UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

The Relationship between the Risk of Falls and Perceived Balance in Patients with Chronic Stroke in Johannesburg

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

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DECLARATION

I, Amy Jessica Morgan, declare that this research report is my own, unaided 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 any other university.

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(Amy Jessica Morgan)

09 June 2020

DEDICATION

I dedicate this research report to every stroke survivor worldwide, for you are true superheroes.

To all the amazing caregivers and health care professionals who assist in caring for and treating stroke survivors.

ABSTRACT

Background: Stroke affects millions of people worldwide every year, and statistics show that there is a constant increase in the number of strokes occurring annually. There have been many research studies conducted looking at strokes, the physical and mental effects post-stroke, balance and gait problems resulting from a stroke, falls in patients with a stroke and many other stroke-related issues; however, there has been very little research done on the perception of balance in patients with stroke and this dearth of research includes the relationship that this perceived balance has on the risk of falls in people with chronic stroke. There has also been very little research done in Johannesburg, South Africa, on people with stroke and this is the first study to be conducted regarding this topic.

Main Objective: To determine the relationship between perceived balance and the risk of falls in patients, more than six months post-stroke within the Johannesburg region.

Method: This study was a cross-sectional study, where 51 participants were assessed for their perceived balance, using the Activities-Specific Balance Confidence Scale (ABC scale), as well as for their risk of falling, by using the Dynamic Gait Index (DGI). In order to ensure that the participants were acceptable for the inclusion criteria, the Modified Mini Mental State Test (3Ms test) was used to screen for early signs of dementia. If participants had scored 50% or less for this test, they were excluded from the study.

Results: In this study, 128 participants were recruited and only 51 took part in the study and met the inclusion criteria. From the results, we see that most of the study participants (n=26; 50.98%) had a higher level of perceived balance; the majority of the participants were found to be at risk of falling (n=36; 70.59%) and, with a p value of 0.002, there was a significant relationship between the risk of falls and perceived balance in the study population.

Conclusion: There are many factors affecting the mobility and functionality of people with chronic stroke, which often result in an increased risk of falling. One factor that was found during this study was that perceived balance has an impact on actual balance scores, and that there is a significant relationship between the risk of falls and perceived balance among patients with chronic stroke.

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- ADLs — Activities of Daily Living
- ABC Scale — Activities-Specific Balance Confidence Scale
- DALYs — Disability-adjusted life-years
- DGI — Dynamic Gait Index
- GBD — Global burden of disease
- ICF — International Classification of Functioning, Disability and Health
- 3Ms — The Modified Mini Mental State Test

CHAPTER 1

Background and need

1.1 Introduction

Stroke is seen globally as the “second leading cause to death and the third leading cause to disability” (Johnson et al., 2016, p. 634). From the above statement, stroke is a prevalent condition worldwide; therefore, research is needed to focus on how we can assist and manage these patients. Stroke, being responsible for muscle weakness, difficulty with performing tasks and dexterity loss, as well as poor coordination, is found to be a leading cause of chronic physical dysfunction (Lee et al., 2013). Stroke also results in impairment, such as reduced upper-limb function and proprioception, as well as somatosensory dysfunction (Norman et al., 2015). Another impairment that is common in stroke survivors is decreased balance. “Balance problems are thought to be common after stroke, and they have been implicated in the poor recovery of activities of daily living (ADLs) and mobility and an increased risk of falls” (Tyson et al., 2006, p. 31). Balance is often affected both statically and dynamically, and affects chronic stroke survivors who are at a higher level of functioning and who are ambulating within the community (Tyson et al., 2006). With decreased balance, the risk of falls increases.

“Falling is one of the most common complications of stroke patients, and falling can lead to reduction of independence of activities of daily living such as eating, bathing, dressing, toileting, and transferring in patients” (Cho et al., 2015, p. 1751). A common finding from researchers observing stroke is that stroke survivors have an increased risk of falling in comparison with non-stroke survivors (Hyndman et al., 2002). Falls are seen as a major global problem and, according to WHO (2016), are the second leading cause of unintentional injury and death, with approximately 424 000 fatal falls happening annually. Falls have been found to be very common and cause serious complications post-stroke, with research showing that, during the recovery of stroke, approximately 76% of individuals experience a fall (Schmid et al., 2013). Falls in patients with stroke may lead to a decreased quality of life, a decreased independence in ADLs, therefore more dependence on carers, an increased fear of falling and an overall lowered rehabilitation outcome (Schmid et al., 2013; Salot et al., 2016).

As mentioned above, stroke survivors are found to have an increased risk of falling, and research shows that these falls are common in both the acute and chronic phases of recovery (Salot et al., 2016). An increase in the risk of falls seen in chronic stroke has prevalence rates ranging from 23% to 50% (Hwang et al., 2013). At the time of the study by Hyndman et al. (2002), not much research had focused on stroke survivors who are more than six months post-stroke. There has been debate about the timeframe for patients to be classified as being in the chronic phase of stroke. According to Pang et al. (2007), chronic stroke is from one year post-stroke, while, according to Hyndman et al. (2002), Hwang et al. (2013) and Salot et al. (2016), chronic stroke can be considered as six months post-stroke.

With South Africa being a developing country—often deemed a low- and middle-income country—we can observe research from other countries with a similar financial context, such as India. We see in research that stroke causes a financial burden, not only on public health, but also among private patients (Whitehead & Baalbergen, 2019). Kamalakannan et al. (2016) observed priority being given with immediate and acute stroke treatment, but many cannot afford additional rehabilitation treatment once discharged from hospital, and immediately are sent home. Ntsiea (2019) reports that a study conducted in South Africa confirms that early discharge from hospitals with patients being sent back into the community after a mere 20 days post-stroke is extremely common. With this being said, many stroke survivors have already returned to their communities before six months post-stroke, thus increasing the risk of falls. For the purpose of this study, chronic stroke will be considered as six months post-stroke, with the main reason being: more research studies have classified chronic stroke as from six months and onward.

There has been much research done on falls during the acute stroke phase while stroke survivors are still in hospital or in an inpatient rehabilitation centre and, according to Weerdesteyn et al. (2008), many of the falls among this population are as a result of transfers in the rooms or lavatories, while most of the falls in community-dwelling stroke survivors occur while the patients are walking. In other research conducted by Hyndman et al. (2002), there were reports of fall events among stroke survivors and more specifically chronic stroke, where the researchers observed stroke survivors 3 months to 24 years post-stroke. In one study it was found that patients with chronic stroke who had more than one fall presented with impaired mobility, arm function and general ADLs completion and also presented with psychological conditions such as depression and anxiety (Schmid et al., 2013).

It is common that an individual who is post-stroke may experience various forms of impairment affecting mobility, which include decreased balance, decreased gait speed, and increased fear of falling, which is also known as falls self-efficacy, and changes in balance self-efficacy (Schmid et al., 2012). “Self-efficacy is defined as a person’s perception of his or her ability to perform a given task” (Forsberg & Nilsagard, 2013, p. 142). Another complication of any trauma to the brain, such as a traumatic brain injury or a stroke, is dementia, with research showing that one-third of stroke survivors are affected with post-stroke dementia (Mijajlović et al., 2017).

According to Salbach et al. (2006), it is important to investigate the role of self-efficacy in motor recovery in stroke survivors to understand their perception in completing tasks such as ADLs, while maintaining their balance and without falling. This will aid in understanding the person’s balance, self-efficacy or perceived balance and their falls self-efficacy. As seen earlier in the introduction, balance problems are evident in stroke survivors and decreased balance increases the risk of falls in this population (Tyson et al., 2006). It is therefore important to incorporate balance self-efficacy or perceived balance tests as outcome measures in stroke rehabilitation (Salbach et al., 2006).

From the information above, it is clear that falls are still very prevalent among people with chronic stroke, and it is therefore important for more research to be conducted to determine if there is a link between perceived balance and risk of a fall post-stroke. There has been an extensive amount of research done globally relating to falls. Salbach et al. (2006) looked at balance self-efficacy to assist in determining falls self-efficacy in the acute and sub-acute phases of stroke, while Salot et al. (2016) looked at the mechanism of fall risk in survivors with chronic stroke. Hwang et al. (2013) researched the effects of fall experiences on cognitive function and physical activities in chronic stroke survivors, Da Silva et al. (2014) wanted to understand balance confidence and fear of falling in the same population, and Schmid et al. (2013) focused on the consequences of falls in chronic stroke survivors.

1.2 Problem statement

Most of the abovementioned studies focus on falls in chronic stroke survivors, but none have looked at the relationship between perceived balance and the risk of falls in this population, and this type of study has not yet been done in the South African setting. In the last four years of clinical experience, working in a physiotherapy neurorehabilitation practice, I have treated a fair number of stroke patients, and more commonly those in their chronic phase. Each patient and caregiver that I have communicated with has mentioned that the patient has either fallen in the past, or has had a near-fall experience post-stroke.

A near fall can be defined as “an occasion on which an individual felt that they were about to fall but did not actually fall” (Hyndman et al., 2002, p. 165).

Many of these patients also have some poor components of balance. Some patients are mobilising independently without the use of a walking device, yet still present with decreased balance in a single-leg stance, dynamic tandem stance, and poor balance during stepping exercises. Therefore, the question is whether these patients have falls or have near-fall experiences because of poor balance or just perceived poor balance? This study is focused on determining the relationship between the risk of falls and perceived balance in patients with chronic stroke.

1.3 Research question

What is the relationship between the risk of falls and perceived balance in patients with chronic stroke?

1.4 Aim of the study

To determine the relationship between the perceived balance and the risk of falls in patients, more than six months post-stroke within the Johannesburg region.

1.5 Research objectives

1.5.1 To establish the perceived balance among the patients with stroke in this study.

1.5.2 To establish the risk for falls and near falls among the patients with stroke in this study.

1.5.3 To establish the relationship between perceived balance and risk of falls in the study population.

1.5.4 To establish factors influencing the risk of falls in this study population.

1.6 Significance of research

One of the disadvantages of falls in stroke survivors is that they cause a decrease in the quality of life of the individual, as well as causing an increase in dependence on others (Hwang et al., 2013). Due to the increasing risk of falls in stroke survivors, it is important during physiotherapy treatment and rehabilitation to identify the risks of falls, and begin intervention and prevention programmes (Hwang et al., 2013). These risks may include increased fear of falling, decreased balance confidence and low perceived balance, among the general risk factors resulting in falls. Da Silva et al. (2014) also stress how important it is to address issues such as falling, balance confidence and fear of falling, not only for the stroke survivors, but for their spouses and caregivers as well.

Knowledge of the relationship between the risk of falls and the patient's perceived balance may lead to more ability to identify and understand the main causes of falls, and this will help in the prescription of appropriate management and treatment.

With understanding the relationship between these two factors, it will also be clearer as to whether the falls are occurring due to the patient's perception of their balance or if their balance is in fact poor, as many falls may still occur even if an individual has good perceived balance. This will also assist the therapist in observing if the patient has a possible fear of falling and if that is influencing their perception of their balance, and therefore the therapist can address these types of issues and assist the patient in overcoming their fears, which may improve the patient's mental wellbeing and quality of life. Obtaining all of this information regarding the patient will also enable the families to understand the patient's condition better, as well as how they can assist in preventing falls, and the importance of maintaining a home exercise programme to improve the patient's balance.

CHAPTER 2

2. Literature Review

2.1 Introduction

In this chapter, there will be a discussion of current literature relating to the epidemiology of stroke, the common impairments found in people with stroke and stroke-related disability with expanding information of balance, perception of balance and actual balance, and furthermore looking at fear of falling in people with stroke, falls post-stroke and the implications thereof.

For this literature review, the following online databases were used: PubMed, Science Direct, Google Scholar, ClinicalKey and Scopus. All searches included at least one or more of the following words or phrases: “chronic stroke”, “falls after stroke”, “balance post stroke”, “self efficacy post stroke”, “perception of balance”, and “fear of falling”.

2.2 Epidemiology of stroke

Stroke has been found to be a major health problem globally and is seen as a great concern in developing countries due to the chronic disability and often mortality that are related to the condition (Batchelor et al., 2012). Worldwide, stroke is said to be the second leading cause of death, affecting approximately 5 million people annually (Bertram et al., 2013). According to the same study, if the constant increase in stroke occurrences continues as it has been over the last 29 years, by the year 2030, it is estimated that worldwide there will be 20 million stroke-related deaths and 70 million stroke survivors (Bertram et al., 2013). Another study confirms the increase in the prevalence of stroke worldwide as the global population of people over the age of 65 years increases annually by approximately 9 million (Mukherjee & Patil, 2011).

Globally, an estimated 56 million deaths occur annually, with approximately 7.2 million deaths as a result of ischemic heart disease and approximately 5.5 million deaths resulting from stroke (Mukherjee & Patil, 2011).

Although there has been a decrease in the age-standardised death rates and stroke prevalence, according to the Global Burden of Disease, Injuries and Risk Factors Study, the general burden of stroke remains high (GBD 2016 Stroke Collaborators, 2019).

Previously, stroke was considered an 'elderly disease', but according to the Global Burden of Disease (GBD), more middle-aged and young people are suffering with strokes due to increased risk of metabolic changes like diabetes mellitus and obesity found in the younger population. It has been found that approximately two-thirds of strokes take place in people below the age of 70 years (Feigin et al., 2017). With these statistics, many people of all ages are left with life-changing symptoms and side effects of stroke, resulting in disability. In the next part of this literature review, stroke-related disability and common forms of impairment following stroke will be discussed.

2.3 Stroke-related Disability

Stroke results in mortality and disability, and results in extremely high costs for the economy, and is therefore seen as a global burden (GBD 2016 Stroke Collaborators, 2019). Globally and among all ages, stroke is said to be the seventh leading cause of lost DALYs. Approximately 13% of global lost DALYs are among stroke survivors 60 years and younger, while the percentage increases to up to 66% in those younger than 70 years of age (Mukherjee & Patil, 2011). Research has also shown that there is an increased risk of mortality following a stroke within the first 28 days post-stroke. Although it is challenging to find specific results for this research in South Africa, and mainly in the rural areas due to poor documentation and data capture in hospitals and clinics (Maredza et al., 2015).

According to the GBD 2010 stroke sequela, in South Africa, 40% of people living with stroke experienced mild long-term physical consequences following their stroke; 23% had moderate long-term impairment, and 15% suffered from severe long-term complications. Some individuals suffered from moderate or severe long-term impairment as well as cognitive problems. These results were 12% and 8% respectively. Only 2% of people living with stroke had no physical or cognitive impairments following their stroke (Maredza et al., 2015). From these results, it is clear that approximately 98% of the time stroke causes physical and occasionally physical and cognitive impairments in individuals.

Stroke-related disability includes changes in the person's ability to perform certain, or occasionally all, ADLs (Schmid et al., 2012). A patient's ability to perform ADLs and function is usually measured with the International Classification of Functioning, Disability and Health (ICF), which defines activity as the performance of an action or task such as toileting, cooking and eating a meal, whereas participation is seen to be when one takes part in a life situation such as attending a soccer game or return to work (Schmid et al., 2012). Kim and Park (2013) also confirm that people with stroke are more dependent on others, regarding their ADLs and have challenges with balance, resulting in severe functional impairment.

People with stroke are prone to suffer with mobility impairment that includes a decrease in gait speed, walking ability and capacity, as well as results in changes in balance confidence and causes an increase in fear of falling (Schmid et al., 2012). Vahlberg et al. (2013) confirm that post-stroke people have a lower level of mobility as well as a decreased involvement in physical activity. According to the same study, it was found that in the first three years post-stroke, between 12% and 43% of people have a further deterioration in their mobility. In the upcoming section of this literature review, more information will be given relating to falls in people with stroke.

2.4 Falls in people with stroke

Falls are common and recurrent adverse events that many stroke survivors experience at all stages of recovery, including the chronic phase, resulting in injury, further disability, functional limitations and, in very extreme cases, can lead to death (Cho et al., 2015; Batchelor et al., 2012). A more recent source has stated that within the first year post-stroke, approximately 40% of stroke survivors experience falls (Miyata et al., 2018). The risk of falls in chronic stroke patients is higher than non-stroke patients of similar age, with one study showing that approximately 36% of chronic stroke patients had experienced falls within one year post-stroke, compared to age- and gender-matched controls that had 24% (Batchelor et al., 2012).

During the acute and in-hospital recovery period, the highest number of falls occurs mid-morning and early evening, and most commonly in the patients' rooms and bathrooms (Batchelor et al., 2012).

The most common areas of falls occurring in chronic stroke survivors take place in their bedrooms, lounge and out in the garden, and the most common activity resulting in the fall includes walking or making transfers (Batchelor et al., 2012). Reasons for falls, according to stroke survivors, include performing transfers, falling over obstacles, poor foot clearance, weakness in the lower limbs, and dizziness, one of the reasons being loss of balance (Forster & Young, 1995). In more recent literature, according to stroke survivors, loss of balance, misjudgement and foot contact during an obstacle-crossing task when walking are seen as the most common reasons for falls in this population, with figures ranging between 31% to 41% (Miyata et al., 2018; Batchelor et al., 2012).

Falls, as mentioned above, can result in severe injury. Common injuries include head injuries, fractures and soft-tissue injuries (Schmid et al., 2013; Batchelor et al., 2012). With falls in people with stroke, it is more likely for the person to fall towards the hemiparesis side and fracture the affected side due to possible osteoporosis (Divani et al., 2009). If a hip fracture occurs in a stroke survivor, they are less likely to gain full independence in terms of mobility as an able-bodied person would (Xu et al., 2018). In a study conducted by Schmid et al. (2013), 72% of stroke survivors who had a fall sustained injuries such as sprains, bruises and fractures. This shows a high percentage of injury resulting from falls and also that stroke survivors are at risk of further injury should they experience a fall. Another consequence of falling in this population is the loss of independence in activities of daily living, such as bathing, dressing, toileting, making transfers and, depending on the severity of the injury sustained during the fall, can also result in dependence with eating (Cho et al., 2015; Schmidt et al., 2013). Depression and fear of falling are also included in the consequences and negative effects on stroke survivors following a fall, resulting in further loss of independence (Cho et al., 2015; Xu et al., 2018).

The risk factors of falls in the stroke population include fear of falling, poor balance, and even cognitive dysfunction (Cho et al., 2015). Furthermore, many cohort and case-control studies have found that, in community stroke survivors; there is an increased risk of falls because of motor and sensory impairment and the fall history, while in hospital and environmental safety hazards (Xu et al., 2018). In the meta-analysis conducted by Xu et al. (2018), it was found that, in community-dwelling stroke survivors, the most common risk factors for falls include impaired balance and mobility problems, poor self-care and the administration of sedative and psychotropic medication.

Other risk factors for falls in this population included depression, history of falls and impairment of cognition, as well as decreased physical function, which include impaired motor and sensory function resulting in motor deficits and impaired dynamic balance (Xu et al., 2018; Cho et al., 2015; Divani et al., 2009).

Another important factor that this current study is focusing on, that may lead to falls in people with stroke, is the fear of falling and, according to Cho et al. (2015), it is one factor that should not be forgotten when assessing people with stroke.

Along with the fear of falling is found a decreased self-care that may be considered to increase the risk of falls (Xu et al., 2018; Cho et al., 2015). People with stroke do not only experience a fear of falling, but also experience other fears relating to their condition, and their recovery, which is linked to their self-efficacy. “Self-efficacy influences functional decline because fear may limit a person’s function to an extent beyond that due solely to an underlying impairment of physical ability” (Kim & Park, 2013, p. 2). The fear of falling and changes in balance are associated with a decrease in the gait speed, decreased stride length, and also the increased double support that people may use, such as walking devices (Stirling et al., 2018).

It has been found that better understanding the risk factors of falls leads to understanding how to treat people with stroke and therefore develop appropriate strategies and treatment techniques to decrease the number of falls occurring in this population (Cho et al., 2015). Furthermore, Xu et al. (2018) encourage screening for falls at the beginning of assessments and treatments, as one of the main goals for the rehabilitation of people with stroke is fall prevention, by using outcome measures associated with balance-testing. Education on the risk factors for falls for the stroke survivor, as well as for their caregivers, is viewed as important to working on fall prevention (Divani et al., 2009).

As mentioned in the first chapter of this study, several studies have investigated falls, such as Salbach et al. (2006), who observed how balance efficacy can assist in determining falls in the sub-acute post-stroke phase. In this study, both first-time stroke survivors and recurrent stroke survivors were observed, and the conclusion of the study found that assessing balance efficacy during stroke rehabilitation is of great importance.

Limitations for this particular study mentioned that the objectives were not fully addressed, generalisations were made to the walking abilities of the participants, and more emphasis was placed on balance efficacy, with limited mention of falls.

Salot et al. (2016), observed the mechanism of fall risk in chronic stroke survivors when perturbations were given. This was a cross-sectional study that consisted of only 14 stroke survivors, 14 age-matched controls and 14 young controls. The conclusion was that stroke survivors are unable to regain postural stability as non-stroke or healthy individuals are able to, therefore indicating that this may expose stroke survivors to an increased risk of falling. A limitation of this study was that the participants were only exposed to large-magnitude forward stance perturbations, while many falls in stroke survivors occur with transfers, or when performing activities (Batchelor et al., 2012), therefore not providing a true reflection of all mechanisms related to falling in the stroke population. Second, the study was limited to only stroke survivors between 43 and 65 years of age, which may raise questions such as what are the mechanisms for falls in stroke survivors older than 65 years of age, or are there other factors contributing to falls in the geriatric population?

Hwang et al. (2013) purposed to examine the effects of falls experience on cognitive and physical functioning in community-dwelling stroke survivors. Forty-seven participants were assessed using the Montreal Cognitive Assessment, Berg Balance Scale, the DGI, the Timed-Up-and-Go Test, the 10 Meter Walk Test and the 6 Minute Walk Test. Findings for this study were that cognitive and physical function influences the risk of falls in stroke survivors, and that determining cognitive function can aid in the prediction of falls in the geriatric population.

Da Silva et al. (2014) aimed to gain more understanding on falling, balance confidence and the fear of falling post-stroke and, although much information was found regarding these three factors, no mention is made of a relationship of falling, balance confidence and actual balance in the stroke population. This particular study was made interesting by interacting with the spouse of the participant to gain a holistic understanding of the participant's balance confidence. Limitations to this study were that the participants were averaged at seven years post-stroke, and the average age of participants was 69.5 years, with many having other co-morbidities, such as osteoporosis, which may also influence the risk of falling.

As read in the above section, one of the risk factors for falls in people with stroke is changes in physical function and, more specifically, decreased balance. In the next part of this literature review, there will be a discussion of balance in people with stroke, observing actual balance changes and also diving deeper into perceived balance.

2.5 Balance in people with stroke: actual vs perceived.

"Balance is believed to be fundamental in the ability to maintain independence in many ADLs as well as in locomotion and prevention of falls in general" (Kim & Park, 2013, p. 1). As noted in the previous sections, decreased actual balance is found in stroke survivors (Xu et al., 2018; Cho et al., 2015; Schmid et al., 2012).

This decrease in balance has been measured in many studies using outcome measures such as the Berg Balance Scale (BBS), gait assessments, Functional Independence Measure (FIM), and the Dynamic Gait Index (DGI), to name a few (Da Silva et al., 2014; Hwang et al., 2013; Schmid et al., 2012). This decrease in actual balance has been found over many years in research to be the cause of poor changes in gait, decreased ability to mobilise, decreased independence in ADLs, and increased risk of falling (Miyata et al., 2018; Kim & Park, 2013; Batchelor et al., 2012; Schmid et al., 2012; Divani et al., 2009; Forster & Young, 1995). With actual balance viewed as a common impairment post-stroke and as a risk factor for falling in people with stroke is balance confidence/balance self-efficacy/perceived balance.

Balance confidence is the individual's confidence in their ability to "maintain their balance and remain steady" (Schinkel-Ivy et al., 2016, p. 238). Another definition of balance confidence is "self-efficacy in being able to perform particular activities without falling" (Da Silva et al., 2014, p. 354). It has been said that the concept of self-efficacy, according to Banura's theory, is the ability to perform tasks dependent on both physical ability and mental confidence, and also has a psychological component that aids in the management of chronic conditions (Kim & Park, 2013).

There is constant research taking place in observing self-efficacy, otherwise known as *balance confidence*, in people with stroke, and how it is associated with various outcomes.

Most importantly for this research report, the focus is on balance self-efficacy which is seen as an important predictor for reintegration into the community post-stroke, as well as satisfaction of function and dependence (Kim & Park, 2013). Balance confidence has been measured commonly in many studies using the Activities-Specific Balance Confidence scale (ABC) (Schinkel-Ivy et al., 2016; Da Silva et al., 2014; Pang et al., 2007). In this study, the same tool has been used to note the perceived balance of the participants based on their balance confidence or balance self-efficacy, as self-efficacy can be identified as "an important determinant of perceived health status" (Kim & Park, 2013).

There has been a study conducted by Schinkel-Ivy et al. (2016), which looked at the relationship between fear of falling, balance confidence, and control balance, gait, and reactive stepping in individuals with sub-acute stroke. From the study, it was noted that there is a link between the risk of falling and balance confidence in the sub-acute stroke population (Schinkel-Ivy et al., 2016).

In a study conducted by Kim and Park (2013), balance self-efficacy in relation to balance and activities of daily living in community residents with stroke was observed. The results for this study showed that there is a relationship between actual balance—using the BBS, self-efficacy—using the ABC scale, and the confidence when performing ADLs in community-dwelling stroke survivors. From this study, it was found that "individuals' confidence in the ability to perform common daily activities without falling could be as important as their actual ability to balance" (Kim & Park, 2013, p. 4).

Da Silva et al. (2014) conducted a study observing falling, balance confidence and the fear of falling after chronic stroke. From this study, it was confirmed that there is a definite link between the balance confidence of an individual and the fear of falling, based on interviews conducted with stroke survivors and their caregivers, when participants who had a low balance confidence resulted in having an increased fear of falling (Da Silva et al., 2014).

From this literature review, it is clear that stroke is a common cause of disability worldwide, leaving many individuals with severe impairment and changes in physical and cognitive function, as well as struggling with decreased independence with ADLs. In stroke survivors, there is an increased risk of falling, which may result in further severe injury, such as

fractures. There are two main risk factors for falling in the stroke population, namely, an increased fear of falling which is linked to a decreased level of balance confidence or perceived balance, as well as the decline in actual balance scores, that will be discussed in this study.

There has been research observing the relationship between fear of falling, balance confidence, and control balance, gait, and reactive stepping in individuals with sub-acute stroke (Schinkel-Ivy et al., 2016), balance self-efficacy in relation to balance and activities of daily living in community residents with stroke (Kim & Park, 2013), and even observing falling, balance confidence and the fear of falling after chronic stroke (Da Silva et al., 2014), but there has not been any research done to observe the relationship between the risk of falling and perceived balance in patients with chronic stroke. For this reason, there is still a significant need to conduct this research study, with the hypothesis that in patients with chronic stroke, with decreased perceived balance or balance confidence, there is an increased risk of falling.

CHAPTER 3

3. Research Methods

3.1 Introduction

In this chapter, the methods of the study will be explained in detail and will include the study design, sample size, inclusion and exclusion criteria, and explanation of the pilot study and how the main study was performed.

3.2 Study design

This study was a descriptive cross-sectional study, which aimed to observe a specific population, namely chronic stroke population, and identify the prevalence of risk of falls, perceived balance and actual balance among the population.

3.3 Participants

3.3.1 Source of participants

Participants were recruited from Nicole Duff Physiotherapist, Netcare Rehabilitation Hospital Auckland Park and Rehab Matters Therapy Centre in Rivonia, which are all neurorehabilitation centres and practices specialising in neurorehabilitation. During the data-collection process, it was realised that more recruitment bases were needed as the sample size was not met within the planned timeframe. A request was made to three additional placements, which included the Stroke Foundation, Alexandra Clinic and Helen Joseph Hospital. An information letter was sent to all of the recruiting areas explaining the aim and purpose of the study and requesting the use of their patients as participants for this research study. Ethical clearance was obtained from the Human Research Ethics Committee Medical of the University of the Witwatersrand, once consent from the recruitment bases was obtained.

3.3.2 Sample size

The sample size was determined using results of a study by Kusambiza-Kiingi, Maleka and Ntsiea (2017), which established that the combined average monthly population of stroke survivors at approximately five health centres over three months was 150. Thus, the number of participants needed to accurately represent the population under study was 67. This figure was calculated at a confidence interval of 95% with a 0.10 alpha and a 0.3 margin of error (Bartlett et al., 2001).

Participants were included if they were chronic community-dwelling stroke survivors between six months and two years post-stroke who were independently ambulating with or without an assistive device. Participants were excluded if they had more than one stroke, presenting with receptive aphasia, if participants were younger than the age of 18, if they had any other co-morbidities that limited their ambulation, such as hip and knee replacements, and lower limb fractures resulting in decreased mobility, and if they showed cognitive deficits, which was determined by the Modified Mini Mental State Test, or if scores were below 50%. The 'cut-off' timeframe post-stroke was set as not more than two years, as there is an increased risk of recurrent strokes occurring in stroke survivors with hypertension, diabetes and ischaemic heart disease (El-Gohary et al., 2019), with research showing that recurrent strokes commonly occur one to four years after the first stroke (Zhu et al., 2016). Therefore, to limit the possibility of second strokes occurring and the increased physical challenges and inability associated with strokes, the inclusion criteria for this study observed stroke survivors between six months to two years post-stroke.

3.4 Outcome measures and Instrumentation

The Modified Mini Mental State Test (3Ms) (Appendix A) was used as a screening tool for cognitive deficits and dementia (McDowell, 2006). The 3Ms is a more comprehensive examination compared to the Mini Mental State Examination (MMSE) and has been found to have more sensitivity and is a valid tool to use (McDowell, 2006, Teng & Chui, 1987). A demographic and clinical profile capture sheet (Appendix B) was given to each participant to record their age, sex, side of stroke, stroke duration, and number of falls or near falls in the last one month.

Once participants completed the demographic capture sheet, the Activities-Specific Balance Confidence (ABC) scale (Appendix C) was used to determine the risk of falls and perceived balance in the participants.

"The ABC Scale has been shown to have good internal consistency (Cronbach alpha = 0.94) and test-retest reliability (intra-class correlation coefficient = 0.85) and significant moderate correlations with the Berg Balance Scale (BBS) (Spearman rho = .36) and gait speed (Spearman rho = .48) (ie, construct [convergent] validity) for people with stroke" (Pang et al., 2007). This was a self-administered capture sheet; however, if the participant had difficulty with writing, due to their dominant side being affected, a caregiver, family member, or the researcher filled in the form. For this study, the first three categories of the ABC were considered, to focus on a high level of physical function as being the same as a high level of perceived balance; a moderate level of physical functioning as a moderate level of perceived balance; and a low level of physical functioning as a low level of perceived balance. However, there is a fourth category, which considers results for older adults who may be at risk of falling, or seen as having predicted future falls if they scored < 67%. For the ABC Scale, an older adult is considered as 65 years and older (Powell & Myers, 1995).

The Dynamic Gait Index (DGI) (Appendix D) was used as the outcome measure for this research study which examined the gait, balance and risk of falls of the study population. "The scale has been shown to have good inter-rater and test-retest reliability, and is a valid predictor of falls in stroke patients" (Hwang et al., 2013). "ICCs for test-retest and inter-rater reliability of total scores were good (0.96 and 0.96, respectively) whereas reliability for single item scores was in the moderate to good range, (0.55-0.93)" (Jonsdottir & Cattaneo, 2007).

3.5 Data collection procedure

3.5.1 Pilot Study:

The purpose of the pilot study was to firstly determine the amount of time to do a full assessment, secondly to familiarise the researcher with the assessment tools, and finally to familiarise the researcher with the data collection and capturing process. Four participants took part in the pilot study.

The pilot study only commenced once ethical clearance was obtained by the Human Research Ethics Committee Medical Department of the University of the Witwatersrand. Participants were recruited from Nicole Duff Physiotherapist, who had granted consent to conduct the pilot study. This practice conducts outpatient neurorehabilitation treatment.

Participants who had fit the inclusion criteria were contacted telephonically and appointments were set up to have the patients come to the Wits Donald Gordon Medical Centre or for the researcher to perform the study at the participant's home setting. An information sheet was given to each participant and they were given the opportunity to ask any questions relating to the study. After written consent was obtained, the researcher used the 3Ms test as a screening tool for cognitive deficits and dementia. Once the participant had scored 50% or more, they were given a capture sheet to complete regarding demographic and clinical information. The ABC scale was then handed to the participant to determine their perceived balance. Lastly, the DGI was administered by the researcher to determine the participant's balance scores. During the pilot study, there was no need to involve members of staff at the Wits Donald Gordon Medical Centre or residence of the participant to interpret information, as each participant was able to understand the process.

Once all four participants were assessed, the data were entered on an Excel spreadsheet and analysed and included in the main study.

3.5.2 Main study:

Participants were recruited from Nicole Duff Physiotherapist; Rehab Matters Therapy Centre's Rivonia, Rosebank and Dobsonville branches; and Rita Henn and Partners Inc. at Netcare Rehabilitation Hospital in Auckland Park, Johannesburg. As mentioned above, during the data collection process it was noted that more recruitment bases were needed; therefore Alexandra Clinic, Helen Joseph Hospital and the Stroke Foundation were added as recruitment bases once ethical clearance was obtained. Nicole Duff Physiotherapist and Rita Henn and Partners Inc. at Netcare Rehabilitation Hospital had given permission to recruit participants through previous records and contact details of the participants. Rehab Matters Therapy Centre had given permission to place posters and flyers in their three practices to recruit participants.

Rehab Matters Therapy Centre and Rita Henn and Partners Inc. at Netcare Rehabilitation Hospital in Auckland Park had granted permission to recruit participants but had stated that their facilities could not be used when conducting the data collection.

The main study followed the same procedure as that of the pilot study, in that participants were contacted telephonically and a brief screening was done by which questions such as stroke duration, number of strokes, and the ability to mobilise independently were asked to ensure that participants would fit the inclusion criteria.

Appointment dates were then set up and participants were given the opportunity to meet at one of the Nicole Duff Physiotherapist rooms, or at the participant's place of residence. An information sheet was given to each participant and they were given the opportunity to ask any questions relating to the study. After written consent was obtained, the researcher used the 3Ms test as a screening tool for cognitive deficits and early signs of dementia. Once the participant had scored 50% or more, they were given a capture sheet to complete regarding demographic and clinical information. The ABC scale was then handed to the participant to determine their perceived balance. Lastly, the DGI was administered by the researcher to determine the participant's balance scores. If there was a language barrier, a caregiver or family member of the participant was present to assist in interpreting and translating all relative information. The data was then entered on an Excel spreadsheet and, once all assessments were complete, the data were analysed. The broad use of different practices to recruit the participants aided in eliminating the possibility of biased results.

3.6 Data analysis

The data collected were saved on an Excel spreadsheet and were later extracted into Stata Network 14.2 for the data analysis. The descriptive statistics, falling under categorical variables, included the frequencies and percentages of the gender of the participants, as well as the side of stroke of each participant. Under the continuous variables, the means and standard deviations of the following were found: age, stroke duration (months), number of falls and near falls within the last month from when each participant was assessed, as well as the scores for the ABC scale, DGI and 3Ms outcome measures. The 3Ms was used to identify those with cognitive impairment, where a score of 50% or more = normal cognitive ability and less than 50% = cognitive impairment.

Originally, it was thought the Pearson Chi exact statistical test would be used to determine the results for the relationship between perceived balance and the risk of falls in the study population. However, during the data analysis, it was noted that the expected values were not greater than five; therefore, the Fischer's exact test was a more suitable test to be used to determine the correlation between the ABC and DGI scores. Further analysis of the study's data was conducted with the assistance of a statistician.

3.7 Ethical considerations

Ethical clearance was applied for from the University of the Witwatersrand prior to the study being conducted (Appendix E). Permission to use facilities as a recruitment base to track outpatients attending their clinical facilities was obtained (Letter and Information sheet, Appendix F, and consent form, Appendix G). An information sheet (Appendix H) and a consent letter (Appendix I) was given to each participant. The participants were informed that participation in this study would be voluntary and that they could withdraw from the study at any time, without penalty. Participants were ensured that their confidentiality would be kept. Lastly, during interaction and assessments, participants were treated with dignity and respect.

CHAPTER 4

4. RESULTS

4.1 Introduction

In this chapter, the results of this study will be presented to give an overview of the profile of the study participants and cover the study objectives, which were to determine the perceived balance in the study participants using the ABC scale; to determine the risk of falls using the DGI; to assess the relationship between perceived balance and the risk of falls and to determine the factors influencing the risk of falls in the study population.

4.2. The profile of study participants

Fifty-one stroke survivors participated in this study. One hundred and 28 participants were recruited and only 51 met the inclusion criteria. From the 128 recruited, 10 had passed away before the assessment, 23 did not fit the inclusion criteria—they either had poor cognition or dementia and scored less than 50% with the 3Ms test—had more than one stroke or other co-morbidities such as hip replacements, back surgery or lower limb fractures, and 44 did not answer the call, declined or had moved out of Johannesburg to another province. The participants who reported having a fall were questioned as to when the fall/s had occurred and the majority reported as follows: when performing a task or transferring from a seated position, or mobilising in the bathroom, or simply because of a lack of foot clearance. This information was only asked as additional information, and was not based on the objectives of the main study. Results of the profile of study participants are presented in Table 4.1.

Table 4.1: The profile of study participants (*n*=51)

Categorical variables			**Continuous variables**		
Sex:	**n**	**%**		**Mean**	**SD**
Male	28	55	Age (years) [Minimum 37; Maximum 87]	62.84	12.19
Female	23	45	Stroke duration (months)	12.90	4.93
Side of stroke			3Ms	85.20	9.21
Left stroke	28	55		**freq**	**SD**
Right stroke	23	45			
			Number of falls in last month	17	0.7
			Number of near falls in last month	123	3.1

SD: Standard deviation; 3Ms: The Modified Mini Mental State Test; freq: frequency

The mean age of the study participants was 62.84 years (±12.19). From the 51 assessed participants, the majority were male and had a left stroke (*n*=28: 55% for both).

4.3 Perceived balance among the study population

As mentioned in Chapter 3, there are four categories for the ABC scale. The three main categories of the ABC score are presented in Table 4.2. However, in the fourth category, observing the risk of falls and prediction of future falls score in older adults; out of the 51 participants, 12 were 65 years and older and scored < 67%.

Table 4.2: Perceived balance among the study population (*n*=51)

Category	ABC scale score range	n (%)
High level of perceived balance	>80%	26 (50.98)
Moderate level of perceived balance	50-80%	12 (23.53)
Low level of perceived balance	<50%	13 (25.49)

ABC- Activities-specific Balance Confidence

From these results, we see that most of the study participants (n=26; 50.98%) had a higher level of perceived balance.

4.4. Risk for falls among the study population

In this section, the results for the risk of falls in the 51 participants of this study are presented using the two main categories of the DGI, in which a score of 19 or less demonstrates the risk of falls and a score of more than 19 indicates no risk of falls.

Table 4.3: Risk for falls among the study population (*n*=51)

Category	DGI score out of 24	n (%)
No risk of falls	>19	15 (29.41)
Risk of fall	≤19	36 (70.59)

DGI- Dynamic Gait Index

From these results, we notice that the majority of the participants were found to be at risk of falling (*n*=36; 70.59%).

4.5 The relationship between perceived balance and risk of falls in the study population

The relationship between perceived balance and risk of falls in the 51 participants was established using Fischer's exact test. These results can be seen below in Table 4.4.

Table 4.4: The relationship between perceived balance and risk of falls in the study population

	DGI score category		Total	P value
ABC score category	**No risk of falls**	**Risk of falls**		
High level of perceived balance	13	13	**26**	**0.002**
Moderate level of perceived balance	2	10	**12**	
Low level of perceived balance	0	13	**13**	
Total	**15**	**36**	**51**	

ABC- Activities-specific Balance Confidence and DGI- Dynamic Gait Index

From the above table, it is noted that 50% of high level of perceived balance are at risk of falls, 83% of moderate level of perceived balance are at risk of falls and 100% of the low level of perceived balance are at risk of falls. This clearly shows that there is a significant relationship between the risk of falls and perceived balance in the study population, and also that there is a risk of falling irrespective of the ABC category.

4.6 Factors that influence the risk of falls in the study population

Results of a univariate analysis of factors that influenced the risk of falls in this study population are presented in Table 4.5. The number of falls in the last month reflected an 'omitted' result which, according to the statistician, could be due to the result being too small a number for the Stata programme to interpret, as the majority of the participants did not report a fall and therefore the presentation of results showed numerous zeros.

Table 4.5: Factors that influence the risk of falls in the study population on univariate analysis (*n*=51)

Factors	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]
Age (Years)	1.07	0.32	2.28	0.02	1.01 – 1.13
Gender (F)	3.07	2.07	1.67	0.09	0.82 – 11.48
Side of stroke (R)	2	1.28	1.08	0.28	0.57 – 7.02
Stroke duration (months)	1.09	0.74	1.21	0.23	0.95 – 1.24
Near falls in the last month	1.37	0.23	1.93	0.05	0.99 – 1.90
Low level of perceived balance	0.16	0.11	-2.67	0.01	0.04 – 0.61

DGI- Dynamic Gait Index

Observing the univariate regression results, there are three variables indicating significance in this study, with $p<0.05$. Age ($p=0.02$) shows that the risk of a fall increased with every 1.07 increase in age. With the analysis of the risk of falls and the number of near falls that occurred in the last month of seeing the participant, $p=0.05$, indicating significance, and the odds ratio indicated that there is a 1.37 increase of the risk of falls occurring if the participant had experienced a near fall in the last month prior to their assessment. Thirdly, with a low level of perceived balance ($p=0.01$), it shows that there is significance between the risk of falls and the perception of the participant's balance. With the other variables, although not statistically significant, females were 3.07 times more at risk of falls than males, patients with right-side stroke were two times more at risk of falls than those with left-side stroke, and there was a 1.09 increase of the risk of falls as the duration of months post-stroke increased.

Table 4.6: Factors that influence the risk of falls in the study population on multivariate analysis (*n*=51)

Interpretation of DGI Score	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]
Age (years)	1.08	0.05	1.72	0.09	0.99 – 1.17
Gender (F)	2.68	2.34	1.13	0.26	0.48 – 14.84
Stroke duration (months)	0.99	0.08	-0.01	0.99	0.85 – 1.18
Side of stroke (R)	1.67	1.42	0.60	0.55	0.31 – 8.86
Near falls in the last month	1.19	0.19	1.07	0.28	0.87 – 1.62
Interpretation of the ABC score – high level of perceived balance	0.23	0.20	- 1.72	0.08	0.04 – 1.22

ABC- Activities-specific Balance Confidence and DGI- Dynamic Gait Index

From the second logistical regression, as seen in Table 4.6, it is noted that none of the factors had a significant influence on the risk of fall; however, this study shows that, with an odds ratio of below one (0.23), having a higher level of perceived balance indicates that there is a lower risk of falls.

With the sample size being smaller than expected, some results could not be obtained, and therefore, with a larger sample size that would meet a 95% confidence interval, clearer results may have been found, with more significance between the factors.

CHAPTER 5

5. DISCUSSION

5.1. Introduction

The aim of this study was to determine the relationship between perceived balance and the risk of falls in patients more than six months post-stroke, with the following objectives: to establish perceived balance in the study participants; establish the risk of falls; establish the relationship between perceived balance and the risk of falls and to determine the factors influencing the risk of falls in the study population. In this chapter, the study findings will be discussed.

5.2. The profile of study participants

Based on this study, it was observed that the majority of the study population were males and most of the study population had suffered a left stroke. These results are similar to previous research conducted by Schmid et al. (2012) and Schinkel-Ivy et al. (2017). In this current study of 51 participants with chronic stroke, 17 falls were reported and a total of 123 near falls were reported. A near fall can be defined as “an occasion on which an individual felt that they were about to fall but did not actually fall” (Verheyden et al., 2010, p. 3). With over 100 near falls being recorded, we observe the significance and the 1.37 increase in the risk of falls occurring if the participant had experienced a near fall in the last month prior to their assessment.

Observing previous studies, it has been found that falls still occur in chronic stroke, and Batchelor et al. (2012) confirm this in stating that 36% of people with chronic stroke had experienced a fall. In this mentioned study, when questioning the participants as to where the falls or near falls had occurred, the majority reported: when performing a task or transferring from a seated position, or mobilising in the bathroom, or simply because of a lack of foot clearance. Similar responses can be confirmed with the studies of Miyata et al. (2018), Batchelor et al. (2012) and Forster and Young (1995).

5.3 Perceived balance among the study population

Observing the ABC scores, which were used to identify the perceived balance of the study population, it was noted that approximately 50% of the study population scored as having a low-to-moderate level of perceived balance.

These were all participants in the chronic stage post-stroke and who had already been reintegrated into their communities. These results can be linked to the previous literature of Kim and Park (2013) and Da Silva et al. (2014), who observed a distinctive link between the stroke population and decreased balance self-efficacy and an increased fear of falling in chronic stroke. This also confirms what was found in the research conducted by Schmid et al. (2012), that even in chronic stroke there is still a concern and worry of falling, even though they may be months post-stroke and have perhaps already accepted their physical limitations. Thiamwong and Suwanno (2017) mention that fear of falling has a significant relationship with perception of health and, as Xu et al. (2018) and Cho et al. (2015) report, that an increased fear of falling causes an increase in the risk of falling, we can once again see that there is a link with how stroke survivors perceive their balance, as well as their confidence levels, and the risk of them experiencing a fall. However, from the results, all three categories showed notable risks of falls, including those with a high perceived level of balance.

5.4 Risk for falls among the study population

In this study, the majority of the participants (*n*=36; 70.59%) were found to be at risk of falling. Similarly, with a percentage of higher than 70%, in the study conducted by Da Silva et al. (2014), they found that approximately 76% of stroke survivors have experienced a fall post-discharge. In addition to this, Xu et al. (2018) conducted a systematic review and meta-analysis and found that community-dwelling stroke survivors have a risk of falls due to many factors that hospital-based patients do not necessarily encounter until discharge. Weerdesteyn et al. (2008) also make mention of the risk of falls being evident in all post-stroke stages and that circumstances and incidence rates for falls increase with the stages of stroke. With an increased risk of falling among the study population, these individuals may be prone to actual falls and the consequences that come with falling, such as head injuries, soft tissue injuries, or even fractures (Schimd et al., 2013; Batchelor et al., 2012).

As mentioned in the second chapter of this study, early osteoporosis is common in stroke survivors who are less likely to mobilise. Therefore, decreased weight-bearing occurs, resulting in decreased bone density, and this may result in an increased risk of fall-related injuries (Divani et al., 2009).

With this being observed, it is becoming clearer that there is a relationship between fear of mobilising, possibly as a result of decreased perceived balance, and the risk of falling. In the next section, this relationship will be discussed further.

5.5. The relationship between perceived balance and risk of falls in the study population

From this study, it has been noted that the perception of the stroke survivor regarding their balance is a risk factor. Due to the nature of other risk factors, such as decreased muscle strength and poor balance, as seen in other research (Xu et al., 2018; Cho et al., 2015), it was expected that those who presented with a lower level of function would be more at risk for falls. According to research done and mentioned in the literature review of this study, it was noted that there are different risk factors for falls, which include poor balance, decreased muscle strength, and fear of falling (Xu et al., 2018; Cho et al., 2015, Divani et al., 2009). In addition to the relationship between perceived balance and the risk of falls, it has been found that improving the balance confidence of an individual is as important as working on their actual balance (Kim and Park., 2013).

5.6 Suggestions of factors that influence the risk of falls in the study population

From this study, it was observed that there is a possible increased risk of falls occurring as stroke survivors become older. Research conducted by Weerdesteyn et al. (2008) confirms this in reporting that approximately 30% of elderly people fall at least once a year and approximately 15% experience two or more falls in a year. Harris et al. (2005) also confirm that elderly stroke survivors experience more falls. In the systematic review and meta-analysis conducted by Xu et al. (2018), it was also confirmed that, with increasing age, there is a higher risk of falls, as well as females showing a higher risk of falling, which leads us to the next part of this discussion. According to Thiamwong and Suwanno (2017), reasons for the increased risk of falling in the elderly can be because with an increase in age comes an

increase in the fear falling and other factors increasing this fear of falling can be due to restrictive health services and a decrease in a socio-economic support system.

Regarding gender, from the profile of the study population, more males had stroke; however, when it comes to the risk of falls, female stroke survivors have a higher risk of experiencing fall compared to males. Results relating to females having a higher risk of fall can be supported with previous research done by Miyata et al. (2018), Thiamwong and Suwanno. (2017) and Harris et al. (2005). Reasons for these results, according to Thiamwong and Suwanno (2017) are that females have a higher history of falls, which results in an increased fear of falling.

5.7 Predictors of falls

Batchelor et al. (2012) mention that many researchers have attempted to find many risk factors for falls so as to work on fall-prediction tools. However, far more research is needed to look at different factors influencing the risk of falls. With this being said, it has been challenging finding research on the influence stroke duration and side of stroke has on the risk of falls. Xu et al. (2018) also confirm this by mentioning that, with a lack of consistency in terminology regarding impairments of stroke, such as side of stroke, it is challenging to determine if there is a significant influence of side of stroke on the risk of falls. For example, few studies mention ‘side of stroke’, while the majority speak of motor impairment in terms of limitations of muscle control, mobility, or movement control of the affected side (Xu et al., 2018). This may be due to a ‘lack’ of universal language among therapists globally.

Observing the number of near falls and the relationship it has with the risk of future falls, it was noted that, in this particular study, there was no statistical significance to confirm that a stroke survivor experiencing a near fall can in fact increase their risk of falling. Batchelor et al. (2012) reported that stroke survivors do not only have an increased risk of falling but they also tend to have frequent falls. With this being said, previous research has noted that an increase in the history of falls results in an increase in the risk of falls (Xu et al., 2018; Thiamwong & Suwanno, 2017; Batchelor et al., 2012).

5.8 Study limitations

In most research studies, there are a few limitations and challenges that exist. For this study, the most challenging part was recruiting participants. Ethical clearance was originally given for three placements, but during data collection, it was noted that more recruitment bases were needed as the sample size was not being reached. Further ethical clearance was then applied for and granted for an additional three placements.

The recruiting procedure was done by collecting possible participant contact details from the placements' databases and then phoning them to firstly explain the research topic and procedure and gain consent to continue with the research project.

Many of the numbers no longer existed, or the person was not interested in taking part in the study, or the person had passed away after their discharge from the placement, or the person moved to another city or went to their original home after discharge from the placement. Another challenge was finding participants that met the inclusion criteria of first-time stroke with no other comorbidities limiting ambulation. For these reasons, the study sample of 67 was not reached, and only 51 participants were used for this research study. With the 51 participants, the data analysis could still be done and a logistic regression could still be performed. However, to improve the confidence interval to 95%, the full sample size should have been assessed. To ensure that the full sample size was obtained, extending the timeframe for conducting the study could have been looked at. Another therapist could have also assisted in the data collection to minimise any bias in the results.

The DGI only observed dynamic balance with walking. However, to further observe the participant's balance, the Berg Balance Scale could have been used with components of static standing balance and transitioning between positions, as observed with other research studies (Hwang et al., 2013; Schmid et al., 2012; Weerdesteyn et al., 2008). An alternative outcome measure for the screening for early signs of dementia and cognitive function could have been the Montreal Cognitive Assessment, which has been found to have good sensitivity and validity in stroke survivors (Hwang et al., 2013).

5.9 Recommendations

From this study, there are recommendations for physiotherapists working with stroke survivors, such as the need to assess perceived balance and identify fear of falling in patients who are ambulatory. There is also a need to use outcome measures to assess the patient's physical balance when walking, as well as take note of their perceived balance. A recommendation for a future study would be to determine therapeutic techniques that can assist in building up the balance confidence and decreasing the fear of falling in stroke survivors.

5.10 Conclusion

There are many factors affecting the mobility and functionality of people with chronic stroke, which often result in an increased risk of falling. In this study, it was found that perceived balance has an impact on actual balance scores, and that there is a significant relationship between the risk of falls and perceived balance among people with chronic stroke. Outcome measures such as the ABC scale can be used by therapists to determine their patient's perceived balance, and therapists are therefore able to treat their patients accordingly, appropriately and holistically, depending on the results. Therefore, treating chronic stroke survivors holistically, by observing the physical and psychological aspect, will aid in improving balance, and decreasing the number of falls occurring in this population.

If the therapists can identify their patient's perceived balance, they can better understand if the patient has a possible fear of falling and if that may influence their risk of fall. Therefore, it is important for us as therapists to work on improving the balance confidence of our patients who have had strokes as well as work on decreasing their fear of falling as this may assist in improving their overall actual balance scores.

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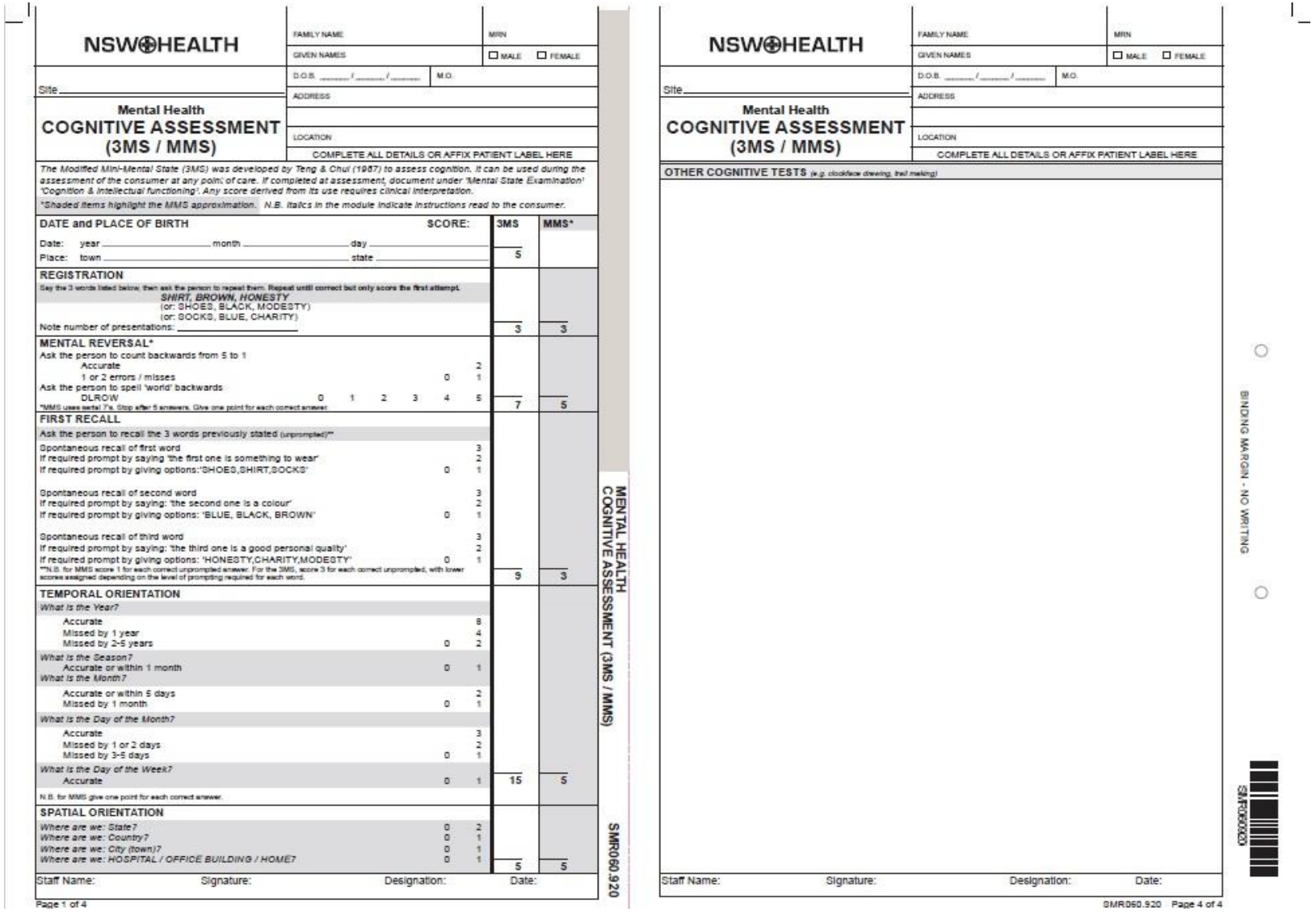
List of Appendices:

Participant Code:

Appendix A:

The Modified Mini-Mental State (3Ms) Test



NSW HEALTH

FAMILY NAME | MRN

GIVEN NAMES | ☐ MALE ☐ FEMALE

D.O.B. ____/____/____ | M.O.

Site ____

ADDRESS

Mental Health
COGNITIVE ASSESSMENT (3MS / MMS)

LOCATION

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

The Modified Mini-Mental State (3MS) was developed by Teng & Chui (1987) to assess cognition. It can be used during the assessment of the consumer at any point of care. If completed at assessment, document under 'Mental State Examination' 'Cognition & Intellectual functioning'. Any score derived from its use requires clinical interpretation.

**Shaded items highlight the MMS approximation. N.B. Italics in the module indicate instructions read to the consumer.*

	SCORE:	3MS	MMS*
DATE and PLACE OF BIRTH Date: year ____ month ____ day ____ Place: town ____ state ____		5	
REGISTRATION Say the 3 words listed below, then ask the person to repeat them. Repeat until correct but only score the first attempt. *SHIRT, BROWN, HONESTY* (or: SHOES, BLACK, MODESTY) (or: SOCKS, BLUE, CHARITY) Note number of presentations: ____		3	3
MENTAL REVERSAL* Ask the person to count backwards from 5 to 1 Accurate 2 1 or 2 errors / misses 0 1 Ask the person to spell 'world' backwards DLROW 0 1 2 3 4 5 *MMS uses serial 7's. Stop after 5 answers. Give one point for each correct answer.		7	5
FIRST RECALL Ask the person to recall the 3 words previously stated (unprompted)** Spontaneous recall of first word 3 If required prompt by saying 'the first one is something to wear' 2 If required prompt by giving options:'SHOES,SHIRT,SOCKS' 0 1 Spontaneous recall of second word 3 If required prompt by saying: 'the second one is a colour' 2 If required prompt by giving options: 'BLUE, BLACK, BROWN' 0 1 Spontaneous recall of third word 3 If required prompt by saying: 'the third one is a good personal quality' 2 If required prompt by giving options: 'HONESTY,CHARITY,MODESTY' 0 1 **N.B. for MMS score 1 for each correct unprompted answer. For the 3MS, score 3 for each correct unprompted, with lower scores assigned depending on the level of prompting required for each word.		9	3
TEMPORAL ORIENTATION *What is the Year?* Accurate 8 Missed by 1 year 4 Missed by 2-5 years 0 2 *What is the Season?* Accurate or within 1 month 0 1 *What is the Month?* Accurate or within 5 days 2 Missed by 1 month 0 1 *What is the Day of the Month?* Accurate 3 Missed by 1 or 2 days 2 Missed by 3-5 days 0 1 *What is the Day of the Week?* Accurate 0 1 N.B. for MMS give one point for each correct answer.		15	5
SPATIAL ORIENTATION *Where are we: State?* 0 2 *Where are we: Country?* 0 1 *Where are we: City (town)?* 0 1 *Where are we: HOSPITAL / OFFICE BUILDING / HOME?* 0 1		5	5

Staff Name: Signature: Designation: Date:

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MENTAL HEALTH COGNITIVE ASSESSMENT (3MS / MMS) SMR060.920

NSW HEALTH

FAMILY NAME | MRN

GIVEN NAMES | ☐ MALE ☐ FEMALE

D.O.B. ____/____/____ | M.O.

Site ____

ADDRESS

Mental Health
COGNITIVE ASSESSMENT (3MS / MMS)

LOCATION

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

OTHER COGNITIVE TESTS *(e.g. clockface drawing, trail making)*

Staff Name: Signature: Designation: Date:

SMR060.920 Page 4 of 4

BINDING MARGIN - NO WRITING

SMR060.920

NSW HEALTH

FAMILY NAME | MRN

GIVEN NAMES | ☐ MALE ☐ FEMALE

D.O.B. ____/____/____ | M.O.

Site ____ | ADDRESS

Mental Health

COGNITIVE ASSESSMENT (3MS / MMS)

LOCATION

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

SMR060.920

BINDING MARGIN - NO WRITING

	3MS	MMS
NAMING		
Ask the person to name the following: Forehead ____ Chin ____ Shoulder ____ Elbow ____ Knuckle ____		
N.B. for MMS ask the person to only name the first two, for the 3MS ask all five.	5	2
FOUR-LEGGED ANIMALS (30 SECONDS) 1 POINT EACH		
Ask the person to name as many 4 legged animals as they can in 30 seconds. The maximum score is 10.	10	
SIMILARITIES		
Ask the person how an Arm and Leg are similar. Correct answer: Body part; limb; etc. (2) / Less correct answer (0 / 1)		
Ask the person how Laughing and Crying are similar. Correct answer: Feeling; emotion (2) / Other correct answer (0 / 1)		
Ask the person how Eating and Sleeping are similar. Correct answer: Essential for life (2) / Other correct answer (0 / 1)	6	
REPETITION		
Ask the person to repeat: 'I WOULD LIKE TO GO HOME/OUT' (2) / 1 or 2 missed/wrong words (0 / 1)		
Ask the person to repeat: "NO IFS ____ ANDS ____ OR BUTS" (3)		
N.B. That for the shaded component the 3MS scores 3 points for a correct answer, the MMS scores 1.	5	1
READ AND OBEY 'CLOSE YOUR EYES'		
Ask the person to read and obey the above sentence, which is located on page 3. Obeys without prompting (3) / Obeys after prompting (2) / Reads aloud only (spontaneously or by request) (0 / 1)		
N.B. For the MMS, score 1 if the person reads and obeys.	3	1
WRITING (1 minute)		
Ask the person to write on the next page: (I) WOULD LIKE TO GO HOME/OUT		
N.B. For the MMS, score 1 if correct.	5	1
COPYING TWO PENTAGONS (1 minute)		
Ask the person to copy the design on the next page.		
Scoring: 5 approximately equal sides (Each pentagon) (4 / 3) / Other enclosed figure (3 / 2) / 2 or more lines (0 1 / 0 1) / 4 corners (Intersection) (2 / 1) / Not-4-corners enclosure (0 / 1)		
N.B. for the MMS, score 1 if correct.	10	1
THREE-STAGE COMMAND		
Ask the person to follow a 3 stage command: *'Take a piece of paper in your left/right hand, fold it in half, and hand it back to me'.*		
N.B. Give one point for each stage correct.	3	3
SECOND RECALL		
Ask the person to recall the 3 words from page 1. (Something to wear) (0 1 2 3) / (Colour) (0 1 2 3) / (Good personal quality) (0 1 2 3)	9	
TOTAL SCORE (3MS out of 100)/ (MMS out of 30)		

MMS: 'normal': >=27; 'Cognitive impairment': 'mild' 20-26; 'moderate' 10-19; 'severe' <10. 3MS under 78 indicates likely cognitive impairment.

CLINICAL OVERVIEW/ISSUES TO BE ADDRESSED IN MANAGEMENT/CARE PLAN *(consider all cognitive testing)*

Staff Name: Signature: Designation: Date:

NSW HEALTH

FAMILY NAME | MRN

GIVEN NAMES | ☐ MALE ☐ FEMALE

D.O.B. ____/____/____ | M.O.

Site ____ | ADDRESS

Mental Health

COGNITIVE ASSESSMENT (3MS / MMS)

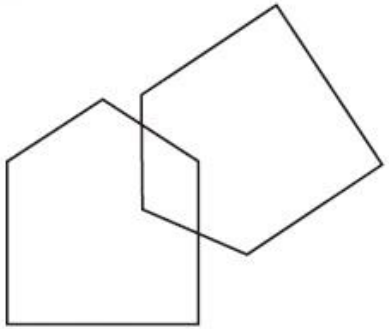
LOCATION

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Ask the person to read and obey the following sentence.

CLOSE YOUR EYES

Ask the person to copy the design below. All 10 angles must be present and two must intersect to form a 4 sided figure. Tremor and rotation are ignored.



DRAWING AND WRITING BY CONSUMER

Staff Name: Signature: Designation: Date:

Appendix B:

Participant Code:

Demographic and Clinical Information

Age: _____

Sex: Male: ☐ **Female:** ☐

Stroke duration (months**):**_____

Left hemiplegia: ☐ **Right hemiplegia:** ☐

Number of falls in the last month: _____

Number of near falls in the last month (loss of balance but no fall to the ground**):**_____

Appendix C:

The Activities-specific Balance Confidence (ABC Scale)

Administration:
The ABC can be self-administered or administered via personal or telephone interview. Larger typeset should be used for self-administration, while an enlarged version of the rating scale on an index card will facilitate in-person interviews. Regardless of method of administration, each respondent should be queried concerning their understanding of instructions, and probed regarding difficulty answering specific items.

Instructions to Participants:
For each of the following, please indicate your level of confidence in doing the activity without losing your balance or becoming unsteady from choosing one of the percentage points on the scale form 0% to 100%. If you do not currently do the activity in question, try and imagine how confident you would be if you had to do the activity. If you normally use a walking aid to do the activity or hold onto someone, rate your confidence as it you were using these supports. If you have any questions about answering any of these items, please ask the administrator.

Instructions for Scoring: The ABC is an II-point scale and ratings should consist of whole numbers (0-100) for each item. **Total the ratings (possible range = 0 -1600) and divide by 16 to get each subject's ABC score.** If a subject qualifies his/her response to items #2, #9, #11, #14 or #15 (different ratings for "up" vs. “down” or “onto” vs. “off”), solicit separate ratings and use the lowest confidence of the two (as this will limit the entire activity, for instance the likelihood of using the stairs.)

Interpretation of results:

- 80% = high level of physical functioning
- 50-80% = moderate level of physical functioning
- < 50%.= low level of physical functioning
- < 67% = older adults at risk for falling; predictive of future fall

Participant Code:

The Activities-specific Balance Confidence (ABC) Scale:

For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:

0%(no confidence) **10% 20% 30% 40% 50% 60% 70% 80% 90% 100**%(completely confident)

"How confident are you that you will not lose your balance or become unsteady when you…

1....walk around the house? %

2.. .. walk up or down stairs? %

3.: .. bend over and pick up a slipper from .the front of a closet floor __%

4.. .. reach for a small can off a shelf at eye level? %

5...stand on your tiptoes and reach for something above your-head? __%

6. . .. stand on a chair and reach for something? __%

7. ....sweep the floor? __%

8. ... walk outside the house to a car parked in the driveway? __%

9... get into or out of a **car/taxi**? __%

10....walk across a parking lot to the mall? __%

11....walk up or down a ramp? __%

12....walk in a crowded mall where people rapidly walk past you? __%

13....are bumped into by people as you walk through the mall? __%

14.... step onto or off an escalator while you are holding onto a railing? __%

15.... step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing? __%

16....walk outside on wet ground? __%

Appendix D:

Participant code:

The Dynamic Gait Index (DGI):

Method of Use
8 functional walking tests are performed by the subject and marked out of three according to the lowest category which applies. 24 is the total individual score possible. Scores of 19 or less have been related to increase incidence of falls.

1. Gait level surface _____

Instructions: Walk at your normal speed from here to the next mark (6m)

Grading: Mark the lowest category that applies.

(3) Normal: Walks 6m, no assistive devices, good speed, no evidence for imbalance, normal gait pattern

(2) Mild Impairment: Walks 6m, uses assistive devices, slower speed, mild gait deviations.

(1) Moderate Impairment: Walks 6m, slow speed, abnormal gait pattern, evidence for imbalance.

(0) Severe Impairment: Cannot walk 6m without assistance, severe gait deviations or imbalance.

2. Change in gait speed _____

Instructions: Begin walking at your normal pace (for 1,5m), when I tell you "go," walk as fast as you can (for 1,5m). When I tell you "slow," walk as slowly as you can (for 1,5m).

Grading: Mark the lowest category that applies.

(3) Normal: Able to smoothly change walking speed without loss of balance or gait deviation. Shows a significant difference in walking speeds between normal, fast and slow speeds.

(2) Mild Impairment: Is able to change speed but demonstrates mild gait deviations, or not gait deviations but unable to achieve a significant change in velocity, or uses an assistive device.

(1) Moderate Impairment: Makes only minor adjustments to walking speed, or accomplishes a change in speed with significant gait deviations, or changes speed but has significant gait deviations, or changes speed but loses balance but is able to recover and continue walking.

(0) Severe Impairment: Cannot change speeds, or loses balance and has to reach for wall or be caught.

3. Gait with horizontal head turns _____

Instructions: Begin walking at your normal pace. When I tell you to "look right," keep walking straight, but turn your head to the right. Keep looking to the right until I tell you, "look left," then keep walking straight and turn your head to the left. Keep your head to the left until I tell you "look straight," then keep walking straight, but return your head to the center.

Grading: Mark the lowest category that applies.

(3) Normal: Performs head turns smoothly with no change in gait.

(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor disruption to smooth gait path or uses walking aid.

(1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down, staggers but recovers, can continue to walk.

(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 0,4m path, loses balance, stops, reaches for wall.

4. Gait with vertical head turns _____

Instructions: Begin walking at your normal pace. When I tell you to "look up," keep walking straight, but tip your head up. Keep looking up until I tell you, "look down," then keep walking straight and tip your head down. Keep your head down until I tell you "look straight," then keep walking straight, but return your head to the center.

Grading: Mark the lowest category that applies.

(3) Normal: Performs head turns smoothly with no change in gait.

(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor disruption to smooth gait path or uses walking aid.

1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down, staggers but recovers, can continue to walk.

(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 0,4m path, loses balance, stops, reaches for wall.

5. Gait and pivot turn _____

Instructions: Begin walking at your normal pace. When I tell you, "turn and stop," turn as quickly as you can to face the opposite direction and stop.

Grading: Mark the lowest category that applies.

(3) Normal: Pivot turns safely within 3 seconds and stops quickly with no loss of balance.

(2) Mild Impairment: Pivot turns safely i*n* > 3 seconds and stops with no loss of balance.

(1) Moderate Impairment: Turns slowly, requires verbal cueing, requires several small steps to catch balance following turn and stop.

(0) Severe Impairment: Cannot turn safely, requires assistance to turn and stop.

6. Step over obstacle ____

Instructions: Begin walking at your normal speed. When you come to the shoebox, step over it, not around it, and keep walking.

Grading: Mark the lowest category that applies.

(3) Normal: Is able to step over the box without changing gait speed, no evidence of imbalance.

(2) Mild Impairment: Is able to step over box, but must slow down and adjust steps to clear box safely.

(1) Moderate Impairment: Is able to step over box but must stop, then step over. May require verbal cueing.

(0) Severe Impairment: Cannot perform without assistance.

7. Step around obstacles _____

Instructions: Begin walking at normal speed. When you come to the first cone (about 2m away), walk around the right side of it. When you come to the second cone (2m past first cone), walk around it to the left.

Grading: Mark the lowest category that applies.

(3) Normal: Is able to walk around cones safely without changing gait speed; no evidence of imbalance.

(2) Mild Impairment: Is able to step around both cones, but must slow down and adjust steps to clear cones.

(1) Moderate Impairment: Is able to clear cones but must significantly slow, speed to accomplish task, or requires verbal cueing.

(0) Severe Impairment: Unable to clear cones, walks into one or both cones, or requires physical assistance.

8. Steps _____

Instructions: Walk up these stairs as you would at home, i.e., using the railing if necessary. At the top, turn around and walk down.

Grading: Mark the lowest category that applies.

(3) Normal: Alternating feet, no rail.

(2) Mild Impairment: Alternating feet, must use rail.

(1) Moderate Impairment: Two feet to a stair, must use rail.

(0) Severe Impairment: Cannot do safely.

TOTAL SCORE: ___ / 24

Appendix E:

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

28 July 2017

To Whom It May Concern

SUBJECT: **CONFIRMATION OF RECEIPT OF ETHICS APPLICATION**
(This letter is not a clearance certificate)
Protocol Ref No: M170683
Protocol Title: The Relationship between the Risk of Falls and Perceived Balance in Patients with Chronic Stroke in Johannesburg
Principal Investigator: Miss Amy Morgan
Department: Physiotherapy

This letter serves to confirm that the Human Research Ethics Committee (Medical) has received an application for ethics approval and the study is under review. In order for a clearance certificate to be issued, the researcher is required to submit written approval to conduct the study in your district/institution and if required from the Gauteng Provincial Research Committee (GPRC).

The researcher has been informed that this letter is not a clearance certificate and that the study cannot commence without your approval and receipt of a clearance certificate from the HREC (Medical).

Should you have any queries, you may contact me at tel: 011 717 1234/2700/2656 or by email Rhulani.Mkansi@wits.ac.za or HREC-Medical.ResearchOffice@wits.ac.za

Yours Faithfully,

.....

Mr Rhulani Mkansi
Administrative Officer
Human Research Ethics Committee (Medical)

UNIVERSITY OF THE WITWATERSRAND
OFFICE OF THE DEPUTY VICE CHANCELLOR RESEARCH
28 JUL 2017
RESEARCH OFFICE
HREC (Medical)
JOHANNESBURG

Research Office Secretariat: Faculty of Health Sciences, Phillip Tobias Building, 3rd Floor, Office 304, Corner York Road and 29 Princess of Wales Terrace, Parktown, 2193 Private Bag 3, Wits 2050 I **T**+27 (0)11-717-1234/2656/2700/1252 **E**: Rhulani.Mkansi@wits.ac.za I **Office E** HREC-Medical.ResearchOffice@wits.ac.za IWebsite: www.wits.ac.za/research/about-our-research/ethics-and-research-integrity/

R14/49 Ms A Morgan

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M170683

NAME: (Principal Investigator)	Ms A Morgan
DEPARTMENT:	School of Physiotherapy Medical School
PROJECT TITLE:	The relationship between the risk of falls and perceived balance in patients with chronic stroke in Johannesburg
DATE CONSIDERED:	30/06/2017
DECISION:	Approved conditionally
CONDITIONS:	Clearance applies only to work carried out at Netcare Auckland Park Hospital, Nicole Duff Rehabilitation and Rehab Matters Therapy Centre
SUPERVISOR:	Dr MV Ntsiea
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	10/11/2017

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

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially reviewed in **June** and will therefore be due in the month of **June** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

08/02/2019

Ms A Morgan
School of Therapeutic Sciences
Department of Physiotherapy
Medical School
University

Sent by e-mail to: 540249@students.wits.ac.za

Dear Ms Morgan

Re: **Protocol Ref No: M170683**
Protocol Title: *The relationship between the risk of falls and perceived balance in patients with chronic stroke in Johannesburg*
Principal Investigator: Ms A Morgan

Thank you for your letter of 28/01/2019.

We note and approve of the addition of three more study sites, *viz:*

1. Helen Joseph Hospital
2. Alexandra Clinic
3. The Stroke Survivors foundation

Thank you for keeping us informed.

Yours Sincerely

J. Burns

.....

Mr I Burns
For the Human Research Ethics Committee (Medical)

Works2000/Iain0007/Acknowledge.docx

Appendix F:

Letter for recruitment bases

Dear Sir/ Madam

Study title: The relationship between the risk of falls and perceived balance in patients with chronic stroke in Johannesburg.

Introduction:

My name is Amy Morgan. I graduated from the University of the Witwatersrand with a Bachelor of Science in Physiotherapy degree in 2014 and I am currently registered to complete my Masters degree in physiotherapy and I am currently working on my Research Report.

This study will look at assessing the risk of falls and identify the perceived balance scores among chronic stroke patients (six months to two years post stroke) and observing the relationship between the two scores. This will be a cross-sectional study- meaning that the participant will only be seen once and will not be required to attend a follow up session. This is an assessment research study and no treatment will be administered.

What is involved in the study?

For the purpose of this study, written consent will be required from the participant, as well as information for the completion of a demographic and clinical profile. The participant will be required to fill in a questionnaire (*Activities-specific Balance Confidence (ABC) scale*) which looks at the participant's perceived balance. The participant will also be required to complete a balance test (*The Dynamic Gait Index (DGI)*) which observes the risk of fall.

There are no added benefits or risks to participating in this study.

Confidentiality: All information related to the participant will be kept confidential.

I hereby make a request for permission to use your facility to conduct this research study, and also request to recruit participants from your facility/practice. An information letter and consent form will be given to each participant who may fit the inclusion criteria. Participation is voluntary so the participants are entitled to withdrawal from the study at any time, without penalty.

If you have any further questions, please do not hesitate to ask.

Thanking you for your assistance.

Amy Morgan

BSc Physio (Wits), MSc physio (under completion)

Appendix G:

Consent Form for Recruitment bases:

I, _____ have read and understand the letter concerning the research study conducted by Amy Morgan. I understand that there has been a request to recruit participants for the study from my facility, and also understand that my facility may be used for the data collection of the research study. I also understand the requirements for the participation in this research study.

I understand that all information collected relating to _____ (name of practice/facility) will be kept confidential.

I hereby give consent to Amy Morgan to conduct the data collection for the research study (*The relationship between the risk of falls and perceived balance in patients with chronic stroke in Johannesburg)* at

_____ (name of practice/ facility)

Signature: _____

Date: _____

Appendix H:

Information sheet

Dear Sir/ Madam

You are invited to participate in a research study.

Study title: The relationship between the risk of falls and perceived balance in patients with chronic stroke in Johannesburg.

Introduction:

My name is Amy Morgan. I graduated from the University of the Witwatersrand with a Bachelor of Science in Physiotherapy degree in 2014 and I am currently registered to complete my Masters degree in physiotherapy and I am currently working on my Research Report.

This study will look at assessing the risk of falls and identify the perceived balance scores among chronic stroke patients (six months to two years post stroke) and observing the relationship between the two scores. This will be a cross-sectional study- meaning that the participant will only be seen once and will not be required to attend a follow up session. This is an assessment research study and no treatment will be administered.

What is involved in the study?

For the purpose of this study, written consent will be required from the participant, as well as information for the completion of a demographic and clinical profile. The participant will be required to fill in a questionnaire (*Activities-specific Balance Confidence (ABC) scale*) which looks at the participant's perceived balance. The participant will also be required to complete a balance test (*The Dynamic Gait Index (DGI)*) which observes the risk of fall.

There are no added benefits or risks to participating in this study.

The participant will be given pertinent information on the study while involved in the project and after the results are available.

Participation is voluntary and you are entitled to withdrawal from the study at any time, without penalty.

Confidentiality: All information related to the participant will be kept confidential.

If you have any further questions, please do not hesitate to ask.

Thanking you for your assistance and participation.

Amy Morgan
BSc Physio (Wits), MSc physio (under completion)

Appendix I:

Consent Form:

I, _____ have read and understand the information sheet concerning the research study conducted by Amy Morgan. I understand that demographic and clinical information will be required from me and I will be required to fill in a questionnaire (*Activities-specific Balance Confidence (ABC) scale*) and complete a balance test (*The Dynamic Gait Index (DGI)*).

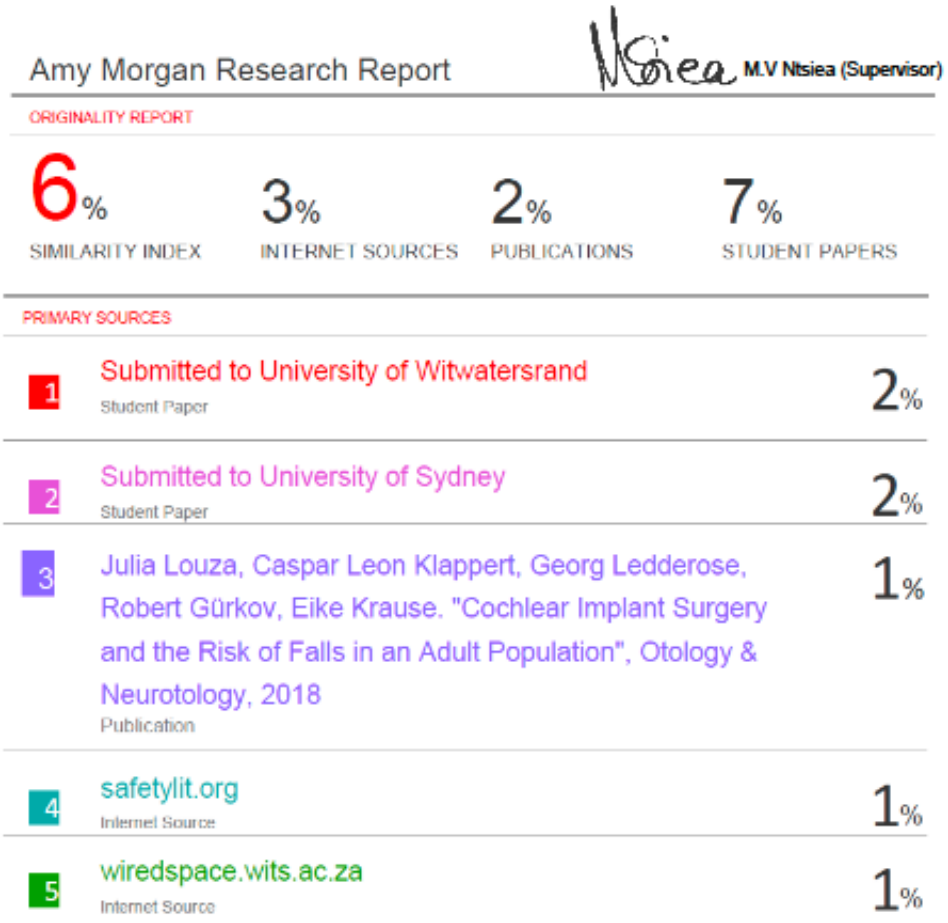
I understand that all information collected relating to me will be kept confidential. I also understand that at any time, I can withdraw or refuse to participate in the study and this will not affect my general therapy management.

I hereby give consent to participate in this research study (*The relationship between the risk of falls and perceived balance in patients with chronic stroke in Johannesburg.)*

Signature: _____

Date: _____

Appendix J:



Amy Morgan Research Report

M.V Ntsiea (Supervisor)

ORIGINALITY REPORT

6%	3%	2%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Witwatersrand Student Paper	2%
2	Submitted to University of Sydney Student Paper	2%
3	Julia Louza, Caspar Leon Klappert, Georg Ledderose, Robert Gürkov, Eike Krause. "Cochlear Implant Surgery and the Risk of Falls in an Adult Population", Otology & Neurotology, 2018 Publication	1%
4	safetylit.org Internet Source	1%
5	wiredspace.wits.ac.za Internet Source	1%