (±SD=3.1). The data were, however slightly skewed and thus a median was calculated, and resulted in a value of three (IQR= 0 to 5) which was similar to the values calculated for a normal distribution.

4.5 Physical Impairments present in patients

4.5.1 Strength

The mean and standard deviation was calculated for each muscle on the affected and unaffected sides. The differences between mean values of the affected and unaffected sides were obtained in order to demonstrate the

average level of strength impairment for each muscle. These statistics can be seen in Table 4.3 below.

Table 4.3 A comparison of the strength in the affected versus the unaffected side by muscle (n = 34)

Affected Side	Mean (±SD) (in pounds)	Unaffected Side	Mean (±SD) (in pounds)	Difference between affected and unaffected side (in pounds)	p-value	95% Confidence Interval
Mid Deltoid	12.4(8.7)	Mid Deltoid	22.5(11.1)	10.1	<0.001	5.3 – 14.9
Biceps	13.3(12.3)	Biceps	27.4(14.5)	14.1	<0.001	7.6 – 20.6
Triceps	9.1(8.2)	Triceps	17.4(7.6)	8.3	<0.001	4.5 – 12.1
Illiopsoas	23.4(15.2)	Illiopsoas	31.6(14.4)	8.2	0.25	1.0 – 15.4
Gluteus Maximus	12.9(10.4)	Gluteus Maximus	18.7(11.6)	5.8	0.03	0.5 – 11.2
Gluteus Medius	21(12.1)	Gluteus Medius	29.1(13.4)	8.1	0.01	1.9 – 14.3
Quadruceps	20.4(11.4)	Quadruceps	27.8(11.8)	7.4	0.01	1.7 – 13.0
Hamstrings	12.6(10.0)	Hamstrings	23.2(13.7)	10.6	<0.001	4.8 – 16.4
Tibialis Anterior	10.5(12.9)	Tibialis Anterior	23.1(13.9)	12.6	<0.001	6.1 – 19.0
Gastrocnemius	16.9(12.5)	Gastrocnemius	30.0(12.7)	13.1	<0.001	7.1 -19.3

The strength of the unaffected limbs was generally greater than that of the affected side. The Iliopsoas muscle strength had the highest mean value (23.4 Lbs; 31.6 Lbs) and triceps (9.1 Lbs; 17.4 Lbs) had the lowest mean value on the affected and unaffected side. The greatest differences in strength were found in Biceps (13.74 Lbs), Gastrocnemius (14.1 Lbs) and Tibialis Anterior (12.56 Lbs). The smallest strength difference was found in Gluteus maximus (5.84 Lbs). All the differences in strength were found to be statistically significant ($p \leq 0.05$).

4.5.2 Active Range of Movement

The mean and standard deviation was calculated for each joint range of movement on the affected and unaffected side. The differences between the mean values of the affected and unaffected sides were obtained in order to demonstrate the average level of impairment in terms of active range of each movement. The statistical data regarding these differences can be seen in table 4.4 below.

Important to note is that with regards to elbow extension, knee extension and dorsiflexion – full elbow extension, full knee extension and neutral dorsiflexion were scored as zero. Any limitation into elbow flexion, knee flexion and plantarflexion were scored negatively. For this reason, the lower the score for these three measures, the better the range being tested.

Table 4.4 A comparison of the active ranges in the affected versus the unaffected side by movement (n = 34)

Affected Side	**Mean (±SD) (in degrees)**	**Unaffected Side**	**Mean (±SD) (in degrees)**	**Difference between affected and unaffected side**	**p-value**	**95% Confidence Interval**
Shoulder flexion	**77.3 (52.5)**	Shoulder flexion	131.4 (30.2)	54.15	< 0.001	33.4 – 74.9
Shoulder Lateral rotation	**32.4 (33.5)**	Shoulder Lateral rotation	65.4 (26.1)	33	< 0.001	18.4 - 47.6
Elbow extension	**-46.3 (51.8)**	Elbow extension	-3.1 (26.3)	43.21	< 0.001	23.3 – 63.1
Hip flexion	**96.6 (36.7)**	Hip flexion	106.4 (27.4)	9.83	0.22	-5.9 – 25.5
Knee extension	**-12.2 (27.0)**	Knee extension	-7.8 (23.7)	4.42	0.48	-8.0 – 16.8
Dorsiflexion	**-13.0 (17.3)**	Dorsiflexion	1.3 (11.8)	11.73	<0.001	7.1 – 21.5

The ranges of movement found on the unaffected side were poorer than those found in the affected side. Hip flexion had the highest mean range of movement value on the affected side (96.6º) and Shoulder flexion had the highest mean range of movement value on the unaffected side (131.4º). The greatest differences in range of movement were found in shoulder flexion (54.2º) and elbow extension (43.2º). The smallest difference in active range of movement was found in knee extension (4.4º). All the differences in range of movement were found to be statistically significant ($p \leq 0.05$) except those of hip flexion and knee extension. The p – values of these measurements were both greater than p = 0.05 and their 95% confidence intervals included 0, they were therefore determined not to be statistically significant differences.

4.6 The level of mobility of patients with stroke living in the community

The distribution of the MRMI scores obtained from the sample is displayed in Figure 4.5 below.

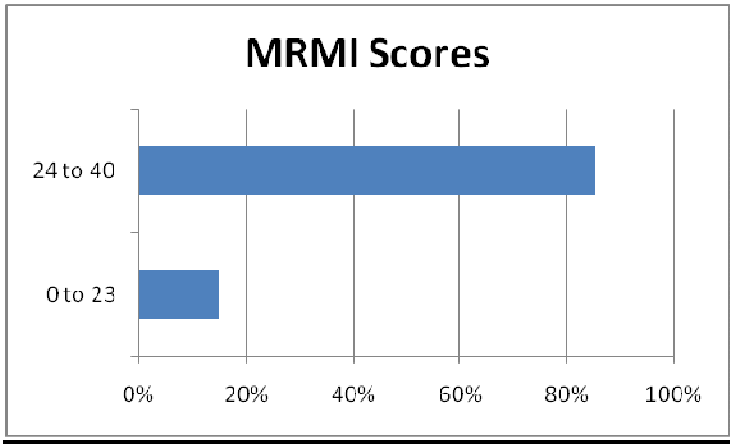

Figure 4.5 Distribution of MRMI Scores (N = 34)

Eighty-five per cent of the patients scored above 24 on the MRMI. The mean MRMI score obtained for this sample was 33.4 (±SD=9.8). These data were, however, slightly skewed and the median was thus calculated. The median score was 38.5 (6;40).

4.7 Activities of daily living functional ability levels of patients with stroke living in the community

Figure 4.6 below represents the Barthel index scores achieved by the sample.

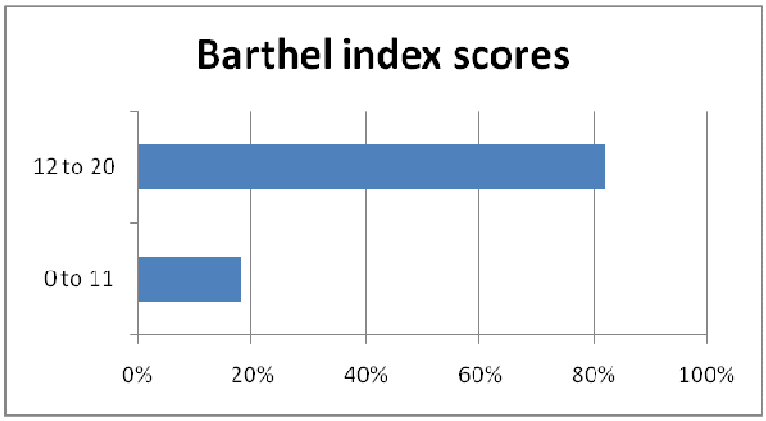

Figure 4.6 Distribution of Barthel index Scores (N = 34)

Eighty-two per cent of the patients scored above 12 on the Barthell Index. The mean Barthel score obtained for this sample was 16.1 (±SD=4.1). These data were, however, slightly skewed and the median was thus calculated. The median score was 18 (4;2).

4.8 The relationship between the patients' strength, ROM and pain and their functional abilities.

Table 4.5 below shows the correlations between the functional abilities of the patients, as measured by the Barthel index and Modified rivermead mobility index, and the measurements taken for pain, range of movement and strength. Correlations of excellent relationships have been highlighted in red, and those of moderate to good relationships have been highlighted in yellow.

Table 4.5 The Spearman's rank correlation coefficient table for the correlations between functional measures and impairment measurements.

Moderate to good relationships (0.50 – 0.75) Excellent relationships (>0.75)

Variables	Affected side				Unaffected side			
	MRMI		Barthel		MRMI		Barthel	
	r	p	r	p	r	p	r	p
Pain	0.14	0.45	0.15	0.40	0.14	0.45	0.15	0.40
Strength								
Mid Deltoid	0.63	0.001	0.74	<0.001	0.67	<0.001	0.72	<0.001
Biceps	0.45	0.01	0.54	<0.001	0.62	<0.001	0.61	<0.001
Triceps	0.45	0.01	0.54	<0.001	0.55	<0.001	0.55	<0.001
Illiopsoas	0.65	<0.001	0.67	<0.001	0.76	<0.001	0.79	<0.001
Gluteus Maximus	0.15	0.40	0.34	0.05	0.32	0.070	0.52	0.002
Gluteus Medius	0.69	< 0.001	0.66	<0.001	0.70	<0.001	0.74	<0.001
Quadruceps	0.64	<0.001	0.67	<0.001	0.64	<0.001	0.61	<0.001
Hamstrings	0.51	0.002	0.58	<0.001	0.52	0.002	0.55	<0.001
Tibialis Anterior	0.59	<0.001	0.54	<0.001	0.58	<0.001	0.61	<0.001
Gastrocnemius	0.58	<0.001	0.58	<0.001	0.71	<0.001	0.68	<0.001
ROM								
Shoulder flexion	0.55	<0.001	0.56	<0.001	0.45	0.008	0.51	0.002
Shoulder Lateral rotation	0.60	<0.001	0.61	<0.001	0.40	0.02	0.32	0.06
Elbow extension	0.29	0.09	0.21	0.22	0.26	0.14	0.26	0.13
Hip flexion	0.16	0.40	0.14	0.46	0.15	0.40	0.12	0.500
Knee extension	0.40	0.02	0.47	0.005	0.41	0.02	0.36	0.037
Dorsiflexion	0.55	<0.001	0.48	0.004	0.56	<0.001	0.55	<0.001

The relationship between strength and the functional measures was moderate to good for all the muscles tested except for the Illiopsoas on the unaffected side (which displayed an excellent relationship with both MRMI and BI) and gluteus maximus bilaterally (which displayed only a moderate to good relationship between the unaffected side and the Barthel index). The

correlation between most of the strength measurements was highly significant.

Range of movement measurements displayed less noteworthy relationships with the two functional measures. The active range of shoulder flexion or the affected side showed moderate to good relationships with both the MRMI and BI scores, while the same movement on the unaffected side displayed a moderate to good relationship with the BI scores alone. Lateral shoulder rotation on the affected side also showed moderate to good relationships to both the MRMI and BI scores. Dorsiflexion on the unaffected side showed moderate to good relationships with both the MRMI and BI scores, while the same movement on the affected side displayed a moderate to good relationship with MRMI scores alone. Pain did not correlate with function in these results.

In conclusion, 72.7% of the sample experienced pain but the median pain score was only 3/11, indicating a relatively low level of pain intensity. Eighty-five percent of the patients were independently mobile and 82% were independent in their activities of daily living. Statistically significant differences were found between the strength of all the muscles of the affected and unaffected sides, with the most significant differences occurring in Biceps, Gastrocnemius and Tibialis anterior. Most of the active ranges of movement of the affected side were statistically less than those of the unaffected side and the most significant differences were found in shoulder flexion and elbow extention. The strength of most of the muscles tested correlated well with the MRMI and BI scores, with Illiopsoas on the unaffected side displaying an excellent correlation with both. Active range of movement of the shoulder flexors, lateral rotators and dorsiflexors correlated well with the MRMI and BI scores. Pain displayed no correlation to function or mobility. These results will be discussed in the following chapter.

CHAPTER 5

5. DISCUSSION

5.1 Introduction

The intention of this research was to investigate the current situation of patients with stroke living in the Daveyton community with regards to the pain prevalence, activity of daily living functional levels, levels of mobility and physical impairments. The findings of this study on these objectives will now be discussed in detail.

5.2 Sample size and distribution

The original recommended sample size was 34 subjects and this sample size was met for the study.

There were more men (56%) included into the sample than women (44%). This result is not unlike the results reported in the literature. Men are cited as being more commonly affected by stroke, particularly in their earlier years. This phenomenon has been attributed to the protective effects of oestrogen. This proportion is typically reversed in the older years due to the tendency for women to live longer and the absence of their oestrogen post menopause (Appelros et al., 2009).

There were slightly more patients with left sided signs at (58.8%) than those with right sided signs (41.2%). The literature which examines the clinical outcomes dependent on stroke side is limited. What could be found suggested that there is no difference in the functional outcomes of patients with left hemispheric involvement and those with right hemispheric involvement (Fink et al., 2008).

Contrary to the literature found on length of hospital stay in South Africa, the majority of the patients included in this sample remained in hospital for more than a week. In fact, approximately 20% of the patients had spent more than

six weeks in hospital after the stroke. Most of the studies reporting on length of stay in South African hospitals were, however, conducted in the Chris Hani Baragwaneth Hospital (Hale and Walner (1996); Hale and Eales (1998); and Mudzi et al. (2009)). The majority of this sample group were hospitalised in Tambo Memorial Hospital or The Far East Rand Hospital. It is possible that the urgency for beds in these, less centralised, hospitals was not as severe.

The majority of the sample group experienced their stroke many years prior to the study. Sixty-five per cent of the patients had a stroke more than three years prior to the study. The John Wesley Community Center typically assists patients who have been living with their disability for some time and are known in the community. The patients with more acute stroke would probably still be receiving assistance from the hospital or clinic and thus not need the services of the John Wesley Center. This community center was utilised to identify the patients to be used in this study and this may be the reason for the relatively high number of years post stroke found in this sample.

In the literature it was stated that 50% of the patients who had a stroke did not receive any rehabilitation while at the Chris Hani Baragwaneth Hospital (Mudzi, 2009). Sixty two of the patients in this study sample did receive some form of rehabilitation, but only 38.2% reported receiving inpatient rehabilitation. This is surprising considering the comparatively longer hospital stay. It would indicate that, while the patients were allowed to stay in hospital for longer than reported by Mudzi (2009), they did not benefit from proportionally greater amounts of inpatient rehabilitation. Twenty-three per cent of the patients who reported receiving no inpatient rehabilitation did report receiving outpatient rehabilitation. Regardless of inpatient rehabilitation, 47% of the sample had made use of outpatient rehabilitation services. They reported receiving exercises to help with the stroke from local clinics and hospitals and some reported family members providing the much needed ‘exercises’. Of these patients receiving outpatient rehabilitation, 87% had more than six weeks of rehabilitation. The fact that outpatient rehabilitation is compensating for the lack of much needed inpatient rehabilitation is mildly

reassuring, but the fact remains that 38% of the sample never received any form of rehabilitation.

Rehabilitation has been shown to improve the functional abilities of patients with stroke (Bode et al., 2004). Inpatient rehabilitation, in particular, has been found to be very important in determining the functional outcome of these patients (Huang et al., 2009, deVilliers et al., 2009). In a study conducted by Huang et al. (2009) they found that earlier rehabilitation intervention was the factor which correlated most significantly with function in activities of daily living and improvement in Barthel index Scores at nearly all the intervals assessed (1 month ($r = 0.72$), 3 months ($r = 0.74$), six months ($r = 0.74$) and even with a lasting effect as long as 12 months ($r = 0.60$)). In addition, they also found that high doses of rehabilitation intervention (as is found in inpatient rehabilitation) have a significant effect on the functional outcomes of patients when received within the first six months post stroke. DeVilliers et al. (2009) found that the implementation of a multidisciplinary stroke unit in a South African secondary hospital resulted in decreased mortality rates and an increase in the referral of stroke patients to rehabilitation. The authors of this study concluded that they found that inpatient rehabilitation improved stroke care in the South African setting.

5.3 Prevalence of pain

There was a very high prevalence of pain among the study sample group with 73% of the 33 patients who were able to complete the pain scale reporting pain to one degree or another. Lundstrom et al. (2009) reported that 21% of patients with stroke suffer from some form of post-stroke pain while Sackley et al. (2008) reported a 55% prevalence of pain. What was also interesting in the latter study was that they found that the residential option where pain was most prevalent was a nursing home. In 2006 Jönsson et al. conducted a study in which they found that the prevalence of pain in patients post stroke diminished from 32% (four months post stroke) to 21% (16 months post stroke) but that the intensity of pain in those experiencing it increased.

Bender and McKenna (2001) reported that 70% of patients with stroke suffer from shoulder pain alone, which is slightly more than the 55% found by Sackley et al. (2008). In a study conducted by Andersen et al. (1995) they found that 8% of patients with stroke suffered specifically from central post-stroke pain. Reflex sympathetic dystrophy was found to be a cause of pain in 30.5% of the sample studied by Gokkaya et al. (2006).

The relatively high prevalence of pain in this sample group could be due to the fact that the nature and location of the pain experienced by the patients was not defined. Consequently pain located anywhere in the body, and even the slightest degree of pain was recorded. In addition to this, many of the other results were obtained in studies conducted in developed countries where access to pain management may have been better, resulting in a limited number of patients who continued to experience post-stroke pain.

There was one patient who was unable to complete the Eleven faces pain scale because she was unable to understand what was required of her. This particular patients' cognitive difficulties even made it impossible to conduct the demographic questionnaire with her directly. She did, however, understand gestures and facilitation sufficiently well to have her impairments tested and so she was included into the study without her pain score. It is possible that the patients struggled due to the number of choices given to them in this tool, and maybe even with the entire concept of quantifying pain. The observation was, however, that very rarely did the patients choose an option which contradicted their clinical presentation (i.e. marking a very high score for pain when they appeared to move fairly effortlessly and painlessly).

The median pain score was 3 (0;5) which indicated that the patients in this sample predominantly experienced fairly low pain levels. The patients complained primarily of pain in the affected limbs, especially the affected shoulder and foot. In the study by Kim and Buschmann (2006) which assessed the use of the Eleven faces pain scale in the elderly, the mean score found was 8.4, indicating a much higher intensity of pain among this population. This study was, however, designed to test a pain scale and so one

of the inclusion criterion was that the patients had to suffer from chronic pain. This would explain the higher intensity of pain among this population.

5.5 Physical impairments present in patients

5.4.1 Strength

The strength measurements were obtained from both the affected and unaffected sides. The differences between the affected and unaffected side mean values were used to determine the degree to which the strength of each muscle was impaired within the sample. The unaffected side was relatively stronger than the affected side. The greatest differences in strength were found in Biceps (13.74Llb), Gastrocnemius (13.18Llb) and Tibialis Anterior (12.56Llb). Weakness of the ankle muscles has been cited as a problem for many stroke patients manifesting in abnormal gait pattern (Neckel et al., 2006; Lamontagne et al., 2002; Lin et al., 2006; Yang et al., 2006).

It has been found that patients with stroke who have the greatest torque in typically spastic muscles show the greatest strength deficits in the muscles responsible for the opposing movements (Lum et al., 2003). This would lead one to expect triceps to be weaker than the typically spastic biceps. The results of this study found the same to be true and, while biceps displayed the greatest strength impairment of all the muscles tested, it remained stronger than triceps. The opposite was found to be true in the studies by Colebach et al. (1986) and Andrews and Bohannon (2000). In 2003 Ada et al. found that the ratio of muscle actions differed depending on the portion of the range of movement that they were being tested in. When muscle strength was tested at 100 degrees elbow flexion, triceps were found to be less affected than biceps. However, when the testing was done at 20 degrees elbow flexion, the converse was found to be true. Thus, muscles generally test weaker in their shortened ranges (Ada et al., 2003; Ada et al., 2000). If one considers that there was a highly significant impairment in the active range of elbow extension of this sample, it would be safe to assume that the majority of the patients in this sample would have to have their biceps tested in a degree of elbow flexion (as limited by the active range of movement), thus possibly in

the shortened range of biceps – resulting in the marked impairment when compared to the unaffected side.

In 2000 Andrews and Bohannon examined the distribution of strength impairments in patients post stroke. They found that their patients displayed decreased strength on both the affected and unaffected sides of the body. Despite the fact that both sides were weaker, they did confirm that the side contra-lateral to the lesion would be the weaker of the two. More specifically, they found that the proximal muscles and muscles eliciting flexion movements (particularly of the upper-limbs) tended to be the weaker groups. Similarly, the patients displayed an obviously weaker side, which was assumed to be the side contra-lateral to their lesion.

When strength differences between the affected and unaffected side for biceps (14.1 Lbs) and triceps (8.3 Lbs) were compared, it becomes clear that the results of this study concur with the finding that the upper-limb flexors tend to be weaker than their antagonistic extensors. However, when the same is done to compare the most proximal lower limb muscle tested (Illiopsoas (8.2 Lbs) and Gluteus maximus (5.8 Lbs)), and the most distal, (Tibialis Anterior (12.56 Lbs) and Gastrocnemius (13.1 Lbs)), one notices that the proximal muscle group appears to have lost less of its strength than the distal group. Gluteus maximus, displayed the smallest strength difference (5.84 Llb) indicating that the least amount of strength had been lost. This muscle was, however, the most difficult to test as some of the patients struggled to assume the correct position. Every effort was made to ensure that the correct, standardised position was used, but the difficulty in assuming this position in order to test both the affected and unaffected side's strength may explain the relatively small difference in strength.

5.4.2 Active range of movement

The ranges of movement were obtained from both the affected and unaffected sides. The differences between the affected and unaffected side mean values were used to determine the degree to which the range of each movement was impaired within the sample. The greatest differences in range of movement

were found in shoulder flexion (54.15°) and elbow extension (43.21°). The upper-limb is typically the most severely affected with regard to increased tone and decreased range of movement (active and passive) post stroke. Somerfeld et al. (2004) found that 65% of their stroke patients with spasticity experienced spasticity in the upper-limb only, as opposed to the five per cent who experienced only lower limb spasticity. O'Dwyer et al. (1996) found that specifically elbow extension range of movement was commonly impaired after stroke. The patients in this sample were no different in that even the more functional patients were still struggling with an aspect of their upper-limb function.

The smallest difference in active range of movement was found in knee extension (4.42°). As will be discussed a little later, a large portion of the patients were fairly mobile. This would require an element of knee extension, which would indicate that the knee extensors are fairly regularly used in their outer range of movement rendering the knee extension of the affected leg similar to the unaffected leg. What is also important to remember is that the hemiplegic lower limb typically increases in extension tone (Yelnik et al., 1999). The active range of knee extension may have been preserved by the increased tone of the quadriceps. It is possible that the active knee flexion in this particular sample would have been more significantly impaired.

5.5 Level of mobility of patients in the community

The median MRMI score in this sample was 38.5 (of a maximum of 40). This is made even more meaningful when one considers that more than 80% of the sample, with an average age of 56 years, scored as mobile. In fact, 71% of the sample scored above 35 (out of a possible 40) and only six% scored under ten. While these results were surprising, it was not unheard of in the literature. A study of a South African community by Hale and Eales in 1998 found that 55% of their patients over 50 years of age and 88% of their patients under 50 years were able to walk without assistance. Considering the age of our sample group, they appear to be more mobile than those of similar ages studied by Hale and Eales. Hartman-Maeir et al. (2007) found that 68% of their sample was independent either with walking or in a wheelchair, but that

only 39% of their community were able to manage stairs independently. If we consider the mobility measure used in this study, the most challenging aspect is that of stairs. For someone to be able to climb stairs independently (with or without a hand-rail) they would score a four for this task and, assuming they were able to complete the rest of the tasks independently, the minimum score for someone who is independently mobile (including stairs) would be 39/40. Seventeen (50%) of the patients in this study scored 39 or more, which is comparable to the abovementioned study. Gresham et al. (1998) considered the long term levels of mobility of a sample of British patients living with stroke. They found eight of the nine patients still alive 20 years after their stroke were independently mobile, with or without a walking aid.

This high percentage of independently mobile patients appears to be congruent with what has been found in other studies. It could also be explained by the longer hospital lengths of stay experienced by the members of the sample and the fact that 62% of them did receive rehabilitation of some sort.

The men in the sample group were proportionally more mobile. Twenty-seven per cent of the women in the sample scored as immobile (<24) compared to the 5% of the sample men. Despite the fact that this difference was not found to be statistically significant ($p=0.08$), the result is in agreement with the study conducted by Kelly-Hayes et al. (2003). They examined the differences between men and women and found that, while the neurological impairments experienced were not significantly different between men and women, women were found to be significantly less independently mobile. The most significant determinant of mobility was, however age. When the abovementioned findings were adjusted for age, they became not-significant. The reason is that women tend to have their strokes at an older age and, as age is a significant determinant in level of disability, the older, female stroke patients are likely to be more disabled (Kelly-Hayes et al., 2003). Paolucci et al. (2006), however, found that even in an age-matched sample the women were still more likely to be less mobile than their male counterparts.

5.6 Activities of daily living functional ability levels of patients with stroke living in the community

The sample also scored very well the area of ADL functional abilities. The median Barthel index score was 18 (of a maximum of 20) and 79% of the subjects scored as not-disabled. More than half the sample (56%) could be found in the top ten per cent (>18) of the possible score, while only 9% of the sample scored 5 or less. These high levels of functional independence in ADL were also found in the study by Hartman-Maeir et al. (2007) in the areas of eating (96%), grooming (64%), toileting (93%), bladder continence (93%), bowel continence (95%) and transfers (75%). They found fewer of their patients to be independent in getting into and out of the bathtub or shower (52%) and dressing their upper bodies (43%) and lower bodies (41%). The Functional Independence Measure (FIM) used in their study has been found to be highly correlated with the Barthel index (Kwon et al., 2004), which was used in this study. Comparisons between the two studies can thus be made. The Barthel index does not consider bathtub/shower transfers. When taking the absence of this aspect of ADL functional ability into account, the findings of this study are very similar to those found by Hartman-Maeir et al. (2007). A British study conducted by Gresham et al. (1998) on the long term functional abilities of patients living with stroke found that eight of the nine patients still alive 20 years after their stroke were independent in their activities of daily living, with only one of the nine not still driving a car.

This high percentage of independently functional patients is thus not unexpected and could further be explained by the longer hospital lengths of stay experienced by the members of the sample and the fact that 62% of them did receive rehabilitation of some sort. It is also possible that the more disabled members of the community were less available to be interviewed.

As with the levels of mobility in the group, the men in the sample were found to be proportionally more functionally independent in their activities of daily living, although the result was not statistically significant ($p=0.44$). Twenty per cent of the women included into the study scored below 12 (thus classified as

functionally dependent) as compared to the 11% of the men in the sample who were unable to manage their ADL independently. Kelly-Hayes et al. (2003) found the same to be true, until they adjusted for age, at which point the differences became non-significant. As previously discussed, age is a significant determinant in the level of disability, but Paolucci et al. (2006) also found that even in an age-matched sample, women were more likely to be functionally dependent than their male counterparts.

5.7 The relationship between the patients' strength, ROM and pain and their functional abilities.

The correlation between strength of most of the muscles tested was found to have a moderate to good relationship with both the MRMI and BI scores, with the strength of the unaffected Illiopsoas muscle displaying an excellent relationship with both levels of mobility (r = 0.76) and functional independence (r = 0.79). The strength of the biceps and triceps of the affected side displayed poor relationships with mobility (r = 0.45 for both correlations), but still showed a good relationship to functional independence (as measured by the BI). The literature is clear that muscle strength impairments limit functional abilities. (Cameron et al. 2003; Gowland et al., 1992; Harris and Eng, 2007; Hsueh et al., 2003; Lamontagne et al., 2002; Lin et al., 2006; Neckel et al., 2006; Yang et al., 2006). The only muscle strength tested that did not display any relationship to the two functional measures was gluteus maximus. While the strength of the unaffected side showed moderate relationship with the Barthel index scores (r = 0.52), all the other correlations were at poor levels or no correlation was seen (r = 0.15 to 0.34). It is possible that the discrepancy in the correlations with regards to Gluteus maximus could be due to the difficulties in gathering these data as described in above discussion.

Overall, more incidences of moderate, good and excellent correlations were seen between the strengths of the unaffected side and the functional measures, than those of the affected side and the functional measures. This suggests that the strength of the muscles of the unaffected side, more than

the affected side, is important in determining the functional abilities of the patient. Buurke et al. (2008) found that highly significant changes in the functional outcomes of their sample group did not correlate with significant changes in their surface electromyography readings. They proposed that the patients' enhanced mobility and functional abilities were more associated with compensatory strengthening of the unaffected limbs than due to neuromuscular changes in the affected limbs.

Active range of movement measures displayed less frequent meaningful correlations than strength. There were however moderate to good relationships seen between some of the movements, on both sides, and the MRMI and BI scores. It is found in the literature that limitation in active range of movement has a negative effect on function (Kamper et al., 2002; Lin et al., 2006). The active range of shoulder flexion or the affected side showed moderate to good relationships with both the MRMI and BI scores, while the same movement on the unaffected side displayed a moderate to good relationship with the BI scores alone. Lateral shoulder rotation on the affected side also showed moderate to good relationships to both the MRMI and BI scores. The fact that limitations in active range of shoulder movements influence the BI scores (i.e. functional independence) is not surprising as bilateral upper-limb function is an important factor determining the ability to accomplish ADL (Kamper et al., 2002). The influence of these RoM limitations on mobility (MRMI scores), however, is surprising. It is possible that the relative immobility of the affected shoulder results in asymmetrical arm swing, and thus limitations in the patients balance (Klimstra et al., 2009) – resulting in limited mobility.

Dorsiflexion on the unaffected side showed moderate to good relationships with both the MRMI and BI scores, while the same movement on the affected side displayed a moderate to good relationship with MRMI scores alone. Dorsiflexion RoM has been documented as a determining factor for independent mobility (Lamontagne et al., 2000). The meaningful correlations between dorsiflexion of both the affected and unaffected sides and the

patients' mobility is thus, understandable. The role that the dorsiflexion on the unaffected side plays in activities of daily living abilities is a little less obvious. It is explained, however, by the fact that most ADL require a certain level of mobility in order to be accomplished independently.

Hip flexion correlated poorly with functional ability (affected side: r = 0.14, unaffected side: r = 0.12) and mobility (affected side: r = 0.16; unaffected side: r = 0.15). This could be due to the fact that both the affected and unaffected sides generally had nearly full range of movement. There was thus little impairment with regard to active range of hip flexion to correlate with the patients' level of mobility and function. Elbow extension, however, was found to be one of the most impaired active ranges of movement and yet correlated poorly with functional ability (affected side: r = 0.21; unaffected side: r = 0.26) and mobility (affected side: r = 0.29; unaffected side: r = 0.26). While one could expect that it would have less of an effect on the patients' mobility, it is surprising that there was no correlation between this impairment and the patients' level of function. It may be that the patients were able to compensate sufficiently for this functional limitation using the unaffected arm. If this is the case one needs to consider the fact that active shoulder flexion was the most significantly impaired range of movement and still correlated moderately with functional ability (p=0.55).

The patients' pain levels did not correlate with function (r = 0.14) or mobility (r = 0.15). This is a surprising finding as most of the literature examining post-stroke pain comment on how this pain influences daily activity and function (Jönsson et al., 2006; Lundstrom et al., 2009). Price and Pandyan (2001) confirmed that post stroke shoulder pain has been implicated in a number of disabling impairments and the systematic review by Bender and McKenna (2001) found that shoulder pain limits the patient even to the activity (ADL) and participation levels. There is, however, a dearth of information detailing the intensity of pain experienced by patients with stroke. The intensity of pain experienced by this sample was relatively low and this could be the reason why it played such a limited role in determining their level of function.

In general, it appears as though the active range of shoulder movements of the affected side and the active range of dorsiflexion of the unaffected side are the ranges of movement which contribute most meaningfully to the functional ability and mobility of patients post-stroke. While most of the muscle strengths correlated well with functional ability and mobility, the strength of the muscles of the unaffected side appear to play the largest role. Low levels of pain did not appear to have any role to play in determining ability or mobility.

5.8 Study Limitations

The study only examined the patients on an impairment and activity level, measurement of participation would have added to the wholeness of this study.

All of the subjects included in the study were self-reported strokes. It was not possible to confirm this with their attending doctors or through radiological investigations as the patients were visited in their homes. There is, however, evidence that self-reported strokes can be reported on with confidence. Engstadt et al. (2000) found that definitely 79.2% (and possibly 84%) of the self-reported strokes they assessed had been accurately reported.

CHAPTER 6

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The prevalence of pain in patients with stroke living in this community is fairly high, with 73% of the sample who completed the pain measure reporting that they experience some degree of pain.

The strength impairments of the patients examined in this study were found throughout the side contralateral to the lesion. The muscles most significantly affected in terms of strength were Biceps, Gastrocnemius and Tibialis anterior.

The impairments in terms of active range of movement were also more commonly found on the contralateral side of the body. The most significantly affected active ranges of movement were shoulder flexion and elbow extension. The least affected active range of movement was knee extension.

The majority of the patients (85%) were found to be independently mobile.

The activities of daily living functional ability levels of the patients in this sample group were also very good, with 82% of the patients scoring above 12 on the Barthel index, which catagorised them as functionally independent in their activities of daily living.

Despite the high prevalence of pain in the sample, it did not correlate with the functional abilities and mobility of the patients. The strength of most of the muscles tested had a relationship with functional ability, especially the unaffected Illiopsoas. The Biceps and Triceps on the unaffected side did not appear to have a relationship to mobility. Active range of movement of the shoulder flexors, shoulder lateral rotators and dorsiflexors were found to have the most meaningful correlations to function and mobility, and there were

slightly more correlations with the ranges of movement of the affected side than the unaffected side.

6.2 Recommendations

One of the areas which has been poorly researched and needs some consideration is the development of an appropriate, continuous pain scale which can be used with confidence with patients who have had a stroke.

It is also recommended that a better way of documenting ranges of movement for elbow extension, knee extension and dorsiflexion be considered, in order to eliminate the use of negative numbers in the data captured.

Although this study identified the physical abilities of people living with stroke in the community, it did not focus on the factors contributing to these physical abilities. Further research examining these factors is recommended. It would also be interesting to evaluate the measures in place to improve the physical abilities of this population, and the effects that these measures are having.

Clinical recommendations:

The study revealed that certain muscle strengths and active ranges of movement contributed meaningfully to functional ability and clinicians would enhance their treatment efficacy by paying special attention to the following:

Try to restore or preserve active movement and strength in biceps, gastrocnemius and tibialis anterior as they have been found to be the muscles most weakened by the stroke. When aiming for functional strengthening, all the muscles contribute meaningfully, but the strength of the hip flexors on the unaffected side appears to play the most significant role.

Try to maintain or restore full active range of movement in shoulder flexion and elbow extention as these were found to be the ranges of movement most limited by the stroke. When working towards functional recovery, the most important ranges of movement to focus on appear to be shoulder flexion and lateral rotation (especially on the affected side) and dorsiflexion (especially on the unaffected side).

There was a high prevalence of pain in the sample, so it is important for clinicians to focus on preventing the development of post-stroke pain where possible. Based on the findings of this study, however, the presence of pain will not play an important role in determining functional levels. It is also important to remember that the level of pain in this sample was relatively low, and this could account for the poor correlation with function.

Community Benefits from the Study

As a result of the findings of this research, Rita Henn and Partners Inc. (Rehabilitation Therapists) were approached to participate in a community project to assist the people with stroke living in the Daveyton Area. This practice provides one physiotherapist for one day per month (who is joined by occupational therapist, Melanie Lotter) to run group classes and provide individual treatments for the people of this community. It is done in conjunction with the John Wesley Community Center and some of the treatment sessions take place in the center, while some are done during home visits for the patients whom are unable to get to the community center.

The focus of the treatment sessions is to train the Daveyton volunteer care-givers with the clients whom they visit every week. The aim is that these care-givers will be able to provide structured therapeutic activities at least weekly. In addition to this, Rita Henn and Partners have undertaken to host an all inclusive full day workshop covering all the basics of home based care and therapy for people living with stroke. This workshop is scheduled to take place at least twice a year and the participants will be provided with a certificate of attendance. We hope that this project will grow and continue to empower the care-givers and bless the stroke patients of the Daveyton community.

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Appendix A

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dearle

CLEARANCE CERTIFICATE	PROTOCOL NUMBER M080956
PROJECT	The Physical Abilities of Patients Living with Stroke in the Community
INVESTIGATORS	Ms LA Dearle
DEPARTMENT	Physiotherapy Department
DATE CONSIDERED	08.09.26
DECISION OF THE COMMITTEE*	Approved unconditionally

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

DATE 08/09/09 CHAIRPERSON _____
(Professor P E Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable

cc Supervisor : Mr W Mudzi

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 considered from the research procedure as approved I/we undertake to resubmit the proposal to the Committee. I agree to the completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix B

FROM (FRI) AUG 15 2008 12:52/ST. 12:51/No. 5900000740 P 2

Northfield

METHODIST CHURCH

[illegible]

Dear Mrs. L.A Dearle (7909060052086)

We have received your request to conduct the research component of your postgraduate studies on the members of the community of which we serve in the Dayvalen area, who have survived a stroke.

We also received your request to employ a volunteer from the John Wesley Community Centre to assist in securing the subjects for your study and in translation when collecting the data pertaining to these subjects. We hereby acknowledge that we have been informed in full of the relevant purpose and process of the above-mentioned research report.

Northfield Methodist Church and the John Wesley Community Centre are happy to give you permission and support for all the above mentioned requests.

Appendix C

FROM (MON) AUG 4 2008 15:46/ST. 15:45/No. 8900000682 P 1



JOHN WESLEY COMMUNITY CENTRE

MMUSO WA BANA ("KINGDOM KIDS")

AIDS ORPHANS AND VULNERABLE CHILDREN PROJECT

[illegible]

11390 Church Street Tel : [illegible]
1319 Eastview West E-Mail : [illegible]
Postal Address: P O Box 12087 Northwood 1511 Rep of South Africa

Dear Mrs L.A Dearle (7909060052086)

We have received your request to conduct the research component of your postgraduate studies on the members of the community of which we serve in the Dayveton area, who have survived a stroke.
We also received your request to employ a volunteer from the John Wesley Community Centre to assist in sourcing the subjects for your study and in translation when collecting the data pertaining to these subjects.
We herby acknowledge that we have been informed in full of the intended purpose and process of the abovementioned research report.

Northfield Methodist Church and the John Wesley Community Centre are happy to give you permission and support for all the above mentioned requests.

JNkomo
Nursing Sister
Project Coordinator.

AN OUTREACH MINISTRY OF NORTHFIELD METHODIST CHURCH TEL: (011) 849-7031

Appendix D

INFORMATION DOCUMENT

Study Title: Physical Abilities of Patients Living with Stroke in the Community

Dear Patient and Caregiver,

My name is Luschka Dearle. I am studying for Master of Physiotherapy degree with the University of the Witwatersrand. As part of the degree I am required to do a research study. The study I am doing is looking at some of the physical problems that people with stoke living in the community experience. There are a few things that usually make life difficult for people with stroke: sometimes they are so stiff that they can't move properly to do things for themselves; sometimes they are too weak to do things for themselves and sometimes they're in too much pain to move properly. The research I am doing is trying to find out which of these three things is the biggest problem for people with stroke trying to live normally in the community. My study will also look at how these physical problems influence the person with stroke's ability to function in his/her every-day lives.

I obtained your name and address from the John Wesley Community Center. If you agree to be part of the study, it means that you are agreeing to what I'm planning to do.

What will I be doing in the Study?

I would like to meet with you in your home and ask you (the patient) some questions about some basic information about yourself. Once this is complete, I'd like to test your (the stroke patients) strength and measure how much you can move and how much pain you experience if any. The rests of the tests will involve asking you to show me how you do some of the things you have to do every day, such as rolling over in bed, or walking (if you are able to walk). Nothing I will be doing should be painful or dangerous, and the questions will mainly be about what you are able to do for yourself every day. If at any point, you decide that you don't want to answer a question – please know that you are more than welcome not to answer any question you don't want to. I expect that the whole process shouldn't take longer than one hour of your time. It is also important to know that if you don't want to be part of the study, you have every right to say so, and it won't affect the services you have been receiving before this research. Finally, if you want to stop participating in this study – you may do that at any time. You will not be paid for agreeing to take part in this study.

I will be visiting at least 34 people in Daveyton, and doing exactly the same thing with each of them.
Once I've spoken to you and tested your friend or family member, I will take your name off of the document and no body will be able to tell that it is your information. Your personal information will remain confidential. The results of the interview and the testing of all the people I see will be used in a research report that other people will read, but your name won't appear anywhere on that report. This information will only be used for this study and all your information will be kept safely locked away once the research is over.

At the end of the research, I will arrange an information session at the John Wesley Community Center so that I can let everyone know the results of this study.

Thank-you again, for helping me to gather this very important information, I hope that it will help to improve the services which can be offered to people who have had stroke.

If you need to get in touch with me at any stage, please feel free to use the details below:

Luschka Dearle
Neuro-rehabilitation Unit
Netcare Rehabilitation Hospital
011 489-1227
0829245684
Physio2@netcare.co.za

CONSENT FORM FOR PATIENTS

I …….. have read the information sheet and agree to take part in the study being conducted by Mrs L. Dearle. By signing this form I am agreeing to being interviewed once in my home, and I understand that my physical abilities will be tested.

I understand that there are no monetary rewards for my participation and that I am not obliged to take part and can withdraw from the study at any given time. I also understand that this will not affect my medical treatment in any way and refusal to participate will not prejudice me in any way.

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Patient	Caregiver (if applicable)	Therapist

Appendix E

Ifayili Lolwazi

Isifundo: Physical Abilities of Patients' Living with Stroke in the Community

Ziguli kanye nabahlengikazi abathandekayo,

Igama lami ngu Luschka Dearle. Ngifundela izifundo ze Master of Physiotherapy Degree nenyuvesi yase Witwatersrand. Ingxezenye yalesifondo sami ingidinga ngiphumile ngenze uphando. Lesifundo engisenzayo sibheka ezinye zezinkinga zomzimba abantu abane sifo sohlangothi abahlangabezana nazo emphakathini. Zikhona izinto emzibalwa ezenza impilo yabantu abane sifo sohlanthi ibenzima. Ngenzinye izikhathi imizimba iyaqina bangakwazi nokunyakaza ngokufanele ukuze bazenzele izinto ngokwabo; ngezinye izikhathi imizimba ibalula kakhulu nalokho kwenza bangakwazi ukuzenzela izinto ngokwabo, futhi nangezinye izikhathi izinhlungu ziyanda bangakhoni ukunyakaza ngendlela okuyiyona. Uphando lew engilenzayo ngizama ukuthola kule zinkinga ezintathu engizibalile, iyiphi eyinkinga kakhulu kubantu abane sifo sohlangothi abazama ukuphila impilo efana neyawo wonke umuntu ophila emphakathini. Isifundo sami siphinde futhi sibheke lezinkinga zomzimba ukuthi zibanomthelela kanjani ebantwini abanalesi sifo futhi bakhona kanjani empilweni yamihla namalanga.

Ngithole amagama namadilesi enu ku John Wesley Community Center uma ngabe uvuma ukuba yingxenye yalesifundo, kusho ukuthi uyavumelana nalokhu engihlele ukukwenza.

Kuyini engizokwenza kulesifundo?

Ngizothanda ukuhlangana nawe, nomdeni wakho ngiphinde ngibuze imibuzo. Ngosizo lwenu sizogcwalisa i fomu ngemininigwane ngawe uma leli fomu seligcwele, ngizothanda ukuhlola isiguli esine sifo sohlangothi ukuthi sinawo amandla bese ngikala nokuthi sikhona kangakanani ukunyakaza, futhi sizwa ubuhlungu kangakanani na uma ngabe sibuzwa. Ukuhlola kuzobe kufaka uku ngibonisa ukuthi uzenzela kanjani izinto okumele azenzele zinsoku zonke, njengo kugiqika embhedeni, noma ukuhamba, uma ekhona. Ayikho into esizonyenza ezokuzwisa ubuhlungu noma enobungozi, futhi yonke imibuzo izobe imayelana nezinto okhona ukuzenzela empilweni yakno yanjalo – nje. Uma ngabe kuyenzeka kokunye unquma ukungaphenduli umbuzo ngicela ukhulukele wazi ukuthi kwamkelekile lokho uma ufuna ukwenqaba. Ngilindele ukuthi lonke loluhlelo lungathathi ngaphezu kwehora esikhathini sakho, kubalulekile ukwazi ukuthi uma wenqaba ukuba yingxenye yalesifundo unawo ilungelo lokusho lokho. Ukwala ngeke kuvimbe usizo obowuluthola ngaphambi kwalo phando lwale sifundo. Oko-kugcina uma ufuna ukuyeka ukuba yingxenye yalophando ungakwenza lokho noma ngasiphi isikhathi, angeke ukhokhelwe lutho, ngokuba yingxenye yalophando.

Ngizovakashela abantu 34 e Daveyton, sobesenza into efanayo nabo futhi, ukubuza imibuzo nokuhlolwa umngani noma ilunga lomndeni. Ngizokhipha igama lakho ezincwadini akekho nomunto oyedwa uzosho ukuthi yimininigwane yakho. Imininigwane yakho ngawe izoba yimfihlo. Imiphumela yalesifundo nokuhlolwa

kwakho wonke umuntu ozosebenzisa loluphando, bazofunda kodwa igama lakho ngeke livele ndawo kulomphumela. Lo lwazi lizosetshenziswewa lesifundo kuphela futhi lonke lolwazi lizogcinwa luphephile livalelwe uma sekuphele uphando.

Makuphela uphando ngizokwenza ngizpkwenza ulwazi olubaluleke kangaka, nghethemba ngizokwazi okwenyusa izinga losizo olungatholwa abantu abene sifo sohlangothi.

Uma undinga ukuqumana nami noma ngasiphi isikhathi, ngincela ukhululeke ukusebanzisa indawe anganginuma kuzo lozi ezilandelayo:
Luschka Dearle
Neuro-Rehabilitation Unit
Netcare Rehabilitation Hospital
(011) 489-1227
0828245684
Physio2@netcare.co.za

I Fomu Lesiguli Lemuume

Mina _____Ngifundile ulwazi kulamaphepha futhi ngiyavuma ukubangxenye kulesifundo esiqutshwa ngu Mrs Luschka Dearle ngoku siyina we fomu ngivuma ukubuzwa imibuzo ekhaya lami, futhi ngiyazwisisa ukuthi ukukhona komzimba wami kuzohlolwa.

Ngiyavuma nokuthi angeke ngithole imali ngokuba yingxenye yalohlelo nokuthi angiphonekanga uthatha ingxente, futhi nginsayeka noma ngabe yisiphi isihkathi. Ngwazwisisa ukuthi kokho ngeke kuthikameza usizo lwezempilo elingilitholayo ngokuoaba kwami. Ngeke ngiphatnwe ihdlewa ehlukile kunabayo.

_____	_____	_____
Iziquli	Umhlengikazi (uma ekhona)	Therapist

Appendix F

Ditokomane tsatsebo

Maemo athuto: Physical abilities bakodi baphelang ka lefu la hoshwa lethlakore mo sechabeng.

Mokudi le mohlokomedi yaratehang

Lebitso laka ke nna Luschka Dearle. Ke etsa dithuto tsa Physiotherapy degree le University ya Witwatersrands . Jwalo ka karolo ya dithuto, ke batla ho nyetsa dipatlisiso tsa thuto.Dithuto tsekidi nyetsang, dishebane lemathata a batho ba phelang ka bolwetsi ba hoshwa letlakure sechabeng .Ho na le dintho tse etsang bophelo ba batho bo beboema,jwalo ka hoshwa letlakure ,ka nako engwe ba ba lemathata baseke ba kgona ho tsamaya hantle ,ho iketsetsa dintho ka bobona ,kanako engwe ba ba lebofokodi ba utlwa botloko base kgone ho tsamaya ka tshwanelo .Dipatlisiso tseo ke dietsang ke holeka ho fumana hore ke difeng dintho tse tharo tse kgolo tse etsang bothata bo boholo ha kana bathong ba nang le lefu la hoshwa lehlakore hore baphele jwalo ka mang le mang sechabeng .Dithuto tsaka dishebane le mathata a boikwetliso ba hoshwa lehlakore honka karolo bophelong ba bona

.

Ke eng seo ketlong ho seetsa ka dithunto tsaka

Ke rata ho kopana le wena lapeng la hao ,ketlo o botsa diputso. Ka tseding tsa bophelo ba hao . hang fela redumellana ke tloleka ho bona hore o kakgona ho otlolla le ho tsamaya. ha mmoho le botlohloko bo o boutlwang hore ke bo boka kananang ,tseo kaofela dikenyeletsa dipotso tsa ho batla hore o mpontshe hore tseding tsa dintho o dietsajwang letsatsi le letsatsi. Jwalo ka hofetoha ha o robetsi ,kapa ho tsamaya ha e ba o kgona hotsamaya,ha hona seo ke tlaseetsa ho o utlwisa bohloko kapa sekotsi ho wena . Dipotso e tlaba hore ke eng seo o ka kgonang hoseetsa tsatsi le leng le le leng . ha e ba hao waikemisetsa ho araba dipotso, kakopo tseba hore o dumelletswe hore o se diarabe hao sabatle. Ke dumela hore kaofela dipotso(dintho)tseo di ka senke metsotso e mashome a tsheletseng ,hape ho botlokwa hore ha o se osabatle ho nka karolo ,o na leditokelo tsa ho hana. hoetsa jwalo ho ke kehwa senya eng kapa eng yeo o neng o thuswakasona ka nako tsohle .Ha ose o batla hotlohela hoba karolo ya thuto o dumeletswe ho tlohela nako engwe le engwe ,Tseba hore o ka sefumane tjhelete ha o nka karolo thuto ena .

Ketlo e tela batho ba 34 ko Daveyton,ke ilo etsa dintho tseo kedingotseng pampireng mona ,Ka mora hore ke buisane le wena mokodi kapa e mong wa lelapa,e tlaba tabanyaka le wena feela ,ha ho motho yadumeletsweng ho tseba (sephiri) seo resebuileng le wena. Ditaba tsa bophelo ba hao ditladula ditshireletsehile.Ditholwane tsa puisano yaka le wena hammoho le thuso ho batho , ke bona hore etla thusa ho batla tsela eo batho ba ka ithutang le ho bala ka lefu lena.Empa wena lebitso la hao reka se le phatlalatse mona pampering.ka o fela dintho tse ngotsweng ditla sebediswa fela mona thutong ena ho fotlela dipatlisiso difitla pheletsong.

Mafelelong a dipatlisiso,ke tlakopana le ba lefapha la Jonh Wesly Community Center ka ho etsa jwalo mang la mang otlatsiba hore dipatlisiso tsaka ditsamaile jwang.

Kenya leboha hape,Ho uthusa ka dipatlisiso tsena tsa botlokwa,ke hopola hore ditla thusa ho nyolla tshebeletso ya ho thusa batho ba ho tshwarwa ke lefula la hoshwa lehlakure.

Ha o batla ho ikopanya lenna ka nako engwe le engwe,ka kopo sebedisa ditokomane tse latelang

Luschka Dearle
Neuro-rehabilitation Unit
Netcare Rehabilitation Hospital
011 489-1227
0829245684

Ditumellano pakeng tsaka le mokudi

Na……..ke badile se ngotsweng pampiring ka hoo ke dumetse honka karolo thutong e ntshetswang pele ke Mrs L. Dearle. Ka ho e tsajwalo ke dumela hore le katla honna lapeng ha hona leseo le batlang hosetseba ka bophelo baka ,hape ke utlwisisa hore bo ikwetliso baka bo tlaba bonolo haholo.

Ke utlwisisa hore haho eng kapa eng etla ba kotsi kapa ho sitisa thuto eo o ke e fumanang , Le ha kese ke sa batle ho tswelapele ha ho letho le ka nthibelang ho etsajwalo.

-- ----------	----------	----------
Mokudi	Mohlokomedi(hale teng)	Mokwetlisi

Appendix G

The Modified Rivermead 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 ten 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 ten 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 ten meters in your usual way

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

Appendix H

THE BARTHEL INDEX

Bowels 0 = incontinent (or needs to be given enema)
1 = occasional accident (once a week)
2 = continent

Bladder 0 = incontinent, or catheterised and unable to manage alone
1 = occasional accident (maximum once per 24 hours)
2 = continent

Grooming 0 = needs help with personal care
1 = independent face/ hair/ teeth/ shaving (implements provided)

Toilet use 0 = dependent
1 = needs some help, but can do something alone
2 = independent (on and off, dressing, wiping)

Feeding 0 = unable
1 = needs help cutting, spreading butter, etc.
2 = independent

Transfer (bed to chair and back)
0 = unable, no sitting balance
1 = major help (one or two people, physical)
2 = minor help (verbal or physical)
3 = independent

Mobility 0 = immobile
1 = wheelchair dependent, including corners
2 = walks with help of one person (verbal or physical)
3 = independent (but may use any aid; for example, stick)

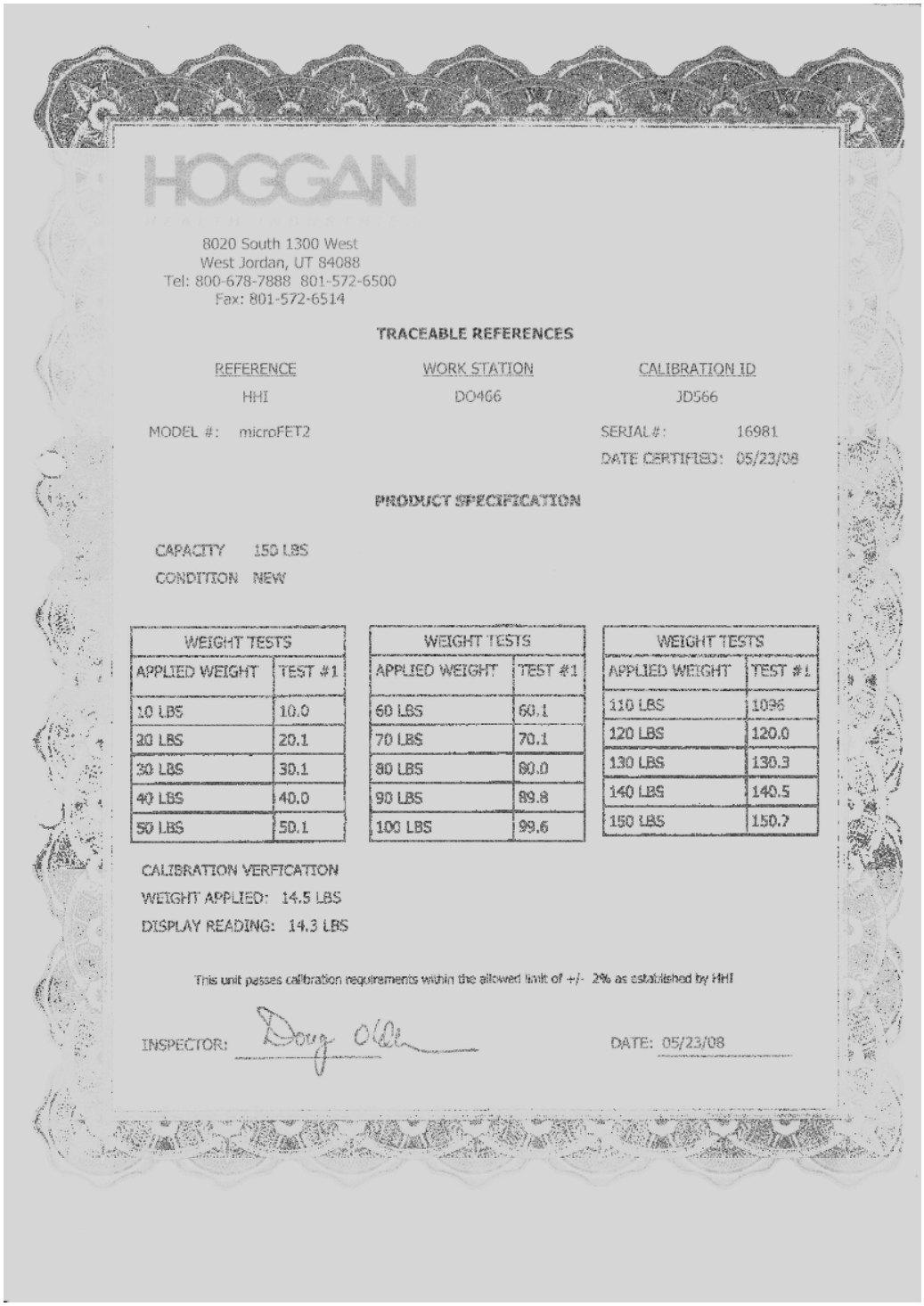
Dressing 0 = dependent
1 = needs help but can do about half unaided
2 = independent (including buttons, zips, laces, etc.)

Stairs 0 = unable
1 = needs help (verbal, physical, carrying aid)
2 = independent

Bathing 0 = dependent
1 = independent (or in shower)

Total: /20

Appendix I



HOGGAN

8020 South 1300 West
West Jordan, UT 84088
Tel: 800-678-7888 801-572-6500
Fax: 801-572-6514

TRACEABLE REFERENCES

REFERENCE	WORK STATION	CALIBRATION ID
HHI	DO466	JD566

MODEL #: microFET2

SERIAL #: 16981

DATE CERTIFIED: 05/23/08

PRODUCT SPECIFICATION

CAPACITY 150 LBS

CONDITION NEW

WEIGHT TESTS	
APPLIED WEIGHT	TEST #1
10 LBS	10.0
20 LBS	20.1
30 LBS	30.1
40 LBS	40.0
50 LBS	50.1

WEIGHT TESTS	
APPLIED WEIGHT	TEST #1
60 LBS	60.1
70 LBS	70.1
80 LBS	80.0
90 LBS	89.8
100 LBS	99.6

WEIGHT TESTS	
APPLIED WEIGHT	TEST #1
110 LBS	1096
120 LBS	120.0
130 LBS	130.3
140 LBS	140.5
150 LBS	150.7

CALIBRATION VERFICATION

WEIGHT APPLIED: 14.5 LBS

DISPLAY READING: 14.3 LBS

This unit passes calibration requirements within the allowed limit of +/- 2% as established by HHI

INSPECTOR: Doug Oller

DATE: 05/23/08

Appendix J

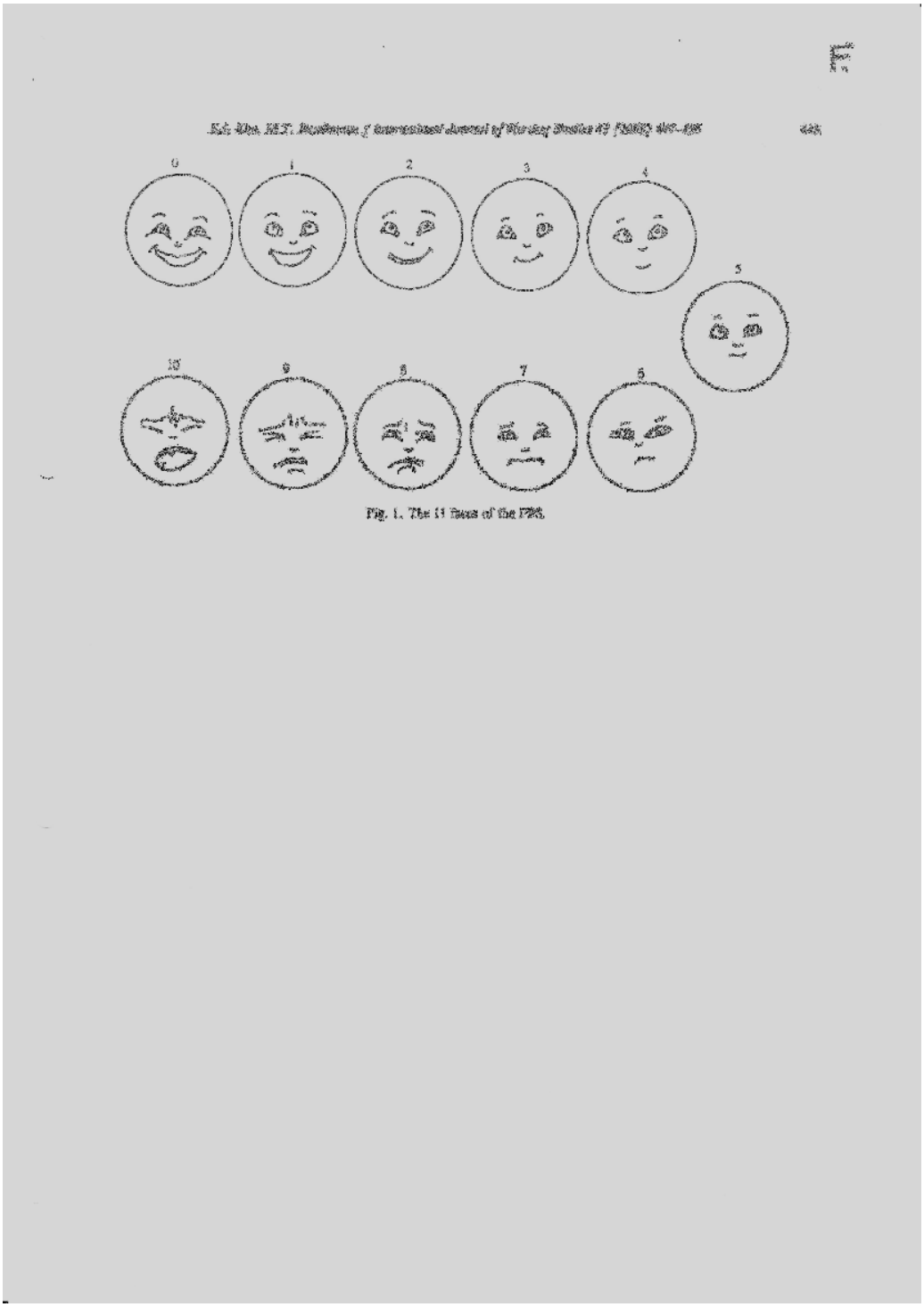


Fig. 1. The 11 faces of the FPS.

Appendix K

Patient Number:

Demographic Questionnaire

Title of Study: Physical abilities of Patients Living with Stroke in the Community?

A. Demographic Information

1. Age:_____

3. Gender

☐M

☐F

4. Home Language: ☐Sotho

☐Xhosa

☐Zulu

☐English

☐Afrikaans

☐ Other (specify) _____

5. Address:_____

_____

_____

6. Contact Telephone Number:_____

7. Back-up Telephone Number:_____

8. Caregiver/s:_____

9. Care-givers´ relationship to the patient:☐Spouse

☐Friend

☐Parent

☐Sibling

☐Child

☐ Other (specify)

B. Details of Stroke

10. Side of body affected ☐Left
☐Right

11. How many strokes have you had? (Including the current stroke)

☐1
☐2
☐3
☐4
☐5
☐5+

11.1 How many years ago did you have your last stroke?

☐1
☐2
☐3
☐4
☐5
☐5+

C. Stroke Management Details

12. Were you hospitalised after your stroke? ☐ Yes
☐ No

If your answer to no. 12 was yes, answer the following questions:

12.1 Which hospital did you go to?_____

12.2 How long were you in hospital for? ☐ Less than one week
☐ One to Three weeks
☐ Three to Six weeks
☐ More than Six weeks

12.3 Did you receive any rehabilitation/exercises while in the hospital?

☐ Yes

☐ No

13.. Did you receive any rehabilitation/exercises to help with the stroke after you left the hospital?

☐ Yes

☐ No

If your answer to no. 13 was yes, answer the following questions:

13.1. Where did you receive this service?_____

13.2. For how long did you receive rehabilitation or exercises to help with the stroke?

☐ Less than one week

☐ One to Three weeks

☐ Three to Six weeks

☐ More than Six weeks

14. Does anyone come to assist your caregiver in caring for you?

☐ Yes

☐ No

15. What does this person do for you to help your caregiver?

☐ bathing and grooming

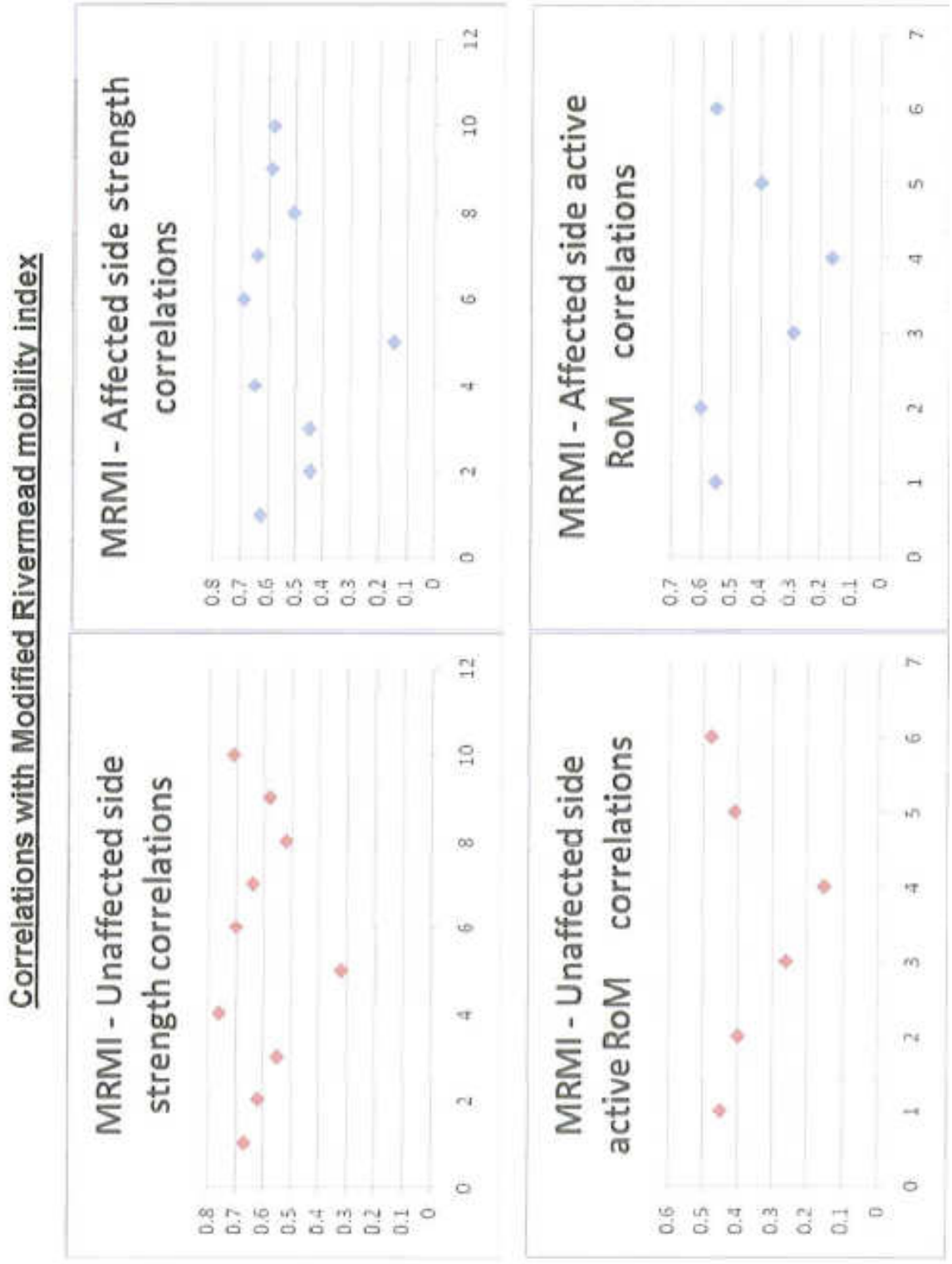
☐ feeding

☐ helping me out of bed/into a chair

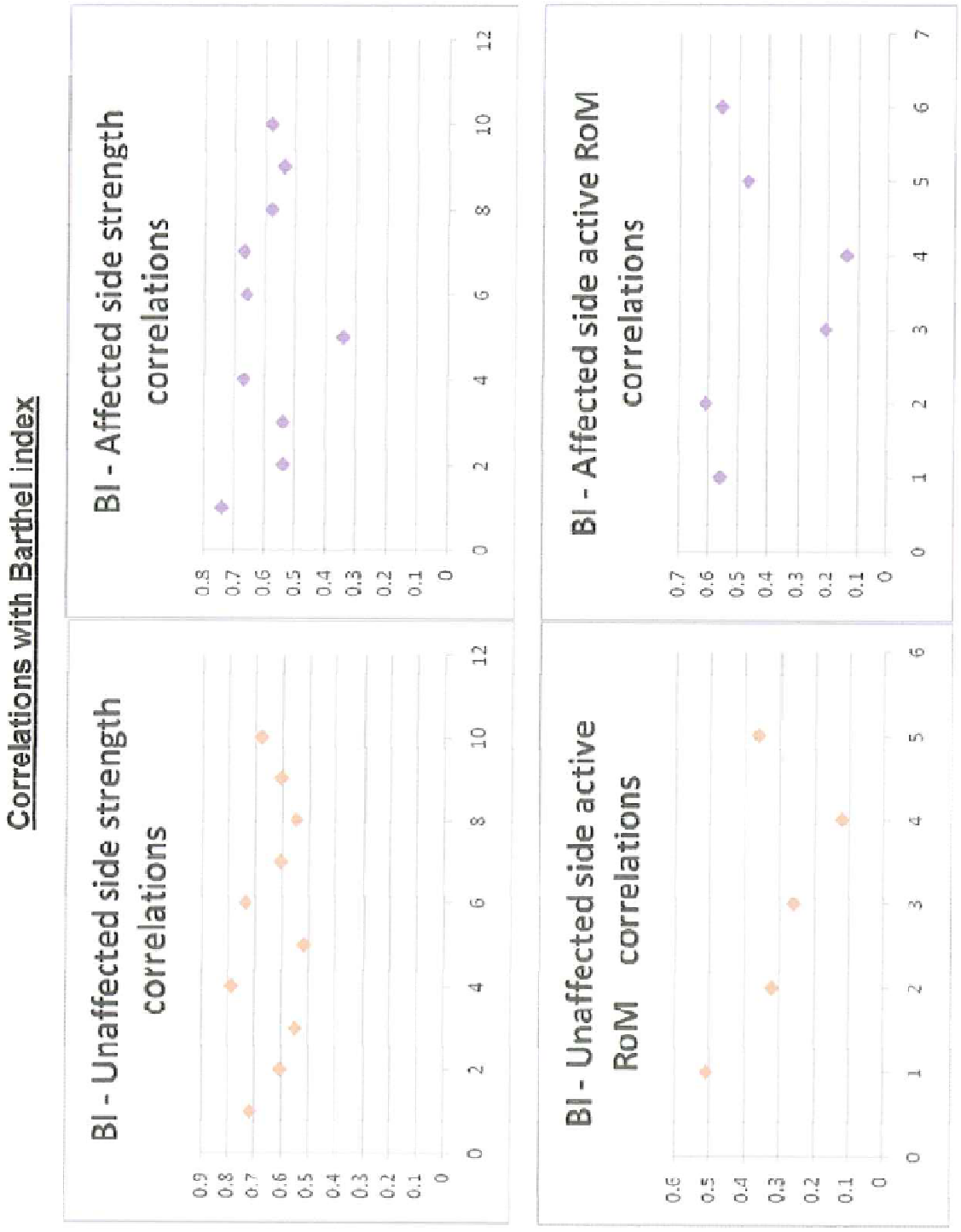
☐ exercising

☐ other

Appendix L


Correlations with Modified Rivermead mobility index
MRMI - Unaffected side strength correlations
MRMI - Affected side strength correlations
MRMI - Unaffected side active RoM correlations
MRMI - Affected side active RoM correlations

Appendix M


Correlations with Barthel index
BI - Unaffected side strength correlations
BI - Affected side strength correlations
BI - Unaffected side active RoM correlations
BI - Affected side active RoM correlations