Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African stroke survivors?

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Declaration

I Christey Llara Harris declare that this research report is my own, unaided work. It is being submitted for the Degree of Master of Occupational Therapy, Neurosciences at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

……

(Signature of candidate)

28th day of July 2025 in Craighall Park

Presentations and publications arising from the research Project

A presentation on the research protocol was presented at the Occupational Therapy Association of South Africa's (OTASA) Congress on 03/07/2024.

A research article (included in the submissible format) has been submitted to the International Journal of Strokes for review.

Abstract

Background

The Montreal Cognitive Assessment (MoCA) is widely used to screen for Post Stroke Cognitive Impairment. However, its clinical utility for the stroke survivor population and populations outside of Western, English-speaking cultures has been extensively critiqued. Cognitive impairments in stroke are common, affecting between 20 to 80% of stroke survivors. Attention, information processing, memory, and executive functioning are cognitive skills frequently affected in Post Stroke Cognitive Impairment. These impairments occur at varying severity levels and can significantly affect performance in multiple areas of daily functioning. An appropriate cognitive screening tool needs to accurately identify areas of dysfunction in Post Stroke Cognitive Impairment **(PSCI)** allow these impairments to be adequately managed through the therapy process.

2.1.1. Aims

The aim of this study was to determine whether the MoCA is a valid screening tool for post-stroke cognitive impairment in moderate-to-severely impaired stroke survivors in South Africa.

2.1.2. Methods

A quantitative, cross-sectional design was employed. A small, expert consensus group was used to gain information around cognitive skills from the Comprehensive ICF Core Set for Stroke which could be assessed using the MoCA. Nominal Group Technique processes were utilised to conduct the group and gather data. Responses from the consensus group were analysed from the transcription and recording, to confirm the cognitive skills from the ICF Core Set for Stroke agreed upon by all experts for each section of the MoCA. Thereafter, a self-administered, online survey was used to collect data on perceptions of occupational therapists who work with stroke survivors in South Africa on the utility of the MoCA for assessing Post-Stroke Cognitive Impairment in moderate to severely impaired stroke survivors in South Africa. 21

completed responses were analysed using the Content Validity Index Method and descriptive statistics.

2.1.3. Conclusion

This study was completed following ethical approval by the Wits Human Research Ethics Committee. A total of 21 responses were collected (n=21) with 17 and 4 participants from the private and public sectors respectively. This study found the MoCA to be largely a valid tool for screening cognition in stroke survivors living in South Africa. However, this was not without critique. Low *simplicity* scores and poor item-level validity of the executive function were areas of concern for participants considering diverse demographics of stroke survivors in South Africa, as well as the confounding effects of other stroke-related impairments. Moreover, participants felt that the MoCA does not adequately screen for PSCI, nor does it screen the most commonly affected cognitive skills following stroke.

Despite these concerns, the MoCA remains widely used. This is due to a lack of other screening tools which are recommended for use with stroke survivors and have some adaptation to account for demographics (specifically language).

Future research should focus on adding to the body of information around the MoCA and its clinical utility for stroke survivors in South Africa to develop a set of normative data, build a foundation of empirical data on the validity of the MoCA in both the private and public sectors, and develop a body of information which could help with the development of a diagnostic and contextually relevant cognitive screening tool. Clinicians using the MoCA with stroke survivors in South Africa should be critical of the interpretation of scores considering demographic and other stroke-related factors. Furthermore, other resources and tools such as the Comprehensive ICF Core Set for Stroke, the Cognitive Assessment for Stroke Patients, the Oxford Cognitive Screen and the MMSE should be utilised to supplement the MoCA administration to triangulate data on test performance; and provide a guide/checklist for commonly affected cognitive skills to be adequately assessed and observed during the evaluation phase of rehabilitation.

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Nomenclature

List of Abbreviations

ADLs- Activities of Daily Living

AIDS- acquired immunodeficiency syndrome

CAM- Cognitive Assessment of Minnesota

COPM- Canadian Occupational Performance Model

CVI- Content Validity Index

DALYs- Disability Life Adjusted Years

FIM- Functional Independence Measure

HAND- HIV-Associated Neurocognitive Disorder

HIV- Human Immunodeficiency Virus

HPCSA- Health Professions Council of South Africa

ICF- International Classification of Functioning, health and disability

I-CVI- Item level CVI

LOTCA- Lowenstein Occupational Therapy Cognitive Assessment

MCI- Mild Cognitive Impairment

MMSE- Mini Mental Status Examination

MoCA- Montreal Cognitive Assessment

NIHSS- National Institute of Health Stroke Scale

OCS- Oxford Cognitive Screen

OT- Occupational Therapy

OTPF IV- Occupational Therapy Practice Framework 4th Edition

OTs- Occupational Therapists

PSCI- Post Stroke Cognitive Impairment

PSD- Post-stroke dementia

RBANS- Repeatable Battery for the Assessment of Neuropsychological Status

S-CVI – Scale CVI

VCI- Vascular Cognitive Impairment

WHO- World Health Organization

List of Operational Definitions

MoCA: A 30-point tool used for the purpose of screening cognitive functioning. It focuses on 8 cognitive domains: executive functioning/visuospatial skills, naming, immediate recall, attention, language, abstraction, delayed recall and orientation. Mild, moderate and severe cognitive impairment are represented by 18-25; 10-17 and <10 respectively.

Post Stroke Cognitive Impairment: PSCI is indicated by impairments in 1 or more domains of cognitive functioning which emerges subsequent to a stroke. Impairments may occur in attention, information processing, executive functioning skills, working memory, learning and memory skills. These deficits must be confirmed by the relevant cutoff points in standardised assessments, validated for use with the stroke population.

Moderate to Severe Stroke: A stroke, of any aetiology, with residual impairments in motor, sensory, cognitive, communication, visual or perceptual skills resulting in NIHSS scores between 15 and 42; and scores on the Barthel Index of less than 60.

Content Validity Index: This is the measure of the degree to which a tool and/items measures the construct it sets out to measure. In this study, content validity is measured with four components/domains: relevance, simplicity, clarity and ambiguity.

Relevance: Relevance speaks to whether or not a tool or item accurately reflects the concept it aims to measure.

Simplicity: This CVI domain refers to the degree to which instructions or the item itself is easily understandable.

Clarity: Refers to how clear and simple the wording of the question or instruction for the tool or items is.

Ambiguity: This CVI domain measures the degree to which the item's meaning is confusing or easily misinterpreted.

CHAPTER 1
INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

1.1.1. Introduction to the Study

Stroke is one of the leading causes of mortality and disability worldwide.[1,2]Between 1990 and 2019 there has been a significant increase in stroke burden; including increased stroke incidence, prevalence, mortality, and Disability Adjusted Life Years (DALYs).[2] However, statistics have shown that stroke incidence, and prevalence is more concentrated in countries forming part of the Global South, such as South Africa.[2,3]

Post-Stroke Cognitive Impairment (PSCI) is common; with an estimated prevalence of between 20 to 80%. [4–6] Even mild PCSI has been associated with detrimental effects on physical recovery and decreased functional independence, participation in rehabilitation, quality of life, and lifespan after stroke.[7,8] Cognitive impairment has been associated with higher levels of disability compared with physical impairment. [9] Occupational therapists are professionals well-suited to be able to address PCSI in the stroke survivor population.

Screening and assessing for the presence of PCSI is the imperative first step in being able to effectively address this in the clinical setting.[8] The Montreal Cognitive Assessment (MoCA) is a 30-point screening tool which is widely used by rehabilitation professionals, including occupational therapists, to screen for the presence of post-stroke cognitive impairment.[7,8] However, its validity for this purpose has come into question. The test structure, universal cut-off point, speech, vision and writing demands have been criticised for this population. [7]

Furthermore, the MoCA has also been critiqued for its validity in non-Western cultures. [9–11] The diversity of language, culture, and level of education in the South African population have demonstrated the reduced validity of the MoCA for our overall population, even in clinically healthy populations.[10–12]

When considering current evidence on the MoCA for the stroke survivor population and the South African population; it stands to reason that its validity for the South African stroke survivor population may also be limited.

1.1.2. Problem Statement

The MoCA is a commonly used screening tool for detecting post-stroke cognitive impairment, and its use is recommended in various stroke clinical practice guidelines; including the *South African Contextualised Rehabilitation Guidelines for Stroke*.[3] However, there has been a significant amount of recent evidence which has critiqued the utility of the MoCA for detecting PSCI [8,9]; but also, its utility in non-Western cultures. [11–13]

There is limited research exploring the impact of impairments associated with moderate-to-severe stroke on the accuracy of the MoCA on a global level. Additionally, no research could be found on the clinical utility of the MoCA with the South African stroke survivor population.

1.1.3. Purpose of the Study

The purpose of the study is to gain insight from expert occupational therapists in the field of neurological rehabilitation on their perceived validity of the Montreal Cognitive Assessment with South African stroke survivors.

There is a paucity of research around the utilisation of internationally developed and normed screening tools with the South African stroke survivor population. The purpose of this study is to contribute to the small body of knowledge around this subject; and ultimately contribute towards the development of evidence-based, contextually relevant practice for South Africans.

1.1.4. Research Question

Is the Montreal Cognitive Assessment (MoCA) a valid tool for screening cognitive impairment in moderate to severely impaired stroke survivors in South Africa?

1.1.5. Aims of the Study

The aim of the study is to determine whether the Montreal Cognitive Assessment (MoCA) is a valid tool for screening cognitive impairment in moderate to severely impaired stroke survivors in South Africa.

1.1.6. Objectives of the Study

The objectives of the study are:

1. To explore cognitive client factors and performance skills which are commonly affected in moderate to severely impaired So stroke survivors in South Africa.

2. To explore the validity of the MoCA for use with moderate to severely impaired stroke survivors in South Africa.

3. To explore whether there is a match between common cognitive impairments in moderate to severely impaired stroke survivors, and the cognitive skills assessed by the MoCA.

1.1.7. Justification of the Study

Screening for the presence of PSCI is a crucial component of the comprehensive assessment of stroke survivors [3,14]. The MoCA is a screening tool which is recommended in many clinical practice guidelines, including the South African-Contextualized Stroke Rehabilitation Guideline, to screen for PSCI; with much literature indicating ins superiority for detecting PSCI.[3,15,16] However, in recent years there is a growing body of literature which has critiqued the use of the MoCA in culturally, and socio-economically diverse contexts; and in stroke survivor populations with more significant impairments [9,17].

The South African stroke survivor population includes a relatively high incidence of moderate to severely impaired stroke survivors who have a greater tendency to present with more severe stroke-related impairments.[9,18] Low levels of education, cultural and language diversity may also reduce the appropriateness of the MoCA for the South African stroke survivor population. [10] These stroke-related factors and context-related factors, in isolation or in conjunction with one another, pose challenges

to be able to administer the MoCA to these patients, and these patients' ability to complete the tasks required in these tests. [9–12,17]

This study serves as the first step towards determining the validity of the MoCA for use with the South African stroke population. It is the goal of this research to help prompt clinicians' clinical reasoning around selecting standardized outcome measures to ascertain the presence of post-stroke cognitive impairments; so that patients are not disadvantaged by the intrinsic properties of the test, and the interaction with the contextual and stroke-related factors inherent for the patient.

1.2 Literature review

1.2.1 Introduction

Stroke is an umbrella term for a variety of vascular disturbances which result in focal disturbances in neurological function, which includes ischaemic and haemorrhagic stroke.[1] Globally, ischaemic stroke has been found to account for the majority of stroke incidence; followed by haemorrhagic stroke, and other non-ischaemic causes.[19] Haemorrhagic stroke is associated with markedly higher mortality rates compared with other stroke types. [19]

Globally, stroke ranks as one of the leading causes of mortality and disability. [2] The World Health Organization (WHO) reports that countries considered part of the Global South are home to 70% and 87% of strokes and stroke-related deaths respectively. [1,2] Countries considered part of the Global South have stroke incidence which has almost doubled in the same period in which Global North countries have seen a 40% reduction in stroke incidence. [1,16,24] Additionally, stroke is occurring increasingly in younger groups, affecting more individuals of working age in Global South countries. [1,3] This trend poses a threat to the socioeconomic state of Global South countries. [1,2] Thus, prevention campaigns for stroke and stroke-related risk factors; as well as appropriate post-stroke management and rehabilitation should be a priority in the health sphere.

1.2.2. Stroke in the Global and Local Contexts

From 1990 to 2019, there has been a significant increase in stroke burden; including increased stroke incidence, prevalence, mortality, and Disability Adjusted Life Years

(DALYs). [2] with the bulk of the burden of stroke is concentrated in countries forming part of the Global South. [2,3]

The incidence of stroke in South Africa echoes the high stroke incidence of the global stage, with cerebral infarction and other cerebrovascular disease accounting for approximately 22 259 deaths in 2017.[20] The Stroke Survivor Foundation expanded further on the stroke statistics, reporting that approximately 240 South Africans are affected by stroke daily, with 70 of these incidents being fatal.[21] The converse of this statistic is that approximately 140 individuals survive the stroke incident are often left to live with some level of impairment in their functioning.[21] Globally, approximately 40% of stroke survivors suffer moderate impairments, while a further 15-30% are left to suffer consequent, severe impairment in their functioning. [22,23]

As in global north countries, Global South countries like South Africa have shown an increase in the number of people living with disability following stroke. [3,24] However, in South Africa and other countries considered part of the Global South, the mortality rate and rate of DALYs is significantly higher than their global north counterparts. [24] Poor accessibility to early screening for stroke, basic and timeous medical management of incident stroke, post-stroke rehabilitative services, and secondary preventative care services have been named as a few of the contributing factors to poor stroke survival rates and high rates of disability in stroke survivors in Global South countries, including South Africa.[3]

Most global north countries continue to demonstrate stroke victim population with an average age 70 years in men, and 75 years in women. [24]This is considerably older than the average age of stroke victims in Global South countries, which is estimated at age 45 to 49 years. [24] Additionally, high rates of HIV-infection in countries like South Africa contribute to the growing burden of stroke.[24,25]

Several studies have conducted research on the associations between stroke and HIV infection. [25–27] A meta-analysis conducted by Yang et al. demonstrated that HIV is a significant risk factor for stroke; with HIV-positive individuals tending to have higher risk for stroke, higher stroke incidence and a tendency for more serious stroke incidents. [27] HIV itself, as well as antiretroviral therapy used in the management of HIV has been found to be associated with increased stroke risk. [24,25] This is owing to

chronic inflammation and immune activation from the disease itself; as well as dyslipidaemia and insulin resistance often related to antiretroviral treatment. [25–27] Furthermore, increased life expectancy as a result of improved treatment of HIV, increases risk for stroke through cardiovascular risk associated with normal aging; and prolonged exposure to HIV also poses risk for stroke in the HIV population.[26]

In South Africa and several other African countries afflicted with high HIV/AIDS incidence, the rate of stroke in young adults (20-30 years) significantly surpasses the increase in strokes in these age groups in global north countries due to high rates of HIV/AIDs infections in younger groups. However, its aetiology and symptomatic manifestation and progression, as well as prognosis may differ from stroke of purely vascular origin.[24] With South Africa having the highest number of people living with HIV worldwide, it is essential to consider this comorbidity and how it may affect the rehabilitation team's treatment planning and approach to the rehabilitation of these stroke survivors.

1.2.3. South African Healthcare System Demographics

The South African healthcare system is characterised by a private sector which serves approximately 16% of the population; and receives approximately 44% of healthcare funding. [28] On the other hand, the public sector serves more than 80% of the South African population; and is characterised by shortages of consumable, human and other essential resources.[28]

Occupational therapists are an integral part of the South African healthcare system, spanning both the public and private sectors. However, as with many healthcare resources, occupational therapy human resources are significantly more concentrated in the private sector, with an estimated 74.8% working in private versus 25.2% working in public. [29]

Furthermore, this population of occupational therapists is significantly higher in urbanised provinces with more economic opportunities. Thus, the concentration of practitioners in rural areas is low; which results in reduced therapeutic input for these communities.[29]

The majority of the South African population, especially those accessing healthcare via the public sector, have limited access to occupational therapy services. [28] When we consider this in the context of stroke, and the need for our considerably younger stroke survivor population to access rehabilitation services; the low concentration of occupational therapists and the vital services they offer is cause for concern.

As such, the use of clinically sound and contextually relevant screening tools for various areas of functioning affected in stroke should be an integral part of practice. This would allow for effective and efficient screening, to maximise opportunity for targeted intervention which adequately addresses post-stroke impairments.

1.2.4. Post-Stroke Impairment and Impairment Severity

The American Heart Association classified post-stroke impairments into the following categories: motor, sensory, visual, cognitive, language and affective/mood-related. [1,19,30] In addition to these, impairments in the ability to carry out daily activities such as activities of daily living, instrumental activities of daily living, work and driving are frequently experienced by stroke survivors.[31] All of these impairments can occur at differing severity levels.

It is important to consider that impairments at a skills level impact stroke survivors' ability to participate in activities and roles which they need to, want to or are expected to. It is therefore useful to consider this interaction within a framework which acknowledges this relationship between skills and participation in activities- such as the International Classification of Functioning, Health and Disability (ICF). [32,33] The ICF considers the interactions between the person with the health condition and the context of that person.[32] Furthermore, the ICF acknowledges that participation limitations are influenced by impairments in functional skills, as well as in activities; and can be further impacted by the context of the individual. [32] The categories of post-stroke impairment described by the American Heart Foundation fall primarily within the domain of body structures and functions. Considering the reciprocal interaction between the condition, body structures and functions, activities and participation; stroke affects not only anatomical and physiological factors; but also, participation and capacity to engage in activities part of everyday life. [34] Rost et al.'s finding that more

severe stroke had a more profound impact on functional outcomes aligns with the conceptualisation of disease/illness as depicted in the ICF-Model. [34,35]

When considering the impact that greater stroke severity has on body structure and function, as well as participation in daily activities; distinguishing between mild, moderate and severe stroke impairment becomes increasingly important in order to set appropriate goals and address impairments in functional skills, activities and participation.[35] This is commonly performed through quantitative scores on impairment scales. The brief descriptions on the ICF checklist could be used to describe the severity of an impairment in body function and structures, as well as activities. [36] However, other means which have been developed and validated for use with stroke survivors are more frequently utilized in clinical practice. [37,38]

The National Institutes of Health Stroke Scale (NIHSS) is a tool commonly used to assess stroke severity. [37] It is the most validated diagnostic tool for use in the acute and hospital settings to identify stroke, and for quantifying severity, monitoring changes in condition, and predicting outcomes for different areas of functioning. [37] For these reasons, it is frequently used in both clinical practice and research to quantify stroke severity. It assesses level of consciousness, visual skills, motor output, speech and language and cognition. [37] Each of these areas is assessed with different tasks, which are then scored according to the patient's performance. Higher scores are associated with increasing stroke severity. Minor/mild, moderate, moderate to severe and severe stroke are delineated by scores ranging between 1 and 4; 5 and 15; 15 and 20; and 21 and 42 respectively. [37]

More recently McGlinchey et al. provided qualitative descriptions on stroke severity levels. [38] Severe stroke was described as encompassing a multitude of neurological impairments, which cause a loss of function and residual disability. These impairments have a slow, and often poor response to rehabilitation, leaving these individuals with high levels of dependency. [38] Outside of the impairment rating scales, specific impairments and dysfunction of moderate impairment appear ill-defined, and inconsistent.

1.2.5. Post-Stroke Cognitive Impairment (PSCI)

While various domains can be affected following stroke, impairments in physical and functional domains are more easily observable and identifiable; and are often placed at the forefront of rehabilitation intervention programmes.[4,5,39,40] While exact statistics on post-stroke cognitive impairment vary significantly between regions and studies; existing evidence has estimated that between 20 and 80% of stroke survivors experience impairments in cognitive skills.[4–6,40] This cognitive impairment which emerges subsequent to suffering a stroke is often referred to as "post-stroke cognitive impairment" (PSCI); or "vascular cognitive impairment" (VCI). [4,5]

Impairments in cognitive skills following stroke have demonstrated their potential to have detrimental effects across various aspects of post-stroke life. These impairments have been found to negatively impact motor abilities, mood and participation in daily activities; even if these impairments are found to be mild. PSCI has also been found to have a negative influence on a stroke survivor's ability to successfully engage in rehabilitation, and reduces their potential to achieve greater levels of functional independence.[40–42] Furthermore, findings have also demonstrated that severe cognitive impairment is found to have a more profound impact on quality of life compared to physical impairment; and it is associated with higher post-stroke mortality. [39] Thus, taking into consideration the widespread, pervasive effects on functioning which can stem from post-stroke cognitive impairment; it is evident that effectively addressing PSCI should be a core component of the post-stroke rehabilitation process, along with addressing physical and functional impairments. [43]

Since cognitive impairment, including a condition like PSCI, has the ability to hinder an individual's occupational performance, and ability to engage in their daily occupations; addressing PSCI is an essential role of occupational therapy within the context of post-stroke rehabilitation.[44,45] However, in order to effectively address impairments in cognitive functioning following stroke; it is important to understand what comprises cognitive functioning, and additionally, the common cognitive skills deficits present following stroke.

The American Occupational Therapy Association defined cognitive functioning as a set of conscious or unconscious information processing skills or processes. [45] It is typically comprised of functions which include attention, memory, executive functions, speech comprehension and formation, numeracy skills, visual perceptual processes and praxis skills.[45] These skills are often distinguished further by identifying them in the following categories: basic cognitive skills, executive functioning and metacognition.[45]

Lanctôt et al. described PSCI as existing on a continuum extending from mild cognitive impairment (MCI) to post-stroke dementia (PSD).[16] However, when exploring the various cognitive impairment categories which occur following stroke, it is evident that there is variability in not only the severity of impairment, but also which domains and how many of these domains are affected.[43] Some of these variations have been prescribed specific terminology. The systematic review conducted by Kosgallana et al. defined the following terms relating to variability in cognitive fallout post-stroke: post-stroke dementia, vascular cognitive impairment/vascular cognitive disorder, vascular dementia, and post-stroke cognitive impairment or vascular mild cognitive impairment. [7] Some of these terms are characterised by impairments in specified cognitive skills, while others refer to the severity of the impairments. [7]

When looking specifically at PSCI and how it is defined in occupational therapy literature, there is a clear link to the definition described in the statement by the American Occupational Therapy Association. It is defined as alterations to cognitive or behavioural abilities which succeed the emergence of cerebrovascular conditions, such as stroke. It is characterised by impairments in at least one cognitive domain.[40,45] Areas of cognitive functioning commonly affected in PSCI include attention, information processing, executive functioning, working memory, memory and learning.[16,40,45]

The ICF has expanded on what is included in cognitive functioning or dysfunction, including PSCI. When the Comprehensive ICF Core Set for Stroke was published, cognitive skills or what the ICF terms as “mental functions” includes cognitive skills, as well as perceptual, emotional and language functions.[46,47] Therefore, post-stroke

cognitive impairment, or impairments in “mental functions” following stroke will be inclusive of cognitive, perceptual, emotional and language skills. As occupational therapists, we need to be involved in screening, assessing and treating all of the components of PSCI within our scope of practice.[45,48]

1.2.6. Assessment and Screening of Post Stroke Cognitive Impairment

To effectively address PSCI in practice knowing the definition of cognitive functioning and the skills of which it is comprised is not sufficient. The first step is accurate identification of PSCI through evaluation or assessment [3,15,49]. The OTPF IV (2020) acknowledges assessment and evaluation as the first step in the OT process [14]. This remains true for OT management for stroke-survivors; and appropriate evaluation (screening and assessment) of all areas of functioning, including cognitive skills and impairment remains the critical first step in the rehabilitation process for this client population [44,50]. Despite occupational therapists’ (and other healthcare professionals) knowledge of the recommended procedures for assessment and evaluation; studies have found that only just over 50% of stroke survivors are screened and assessed for PSCI [8]. The implications of this are sub-standard management of or neglect to manage this area of impairment; with reduced outcome achievement and overall quality of life for these clients[8,16].

As with recommendations from clinical practice guidelines for other stroke impairment categories; the current recommendations for evaluation of post-stoke cognitive impairment emphasise the use of standardised instruments which are validated and reliable for use with stroke survivors, within the specific context in which it would be administered.[8,15,31,51,52] The South African Contextualised Stroke Rehabilitation Guideline published recommends the use of the following assessments: Functional Independence Measure (FIM), the Canadian Occupational Performance Measure (COPM), and the Montreal Cognitive Assessment (MoCA) as means to assess for the presence of post-stroke cognitive impairment. [3] Other international studies have found occupational therapists made frequent use of the following tools as a means to formally assess post-stroke cognitive impairment: Lowenstein Occupational Therapy Cognitive Assessment (LOTCA), Repeatable Battery for the Assessment of

Neuropsychological Status (RBANS), Cognistat, and the Cognitive Assessment of Minnesota. [3,53–56]

It is evident that the use of standardised screening and comprehensive assessment tools with a pen-paper format forms the basis of many recommendations for the evaluation of PSCI [3,6,15,16,52]. However, barriers to their use with stroke survivors in clinical practice have been identified and documented. [8]

In-depth cognitive assessments provide a detailed picture of the cognitive impairments experienced by a stroke survivor. However, these assessments are often lengthy, expensive, require professionals to undergo training, have high language and motor demands; and also require the patient to have sufficient cognitive and physical endurance.[8] Cognitive screening tools have been identified as useful alternatives to the use of in-depth neuropsychological assessment of cognitive skills. Typically, these screening tools are more cost and time-effective compared with in-depth assessment; and are quick to administer. They have been reported as a useful part of the evaluation process to aid in streamlining assessment and identifying areas which need to be assessed in greater depth.[8]

While both in-depth assessment and screening of cognition, using standardised measures is the current best practice recommendation for rehabilitation professionals; scrutiny around their clinical utility is persistent. Stroke survivors frequently present with impairments like hemiplegia, visual-perceptual deficits, visual deficits, aphasia and other verbal output deficits. [8,44] Such impairments negatively influence stroke survivors' abilities to perform on standardised tests, where understanding instructions and responding appropriately through either verbal or motor output are inherent to the tasks included in the assessment. [8] This is especially true when utilising assessments and screening tools not originally designed for use with the stroke survivor population.

1.2.7. The Montreal Cognitive Assessment (MoCA)

The Montreal Cognitive Assessment (MoCA) is a 30-point cognitive screening tool originally developed for the purpose of detecting mild cognitive impairment (MCI), the intermediary state of cognitive decline between what is considered normal cognitive

decline with aging; and dementia.[57] It assesses the following areas of cognitive functioning: visuospatial/executive function, naming, episodic memory, attention, language, abstraction, and orientation.

A cutoff point of ≤26 was implemented for the detection of MCI in the initial study group.[57] This yielded good specificity and sensitivity for the detection of both mild cognitive impairment and cognitive impairment associated with Alzheimer's disease. Sensitivities of 90% and 100% were demonstrated by the MoCA in identifying MCI and Alzheimer's disease respectively. Specificities demonstrated by the MoCA for MCI were 89% and 91% respectively and for Alzheimer's disease 89% and 100% respectively.[57] The MoCA Organization acknowledges on their website that the MoCA can be used for screening for cognitive impairment in stroke survivors.[58]

From 1 September 2019, formal training and certification for administration, scoring and interpreting the MoCA became mandatory for clinicians wanting to utilize the MoCA in practice.[59] The goal of introducing such mandatory training was to improve standardization and reliability of the tool in clinical settings.[59]

In years following its inception and validation as a cognitive screening tool; aspects of the MoCA have come under scrutiny in both the clinical and research communities. The originally-suggested cutoff point of ≤26 has been questioned for its diagnostic accuracy.[60] This cutoff has reportedly led to high levels of false positives for MCI, after in-depth neuropsychological testing. Furthermore, the 1-point adjustment for years of formal education has been identified as insufficient in compensating for difference in years of formal education.[61]

A meta-analysis of nine studies exploring the diagnostic accuracy of the MoCA for MCI in suspected MCI groups and normal functioning control groups attempted to ascertain a cutoff point which optimizes both diagnostic specificity and sensitivity. It was revealed that a cutoff score of 23/30 was more accurate in diagnosing MCI in comparison with the cutoff of 26/30 originally suggested by Nasreddine et al., as well as providing an optimal balance of specificity and sensitivity. [57,61] Scrutiny of the

MoCA's cutoff score is not only for its use for detecting MCI; but also, for its use in detecting cognitive impairments in a variety of conditions.

The MoCA is used to assess for cognitive impairment in a variety of conditions; and the universal cutoff of ≤26 is applied across these conditions. However, in many instances the MoCA, and particularly the cutoff of ≤26 has not been normed for many of these populations. Despite this ongoing critique of the MoCA cutoff score, there has not been a change in the recommended cutoff score for the originally intended population, or other populations, by the MoCA Foundation as yet.

1.2.8. Use of the MoCA in the South African Context

Cultural context and language have been found to have notable impact in an individual's performance on several standardised assessment tools, including the MoCA.[13,14] Several studies have explored the utility of the MoCA with the South African population; many of them focusing on the impact of culture, first language, English proficiency, age, gender and level of education.

Age and years of education were found to have significant correlations with performance on the MoCA (total score), while gender was found not to have a significant correlation.[10] A study by Kirkbride et al. demonstrated a significant, inverse relationship between age and the number of years of education, which was suggested may be a result of apartheid education policies.[10] Lower education levels and older age were both linked to poorer performance on the MoCA. This study by Kirkbride et al. echoed findings of a study conducted in North America with a demographically heterogenous sample with regard to the cutoff point for identifying MCI. Even in healthy control groups, and samples with higher levels of education demonstrated mean scores below the universal cutoff for MCI of ≤26.[10–12]

The studies reviewed provide convincing evidence that culture, first language, English proficiency, age, and level of education all have a profound impact on performance on the MoCA in the South African population, including healthy and neurocognitively intact groups.[10–12] As a result, health care professionals certified to use the MoCA should exercise caution and clinical judgement when administering this cognitive

screening to the South African population. This is especially true for use with patients suffering from suspected HIV- Associated Neurocognitive Disorder (HAND), or for any other condition outside of the originally intended population.[10] Considering the critique of the utility of the MoCA with even a healthy South African population; how does this affect its clinical application to South African stroke survivors?

1.2.9. The MoCA as a Screening Tool for Post-Stroke Cognitive Impairment

Screening and assessment for PSCI in all stroke survivors, using standardised tools and batteries is a frequent recommendation in clinical practice guidelines for professionals working with the stroke survivor population.[3,16] While in-depth assessment with neuropsychological tools is beneficial in ascertaining detail relating to the nature of and severity of cognitive impairments, the clinical utility in the stroke setting has limitations.[8] Cognitive screening instruments have been shown to provide value in clinical practice by assisting clinicians in ascertaining the need for further, in-depth assessment; while also enabling them to commence basic treatment planning based on the results of the cognitive screening.[8,44] However, many of the cognitive screening tools in use with stroke survivors today were not developed for this population. This had led to the scrutiny over the feasibility of the use of these screening tools with the stroke survivor population.

Van Heugten et al. put forward several criteria that a screening tool for PSCI should meet if it was to accurately determine the presence of this phenomenon.[62] They proposed a that a screening tool must: at least assess all of the most- affected domains of cognitive functioning post-stroke; have adequate sensitivity to detect those with cognitive impairment versus those without; be correlated to other cognitive assessments which test the same cognitive domains; and also have some value in predicting functional outcomes in this population [62]. When looking at the screening tools frequently used by occupational therapists to identify the presence of PSCI, it is beneficial to consider Van Heugten et al.'s proposition. The Mini Mental Status Exam (MMSE), The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), the Oxford Cognitive Screening (OCS) and the MoCA are among the most frequently-used screening tools by occupational therapists to assess for PSCI. The

MMSE and the MoCA remaining the most widely-used screening tools for identifying PSCI.[7]

Occupational therapists are among the health care providers who, after training and certification, use the MoCA to screen for cognitive impairment which may impact on performance of occupations such as activities of daily living (ADLs), work or driving in various groups of people, including stroke survivors.[63] Multiple studies have found the MoCA to demonstrate superior sensitivity to vascular-related cognitive changes when compared with other screening tools such as the Mini Mental Status Exam.[3,60,64] However, the 2019 systematic review conducted by Kosgallana et al. did not find conclusive evidence for the superiority of the MoCA over other screening tools for detecting PSCI, as had been the case in many previous studies.[7]

Many stroke survivors experience impairments including aphasia or other speech-related impairments, hemiplegia and hemiparesis, and visual neglect syndromes. [8] The MoCA has reliance on good communication skills, functioning of the dominant upper limb and fair vision to be able to engage with the test content.[8] The test design and requirements for task completion in the MoCA have been found to pose barriers to its use with stroke survivors. Thus, the greater the severity of communication, motor and visual impairments, the more likely it will be that performance on a screening tool, such as the MoCA, will be negatively affected.[8]

In spite of these challenges, the MoCA continues to remain one of the most widely-used tools for assessing cognitive functioning in stroke survivors. However, its continued use with this population has resulted in a growing critique in light of the implementation of the original cut-off point for this patient population. Khaw et al.'s systematic review found that studies had reported optimal cutoff scores ranging between 19 and 27, with many finding the original cutoff to be inappropriate for the stroke survivor population.[9] Furthermore, the studies included in the review demonstrated considerable variability in the optimal cutoff point for the MoCA in stroke survivors. The review found this accounted for largely by the variation in the phases of stroke recovery included in the various studies.[9] While the MoCA has come under scrutiny, perhaps some of the critique for its use in the stroke survivor population stems from lack of research and the clinical utility of "altered" guidelines and cutoff points to

ascertain the presence of PSCI. The validity and psychometric values of the MoCA for the stroke survivor population need to be researched in order to ascertain the clinical utility of this popular screening tool.

The negative effects on performance resulting from stroke-specific symptoms can be further compounded by education levels and lack of understanding of instructions due to language barrier.[10,17] Thus, careful consideration should be employed when selecting the MoCA for screening in stroke survivors, especially in countries considered part of the Global South.

1.2.10. Conclusion of Literature Review

The negative implications of PSCI for rehabilitation, length of hospital admission, mood, quality of life, overall independence in daily occupations and even mortality is well-understood.[7,41] However, recommended screening tools to assess the presence of PSCI have had their appropriateness for use with stroke survivors critiqued in recent years.[10] This creates challenging circumstances for clinicians, including occupational therapists, who actively integrate assessment and screening for cognitive impairment into post-stroke rehabilitation. However, critique of appropriateness of such tools creates a space for researchers and clinicians involved in post-stroke rehabilitation to address these limitations. This can be through working towards incorporating or developing more appropriate assessment tools; or creating recommendations for criteria changes for the stroke population within existing tests.

Despite ongoing critique and acknowledgement of its limitations for use with stroke survivors, the MoCA continues to hold its place as one of the most-widely used cognitive screening tools by occupational therapists for identifying post-stroke cognitive impairment. This is perhaps a result of the ease and simplicity of utility in practice. Furthermore, the use of the MoCA is recommended in multiple clinical practice guidelines for stroke rehabilitation, including the South African Contextualised Stroke Rehabilitation Guideline.[3,15] Its use with the South African stroke survivor population, often without consideration of the impact of stroke-related symptoms and contextual factors, may negatively impact the rehabilitation plan and intervention administered by professionals, such as OTs. As such, it is important for researchers and clinicians alike to consider our own perceptions around the use of the MoCA with

our unique stroke-survivor population, and its validity as a screening tool for identifying PSCI. Its use with the South African stroke survivor population, who demonstrate other unique medical, cultural and social demographics should be continued with caution; and the results should be interpreted through a critical lens of clinical reasoning.

The impact of increasing stroke-related disability in South Africa, especially in younger, working-age groups is growing cause for concern as affects and has the potential to affect the livelihoods and wellbeing of not only the stroke survivor but also their families and caregivers.

The detrimental effects of cognitive impairment in functioning increases the impact of burden of care and ability to enter into and sustain paid employment. As such, it is critical that cognitive impairments in those with moderate to severe stroke be assessed and treated in accordance with best practice guidelines to improve overall quality of life for these individuals and their families.

The MoCA, while widely used, is under scrutiny for its validity in detecting the presence of PSCI. Literature exists for: the use of the MoCA in stroke, the use of MoCA in South African populations, and the validity of the MoCA in detecting cognitive impairment in general. However, the primary researcher/author could not find any literature which explores the validity of the MoCA for use in detecting cognitive impairments in stroke survivors in South Africa. The intersection of cultural, contextual and stroke-related factors for MoCA utilization is unexplored for the South African context, and presents a significant knowledge gap for practitioners using this tool in their stroke rehabilitation services.

The information found through reviewing literature; as well as my own clinical experience working with South African stroke survivors, resulted in the following question set to be addressed by this research study, “Is the Montreal Cognitive Assessment (MoCA) a valid tool for screening cognitive impairment in moderate to severely impaired stroke survivors in South Africa?”

1.3 Methods

1.3.1 Study Design and Research Context

This research study utilised a quantitative descriptive, cross-sectional design. This design is a non-experimental study, whose results are reported as descriptive statistics. This type of study is often used for identifying problems with or justifying

current practice, which aligns with this study's purpose of gaining insight into South African occupational therapists' perceived validity of the MoCA as a cognitive screening tool for South African stroke survivors.

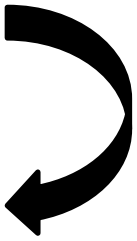
A small, expert consensus group was used to gain information around cognitive skills from the Comprehensive ICF Core Set for Stroke which could be assessed using the MoCA. Nominal Group Technique processes were utilised to conduct the group and gather data.

This research project was set against the backdrop of the South African healthcare system, spanning both the public and private healthcare sectors. Additionally, all settings and phases of stroke rehabilitation in South Africa in which occupational therapists are involved were included in this study.

Piloting of the researcher-developed online survey around the MoCA and ICF Core Set for Stroke.

5 invitations sent out to occupational therapists to conduct content validity and provide feedback on the survey.

Population: Occupational Therapists who have completed at least a Masters Degree

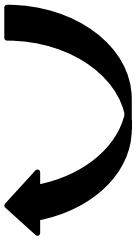


Survey too long- focus group indicated to look at commonly-affected cognitive skills in moderate-to-severe stroke.

Consensus group held with 4 occupational therapists.

Population: Occupational therapists with ≥5 years clinical experience working with South African stroke survivors, and formal training and certification for the MoCA.

Consensus group aim: To identify cognitive skills included under “mental functions” in the ICF Core Set for Stroke which they felt could be assessed in the various sections of the



Survey amended on REDCap to include findings of consensus group and remove redundant sections.

Online survey distributed through OTASA network, and through snowballing techniques.

Population: post-community service occupational therapists, with completed formal training and certification in the MoCA, who are actively working with South African stroke survivors.

65 partially completed responses

28 completed responses

21 completed with MoCA training and certification (n=21)

Figure 1.1. : The Research Process

1.3.2 Population

The population for this research study consisted of occupational therapists working in the public or private sectors, at any level of care, who are considered experts in the stroke rehabilitation field of practice. An 'expert' occupational therapist has been defined in several ways in occupational therapy literature. Holmqvist, Holmefur & Ivarsson defined an expert occupational therapist as an occupational therapist actively practising in the field of interest of the study, with a minimum of 5 years of clinical experience working with the population of interest.[66] This study required information from practicing clinicians, using the MoCA with stroke survivors. As such, the definition of an expert occupational therapist described above may limit the information collected. This study defined an expert occupational therapist as a qualified occupational therapist trained in the administration, scoring and interpretation of the MoCA, actively working with the South African stroke survivor population.

1.3.3 Sampling Methods

Total population sampling was used for this research study. This sampling method falls under purposive sampling. In this type of purposive sampling, the total population demonstrating a specific set of attributes or features (i.e., all of the population) is examined in the study.[67]

The sample size required for this study was made using an estimation of the population of occupational therapists working in the field of adult neurorehabilitation. 5876 occupational therapists were registered with the HPCSA in 2021.[68] We estimated that one third of this population (1958 occupational therapists) work in the field of neurorehabilitation in the South African setting. Furthermore, it was likely that the population of expert occupational therapists (as described under "Research Population/Participants") was even smaller than the estimated population size of 1958. This relatively smaller population made this research study suitable for employing total population sampling.[67,68]

1.3.4 Sample Selection

Table 1.1. Inclusion and Exclusion Criteria

	Pilot Study	Focus Group	Survey
Inclusion Criteria	Qualified occupational therapists • At least Masters Level Qualification	Qualified Occupational Therapists • Registered with the HPCSA • At least 5 years clinical experience with South African stroke survivors. • Formal administration and certification in the MoCA.	Qualified Occupational Therapists • Actively working with stroke survivors • In either the public or private sector, at any phase of the stroke rehabilitation process. • Who have completed their community service year • Completed formal training and certification for using the MoCA in practice. • Can be involved in only assessment-related procedures (example; occupational therapists conducting functional

			capacity evaluations)
Exclusion Criteria			• Qualified occupational therapists who are not certified in the administration, scoring and interpretation of the MoCA. • Qualified occupational therapists who are certified in the administration, scoring and interpretation of the MoCA; but are not actively working in the field of stroke rehabilitation.

1.3.5 Data Collection Methods and Procedure

i. Instruments

The research instrument comprised a three-part, online survey developed by the researcher. The three parts included a demographics questionnaire, the Content Validity Index on the MoCA, and the match between commonly affected cognitive skills in stroke and the MoCA. This survey was developed on and distributed via the RedCap platform.

A self-administered, online survey was chosen as the means of data collection, as this allowed for the survey to be distributed to occupational therapists throughout South Africa, where they have internet access (even if practicing in more remote parts of the country).

Doing so afforded the opportunity to gain a sample which was more representative of the practising clinicians in this country.

ii. Research Procedure

Data collection commenced following research ethical approval by the Human Research Ethics Committee (HREC) (Ethics Certificate Number: M221046); as well as granted approval for use of the MoCA in this study from the MoCA Organization.

A. Piloting

Piloting of the survey questionnaire was conducted with 3 members of staff from the Department of Occupational Therapy at the University of the Witwatersrand. These occupational therapists were selected to participate due to their expertise in research procedures as members of academia. Each staff member assessed the content validity of the survey, rating each survey item on its relevance and clarity on a scale of 1 to 4.

The responses of the experts involved in the pilot study demonstrated that the original version of the survey was too long, nor was sufficiently focused to enable answering of the objectives set for this study. Amendment of the survey was recommended to decrease survey completion time but also ensure focused survey content. A focus group was recommended to aid in partially addressing the first

objective to allow for condensing of the section on commonly experienced post-stroke cognitive skills impairments.

B. Consensus Group- Nominal Group Technique

The consensus group aimed to gain insights from occupational therapists around the MoCA and the ICF Core Set for Stroke; and how the skills included in the ICF Core Set for Stroke were assessed in the MoCA.

During this group, each of the experts were provided a copy of the MoCA original version (7.1), as well as a copy of the ICF Core Set for Stroke; and were asked to select the cognitive functions and skills (part of mental functions) in the ICF Core Set for Stroke which were assessed in each section of the MoCA. The four experts were tasked with reaching consensus on the cognitive skills from the ICF Core Set for Stroke which they felt were assessed in the various sections of the MoCA. Nominal group techniques were employed to ensure contribution of all members, and consensus was reached when all 4 experts agreed on whether a skill was to be included. Silent generation, round robin, clarification and ranking steps were employed during the group process.

The group was transcribed and the content was analysed. The discussion on each section of the MoCA was analysed, and the skills on which consensus was reached were confirmed. These skills from the consensus group are included in the table included in **Appendix F**. No further data analysis was required for the consensus group.

C. Survey Instrument/data collection

i. Survey amendments

On completion of the focus group and the piloting process the following changes were made:

a. Removal of *"Section 1: The Comprehensive ICF Core Set for Stroke"*
b. Addition of a single question for each section of the MoCA in the *"MoCA and CVI".* The question asked the survey participant whether or not they

agreed that the particular MoCA section assessed/screened the cognitive skills suggested in the focus group.

c. The addition of a full demographics section which included:
    i. Type of stroke rehabilitation services offered in participants' place of work.
    ii. Sector in which participants currently worked.
    iii. Stage/phase of rehabilitation offered by participants' workplace.
    iv. Years of experience working with a stroke population.
    v. Training and certification for use of the MoCA.
    vi. Frequency of use of the MoCA with stroke survivors.
    vii. Postgraduate training (continuing education courses).
    viii. Postgraduate qualifications in neurology.

ii. Survey distribution

The amended researcher-developed instrument (survey) was hosted on the RedCap platform. It was distributed to occupational therapy practitioners via the Occupational Therapy Association of South Africa's (OTASA) network, and social media platforms and South African professional networking groups to reach OTs who are not members of OTASA. Snowballing was also utilised. Two other professional organisations of which occupational therapists can be members did not respond to the follow-up request for survey distribution.

Initially the survey was sent out through OTASA and a reminder sent out approximately 1.5 months later. Snowballing comprised an initial distribution, a reminder approximately 1.5 months later, then a further reminder 1 month thereafter.

Data collection was finalised on 31/03/2024, as no new participants had completed the survey 2 weeks after the third reminder was distributed.

iii. Analysis and Interpretation

Data analysis differed for the focus group and the survey instrument results. The methods used for analysis of the different components of this study are discussed below:

a) Pilot Study:

The content validity data and feedback were analysed by the primary researcher. Items on the survey instrument scored as 1 and 2 were considered for revision. Additionally, the feedback comments were considered for any further amendments for the survey instrument.

Amendments were made to the survey as described under "*Survey Amendments"*. Additionally. The topic and format for the recommended focus group was carried out based on feedback from the pilot study.

b) Consensus Group- Nominal Group Technique

The discussion from the consensus group was first transcribed from the recording on Microsoft Teams using the Descript app; and the transcription was refined and further organised by the primary researcher.

The transcription was used in conjunction with the researcher's own notes of the discussion; and alongside the notes made by the participants on their copies of the MoCA. The information from these resources was triangulated to develop the list of cognitive skills from the ICF Core Set for Stroke agreed upon by all four experts, that could be assessed in each section of the MoCA. The data for the consensus group are included in the table found in **Appendix I.**

c) Survey Instrument:

Data analysis was conducted using descriptive statistics and the Content Validity Index method.

Demographic data was represented using frequency proportions to demonstrate the characteristics of the expert occupational therapists. Descriptive statistics were used to demonstrate the relative frequency of participant responses for sections 1 and 3 of the survey.

Section 2 of the survey was analysed using the CVI. This was preceded by recoding of the relevance for each item; with a score of 1 allocated to items scored originally as a 3 or 4, and 0 allocated to items originally scored as a 1 or 2.[69–71]

Item-level CVI was used to determine the validity of each item, by adding together the number of experts who originally rated the items as 3 or 4 and then dividing this by the total number of experts. This demonstrated the portion of the agreement between experts on the validity of item.[69–71]

Scale level CVI was calculated to demonstrate the overall validity of the MoCA to screen for post-stroke cognitive impairment. This was done using the universal agreement method, where the sum of the universally agreed upon items (items with a score of 1) was divided by the total number of items.[69–71]

1.3.6 Data Management

All data generated from the surveys was stored on REDcap under a password protected profile, accessible to only the researcher and the two research supervisors. A second copy of the survey responses was backed up onto an access-controlled server provided by the university. This ensured the safety of the data and maintained anonymity and confidentiality of the study participants. Survey responses will be stored for 2 years on Redcap if no publication is released, or for 6 years following publication.

1.3.7 Ethical Considerations

Ethical clearance to conduct this research study was obtained through the Human Research Ethics Committee (Medical) from the University of the Witwatersrand (Ethics Number: M221046 MED22-10-002). Research was only conducted once ethical clearance had been obtained. This research was conducted bearing the following ethical principles in mind:

Autonomy refers to the right of an individual to make their own decisions; and can relate to participation and non-participation.[72] Surveys were distributed to as many relevant occupational therapists as possible via professional organizations, as well as

through snowball sampling. An information sheet was positioned as the first page of the online survey, and information on informed consent was provided. By continuing with the survey, consent for participation and use of the information included in the participant submission was assumed. The information sheet provided practitioners with the pertinent information to guide their decision as to whether or not to participate in the study, and that their response could be withdrawn from the study at any time without consequence.

The research survey was distributed to relevant occupational therapy practitioners through the largest professional organisation for occupational therapists. This way, the researcher did not have access to the participants personal or identifying information. Furthermore, neither the survey itself, nor the demographic questionnaire required participants to provide information from which their identity could be deduced. These steps will assist in maintaining participant confidentiality and anonymity.

Beneficence is the ethical principle which explains that participants should either have some benefit from the research study, or the risk-benefit ratio should be balanced.[71] This study did not provide participants with any direct benefits for their participation. However, it provided an opportunity for participants to contribute to growing the body of knowledge in their field, which could contribute to furthering the development of evidence-based practice in their field of interest.

Non-maleficence refers to the notion of “do no harm”, which, in part, encompasses avoidance of offending others through research or practice and avoiding harm to participants.[72] In this research project, participants were not in a position where they could be harmed. However, careful consideration of the phrasing of the survey questions was crucial in ensuring no offense or judgment to the study participants.

CHAPTER 2
SUBMISSABLE MANUSCRIPT

2.1. Manuscript Details

This chapter is presented as a manuscript which has been prepared for submission for publication to the International Journal of Stroke. This journal publishes international research focused on all clinical aspects of stroke. Various article types are considered by this journal for publication.

This manuscript has been submitted as an original research article focused on screening and assessment of post-stroke cognitive impairment (PSCI); which aligns with the International Journal of Stroke's scope. This original research article has been prepared in accordance with the submission guidelines (Appendix D) specified for this type of article in the International Journal of Stroke. A word count of 5000 words is allowed for an original research article, including 500-word (max) abstract, references and figures.

2.2. Details of Author Contribution

Christey L. Harris is the primary researcher and author for this research. Bhavna Bahgoo and Faye Jackson from the Department of Occupational Therapy at the University of the Witwatersrand were co-authors and supervisors for this research.

Table 2.1. Contributions of Primary Author and Co-Authors/Supervisors using Contributor Roles Taxonomy (CRediT) Terminology

CRediT Term	Christey L. Harris (Primary Researcher and Author)	Bhavna Bahgoo and Faye Jackson (Co-authors and Supervisors)
Conceptualisation	X	X
Methodology	X	X

Formal Analysis	X	X
Investigation	X	
Resources	X	X
Data Curation	X	
Writing- Original Draft	X	
Writing- Review and Editing	X	X
Supervision		X

2.3. Abstract

2.3.1. Background

Post-stroke cognitive impairment (PSCI) has an incidence between 20 and 80% in the global stroke survivor population. Even mild forms of PSCI have been found to have detrimental impacts on participation in rehabilitation, achievement of functional independence, quality of life, and life expectancy following stroke. Screening for PSCI is crucial in the stroke survivor population. The Montreal Cognitive Assessment (MoCA) has been widely used to screen for PSCI; though has come under scrutiny for its clinical utility with the stroke survivor population and populations outside of Western, English-speaking cultures.

2.3.2. Aims

The aim of this study was to determine whether the MoCA is a valid tool to screen for PSCI in moderate to severely impaired South African stroke survivors.

2.3.3. Methods

This quantitative, cross-sectional study collected data through 1) a consensus group of 4 expert occupational therapists using the Nominal Group Technique and 2) an online, self-administered survey consisting of a) demographic information, b) the validity of the sections of the MoCA using the Content Validity Index, and c) the match between the ICF Core set for stroke and the MoCA. 21 completed survey responses were analysed from a total of 90 responses. The MoCA demonstrated acceptable-to-excellent scale-CVI scores in all aspects except simplicity (score 0.749 with a highest possible score of 1).

2.3.4. Conclusion

The findings of this study indicate that the MoCA is largely valid; but lacks simplicity for optimal performance for South African stroke survivors. Furthermore, expert occupational therapists working in the field of stroke rehabilitation felt that the MoCA does not sufficiently screen for the presence of PSCI.

The sample size, though small, is sufficient for conducting the CVI method. However, the public sector was poorly represented in the sample, creating a sample bias. Furthermore, non-response bias also resulted in a small sample which lessened the generalisability of the results. However, it highlights the gap in knowledge for cognitive assessment in South African stroke survivors; as well as the need for development of a diagnosis and contextually relevant screening tool. This study emphasises that the MoCA alone is insufficient for diagnosing PSCI, and complementary assessment tools should be administered to triangulate data around PSCI in South African stroke survivors.

2.3.5. Data Access Statement

The raw data is stored on a password-protected platform, accessible only to the study authors; and is from the corresponding author.

2.4. Introduction

Stroke remains one of the leading causes of mortality and disability globally.[1,2] In South Africa, the incidence of stroke is estimated at approximately 240 per day.[21] 170 Stroke

victims survive and are often left with residual impairment in different areas of functioning, varying in severity. South African stroke incidence has almost doubled in the past 20 years; with a marked increase in the incidence among younger adults.[24,51] This is a critical portion of the population contributing to socioeconomic growth. Thus, effectively managing stroke and its subsequent impairments is paramount in continuing to develop the working population in our country.

Cognitive impairment following stroke is common, affecting an estimated 20-80% of stroke survivors globally.[4–6] Commonly termed Post-Stroke Cognitive Impairment (PSCI), these deficits in cognitive functioning can be subtle; and because of the overt nature of physical and functional skills impairments, tend to be under-addressed in the rehabilitation process [42]. PSCI affects various cognitive skills including: attention, information processing, executive functioning, working memory, memory, learning, visuospatial skills, perceptual skills, emotional and language skills.[16,40,46,73] It is associated with poor motor recovery, participation in rehabilitation, achievement of greater functional independence, mood, engagement in daily activities, quality of life and lifespan following stroke.[39,41,42] Considering the range of cognitive skills, and the pervasive impact on functioning and quality of life for stroke survivors, management of PSCI is a crucial component of the stroke rehabilitation process.

Evaluation is the first step in being able to effectively address PSCI.[3,15,52] Due to a combination of disease-related factors and contextual factors, comprehensive neuropsychological assessment of cognitive functioning is not always feasible with stroke survivors.[8] Screening for PSCI using a screening tool validated and normed for the stroke population is recommended as a quick, and easy way to gain a brief overview of areas of cognitive functioning which may be affected.[8]

The Montreal Cognitive Assessment (MoCA) is a 30-point, multi-domain cognitive screening tool that is widely recommended and utilised with the global stroke survivor population.[57,63] However, its clinical utility has been scrutinised. The cutoff of ≤26 developed for the detection of mild cognitive impairment in the aging, is applied universally to a variety of conditions and cultural populations despite not being normed

for these samples.[7] As a result, its validity in detecting cognitive impairment in various populations, including stroke survivors, has been criticised.

Communication, motor and visual impairments commonly found in stroke survivors have been shown to impact the ability of this population to successfully complete MoCA items.[8] Additionally demographic factors such as culture, language, English proficiency and level of education have a significant impact on the MoCA performance.[10–12]

Professionals, including occupational therapists, working with South African stroke survivors need to reflect on the clinical utility of the MoCA in light of contextual and stroke-related factors that have been found to impact performance on this tool. There is a paucity of research on the MoCA and South African stroke survivors which impacts HCPs ability to implement contextually relevant evidence-based practice.

This led to the following question for this research study, “Is the Montreal Cognitive Assessment (MoCA) a valid tool for screening cognitive impairment in moderate to severely impaired stroke survivors in South Africa?”

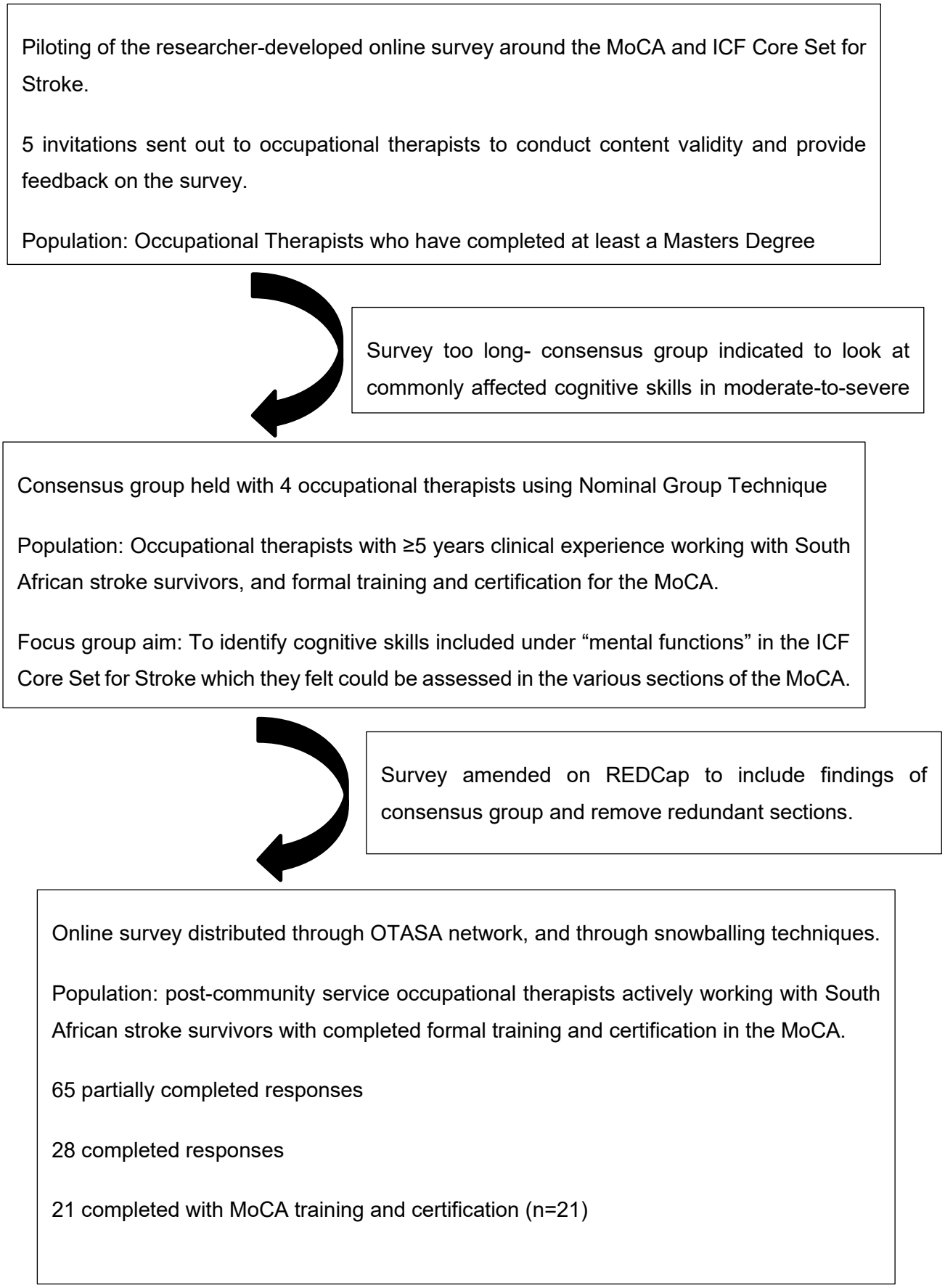
2.6. Methods

2.6.1. Study Design

This research study utilised a quantitative descriptive, cross-sectional design. This design is a non-experimental study, whose results are reported as descriptive statistics. This type of study is often used for identifying problems with or justifying current practice, which aligns with this study’s purpose of gaining insight into South African occupational therapists’ perceived validity of the MoCA as a cognitive screening tool for South African stroke survivors.

This research project was set against the backdrop of the South African healthcare system, spanning both the public and private healthcare sectors. Additionally, all settings and phases of stroke rehabilitation in South Africa in which occupational therapists are involved were included in this study.

Figure 2.1. The Research Process



2.6.2. Participation

This study employed two types of sampling in its methodology:

Convenience sampling was utilised to recruit experts for the consensus group. At least 5 years of clinical experience with stroke survivors and formal training on the MoCA was required for participation in the focus group. Four experts were selected for participation.

Purposive, total population sampling and snowballing were used to recruit survey participants. Survey responses were included if the participant was a qualified occupational therapist registered with the HPCSA, actively working with the South African stroke survivor population, following their community service year. Formal training in the MoCA was part of the inclusion criteria.

A sample of 21 participants, meeting inclusion criteria, completed the online survey over a period of approximately 5 months between October 2023 and March 2024.

2.6.3. Data Collection Process and Statistical Analysis

Data for this research were collected during a consensus group that made use of the Nominal Group Technique, and using an online, self-administered survey.

A list of commonly affected cognitive skills which could be assessed using the MoCA was created during the consensus group with 4 expert occupational therapists in the field of neurological rehabilitation. This data was then incorporated into the survey to make the survey more concise.

The survey collected data on the following:
1) occupational therapists' level of agreement with the consensus group on cognitive skills that can be assessed using the MoCA;
2) perceived validity of the various sections of the MoCA using the CVI method; and
3) occupational therapists' perception of the MoCA's ability to effective screen for the presence of PSCI.

Survey data was collected between October 2023 and March 2024. A total of 93 survey responses were received. However, 65 were only partially completed, leaving

28 completed responses. Of the 28 complete responses, only 21 participants met the inclusion criteria; and thus, only these 21 responses were used for statistical analysis.

The Nominal Group Technique was utilised to conduct and analyse the consensus group prior to the survey distribution. The clarification and ranking stages in the NGT process were used to reach consensus on the cognitive skills from the Comprehensive ICF Core Set for Stroke that the group participants felt were assessed in each section of the MoCA.

Descriptive statistics were used to analyse and represent the demographic data of the survey participants; and to demonstrate the relative frequency of participant responses for sections 1 and 3 of the survey. Section 1 focused on participant demographics, while section 3 looked at the perceived match between commonly affected cognitive skills in PSCI and those skills screened by the MoCA.

The Content Validity Index method was utilised for statistical analysis of section 2 of the online survey, which looked at the validity of the MoCA as a whole, and then the validity of each section of the MoCA. It focused on 4 domains of content validity, namely *relevance, simplicity, clarity, ambiguity.*

Item relevance was first allocated; with a score of 1 allocated to items scored originally as 3 or 4, and 0 allocated to items originally scored as 1 or 2.[69,70] Item-level CVI (I-CVI) and Scale-Level CVI (average method) were calculated to determine the validity of each MoCA item/section; as well as the overall validity of the MoCA for detecting PSCI in moderate to severely impaired South African stroke survivors.

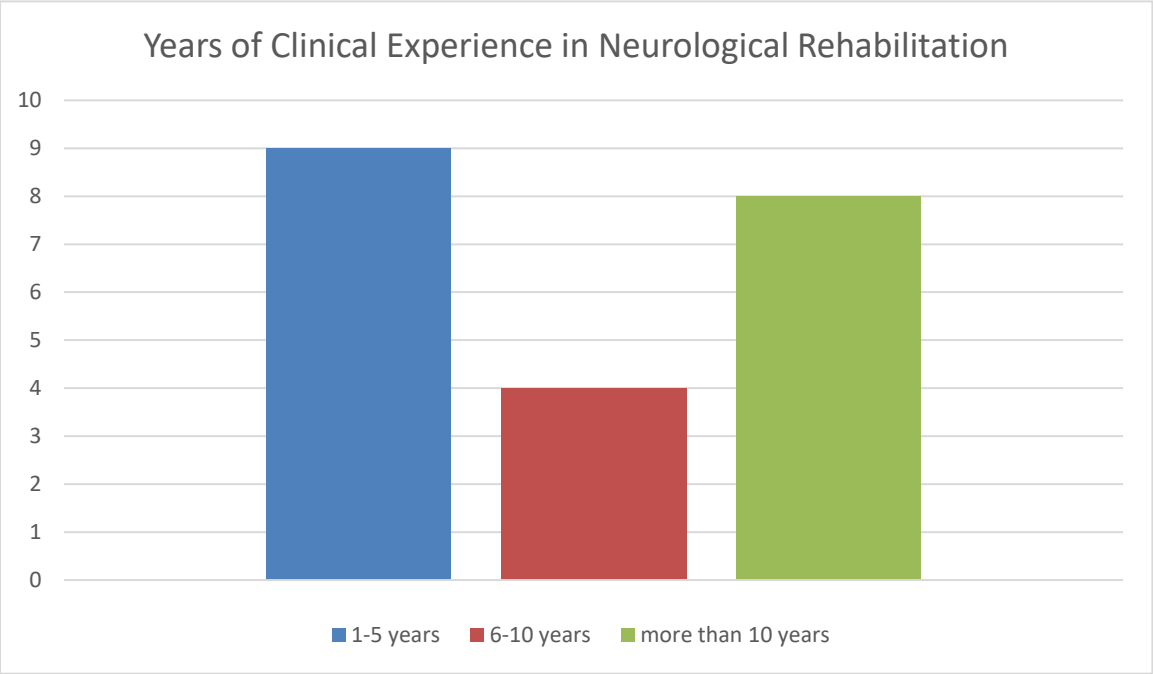
2.7. Ethical Considerations

Ethical clearance was obtained through the Wits Human Research Ethics Committee (Medical) (Ethical Clearance Number: M221046) prior to collection of any data. Ethical principles of autonomy, informed consent, beneficence and non-maleficence were adhered to in this study.

2.8. Results

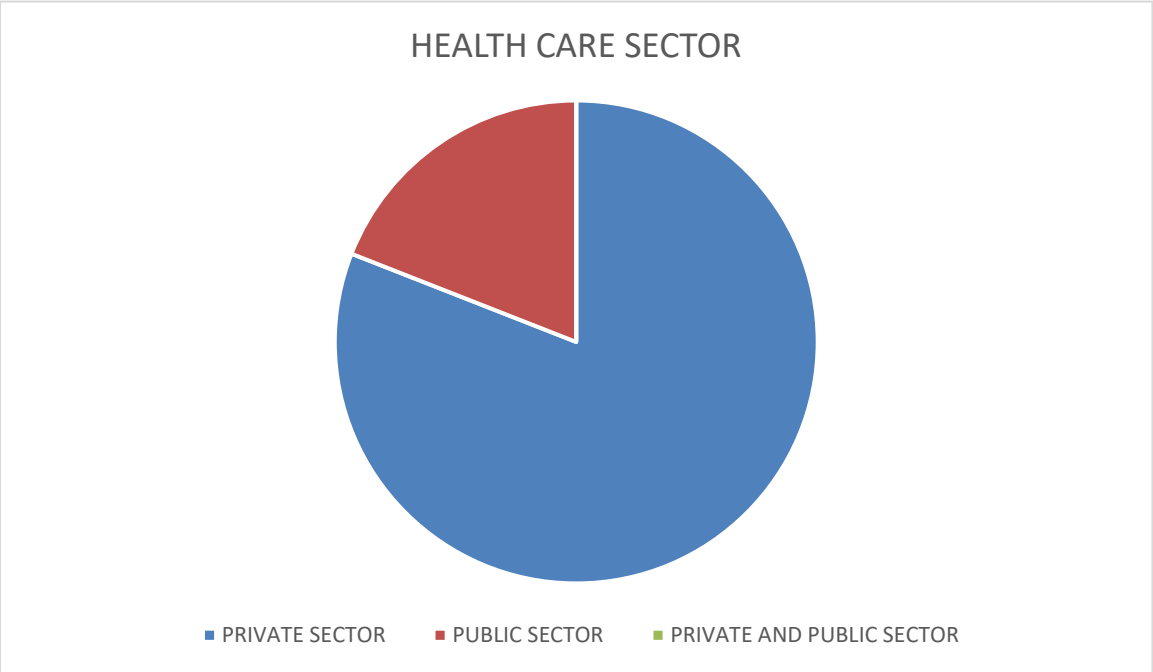
The results presented are based on the 21 completed participant responses. Various key demographics of the sample are depicted in the figures below:

Figure 2.2. Survey Participants' Number of Years of Clinical Experience in Neurological Rehabilitation



As shown in figure 2.2., most survey participants had 1-5 years of clinical experience with stroke survivors (42.85%); followed by those with more than 10 years clinical experience (38.10%). Occupational therapists with less clinical experience may have opinions and experiences which differ from clinicians who have worked longer with the stroke survivor population. More years of clinical experience may also bring greater insight into advantages and challenges around administering the MoCA with South African stroke survivors.

Figure 2.3. Shows the distribution of survey participants between the South African public and Private health care sectors.



As shown in figure 2.3. the majority of survey participants worked in the private healthcare sector. However, the majority of stroke survivors access healthcare and rehabilitation services via the public sector; but occupational therapists working in the public sector are poorly represented in the sample (only 4/21 participants). With the vast majority of the sample working in the private sector, the findings of this study may not necessarily be representative of the challenges experienced when administering the MoCA with the majority of South African stroke survivors who access rehabilitation services through the public sector.

Figure 2.4. shows the distribution of survey participants across the stages of stroke rehabilitation

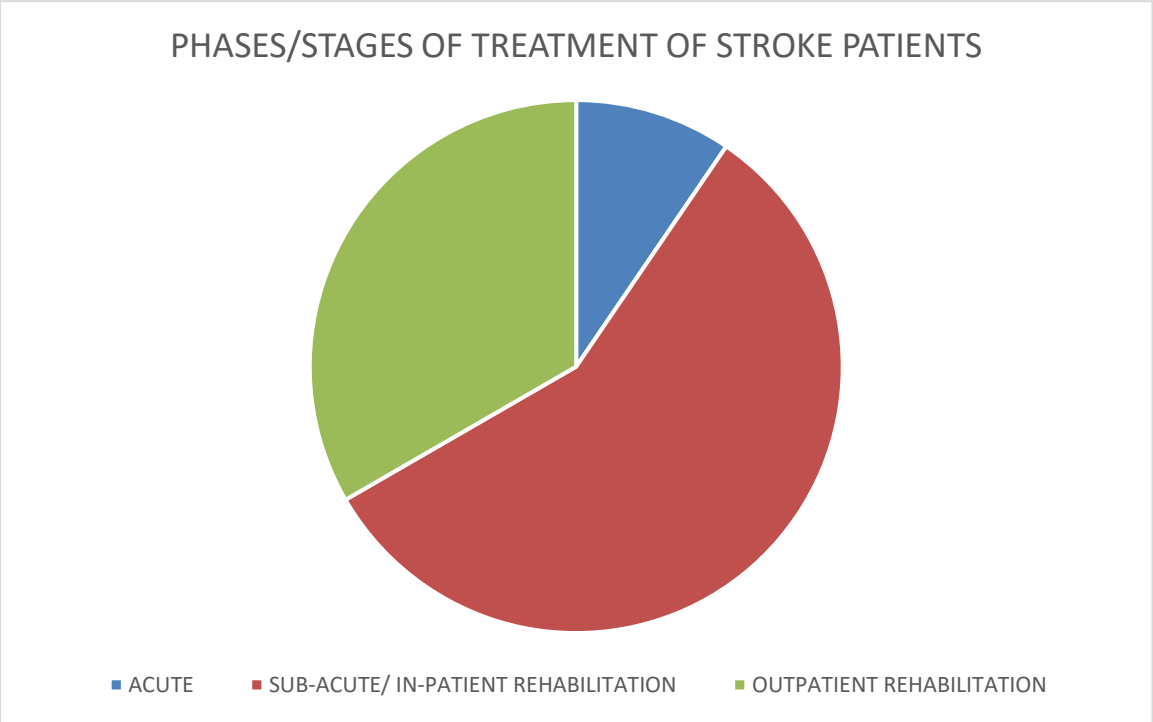
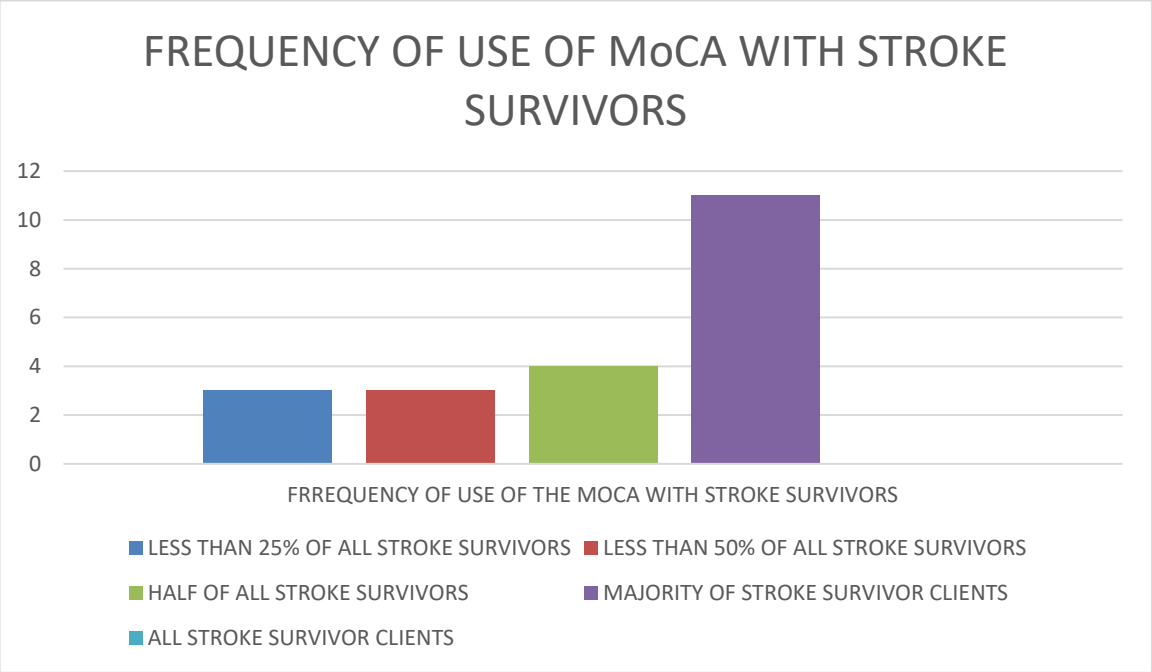


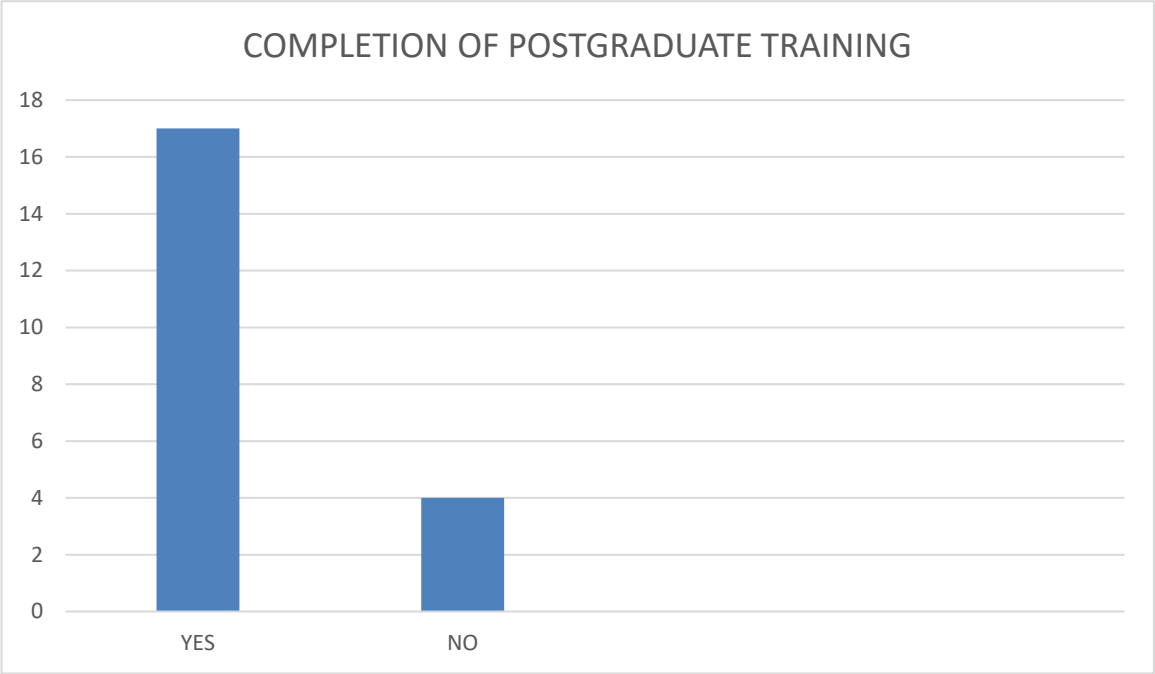
Figure 2.4. shows that more than 80% of participants work in either subacute or outpatient stroke rehabilitation. Stroke survivors' ability to engage, and the severity of various impairments often changes over the course of the rehabilitation process. Thus, therapists' experiences in administering the MoCA with South African stroke survivors may differ depending on the stage of rehabilitation in which they work.

Figure 2.5. Shows the frequency with which the survey participants utilise the MoCA for screening for PSCI.



As shown in figure 2.5, cumulatively, more than 70% of the OTs in the sample administer the MoCA with either the majority of their stroke survivor clients, or at least half of their stroke survivor clients. While the MoCA has been critiqued in its use with non-Western populations, and in conditions other than those described in Nasreddine et al. [57]; it is still widely used in the South African context to screen for the presence of cognitive impairment.

Figure 2.6. demonstrates the survey participants' completion of further postgraduate training in neurological conditions.



80.95% Of participants had completed some form of postgraduate training, furthering their knowledge in the field of neurological rehabilitation, as shown in figure 2.6. The theoretical and practical knowledge gained through post-graduate training provides important insights and expertise when providing feedback on the use of the MoCA with South African stroke survivors.

Commonly- affected cognitive skills post-stroke assessed by the MoCA

The cognitive skills and functions detailed in the ICF Core Set for Stroke, which can be assessed by the MoCA, were explored during a consensus group held with four occupational therapists who are experts in the field of neurological rehabilitation. The list developed in this consensus group was incorporated into the online survey, and participants had to indicate their level of agreement with the list of skills provided for each section of the MoCA.

Figure 2.7. illustrates the level of agreement of survey participants with consensus group experts' suggested list of cognitive skills which can be assessed using the MoCA.

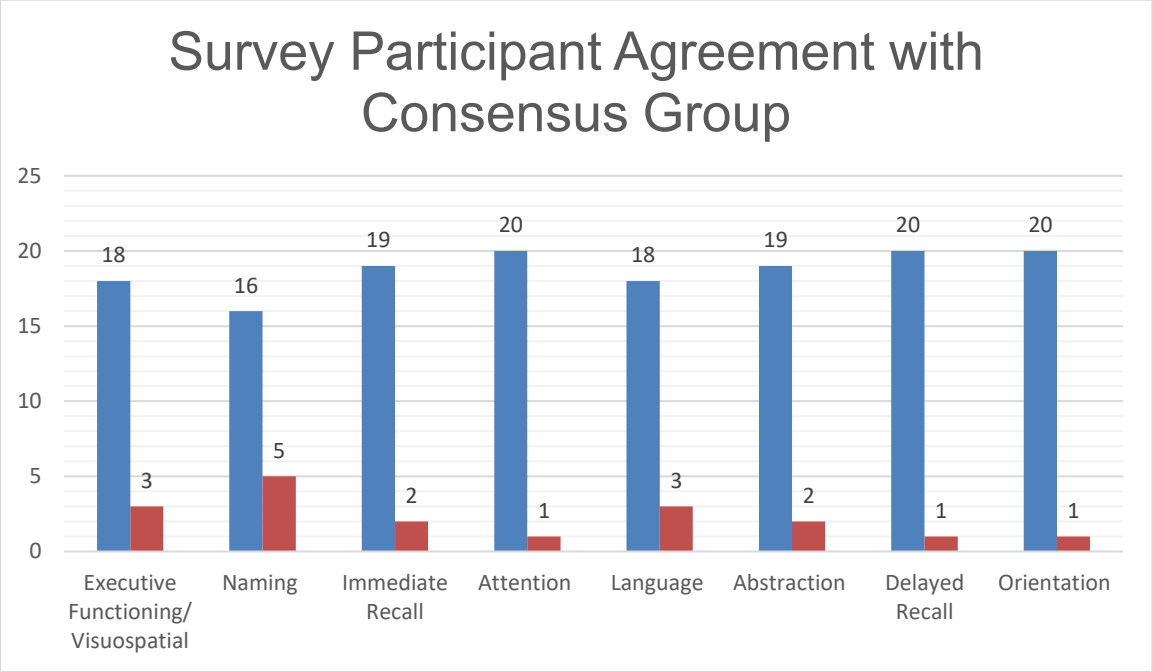


Figure 2.7. shows that across all eight sections of the MoCA, there was no less than 76% agreement from study participants with the consensus group experts on the cognitive skills which could be assessed using the MoCA. This high level of agreement from participants demonstrated that OTs working with South African stroke survivors are seeing similar commonly affected cognitive areas which can be incorporated into screening with the MoCA.

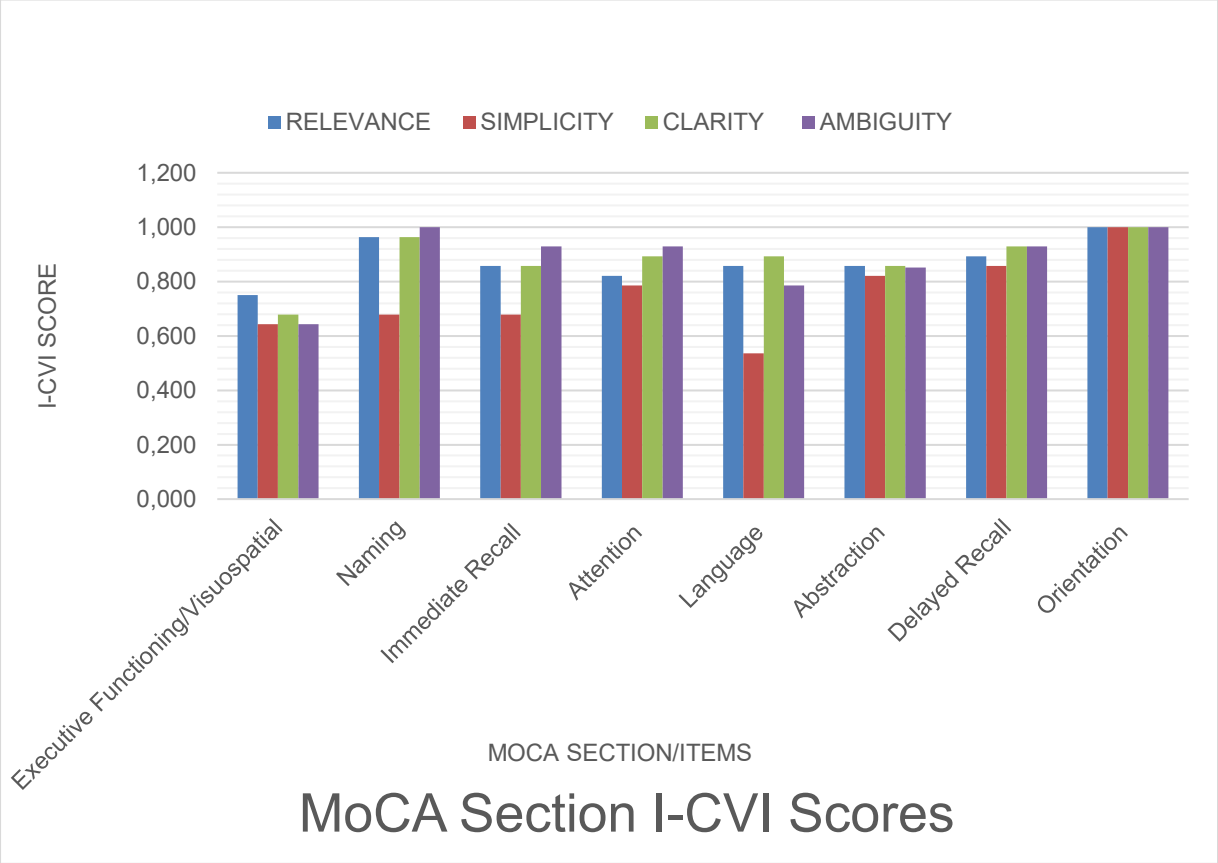
The Validity of the MoCA for assessing PSCI in moderate-to-severely impaired South African Stroke Survivors

The validity of the MoCA as a screening tool for PSCI in the South African stroke survivor population was determined by expert occupational therapists in the field of neurological rehabilitation scoring 4 components of the Content Validity Index/CVI (relevance, simplicity, clarity and ambiguity) for each section of the MoCA. This is reported as Item-level CVI (I-CVI) and Scale CVI (S-CVI). However, it is important to understand the definition of each domain of the CVI. These four concepts are defined below:

- *Relevance* refers to whether the definition of the concept is represented in the test item.
- *Simplicity* refers to how straightforward or easily understandable the instructions or task is.
- *Clarity* is defined as how clear and simple the task wording is.
- *Ambiguity* refers to whether the meaning of the task/item is confusing or easy to misinterpret. [74]

The CVI method was used to ascertain the validity of the MoCA for South African stroke survivors. This method typically requires between 5 and 10 experts to review the tool; this study had 21 experts.[71]

Figure 2.8. presents the I-CVI for each section of the MoCA, in components of relevance, simplicity, clarity and ambiguity.



I-CVI scores are interpreted as follows [71]:

- Greater than 0.79 is considered acceptable

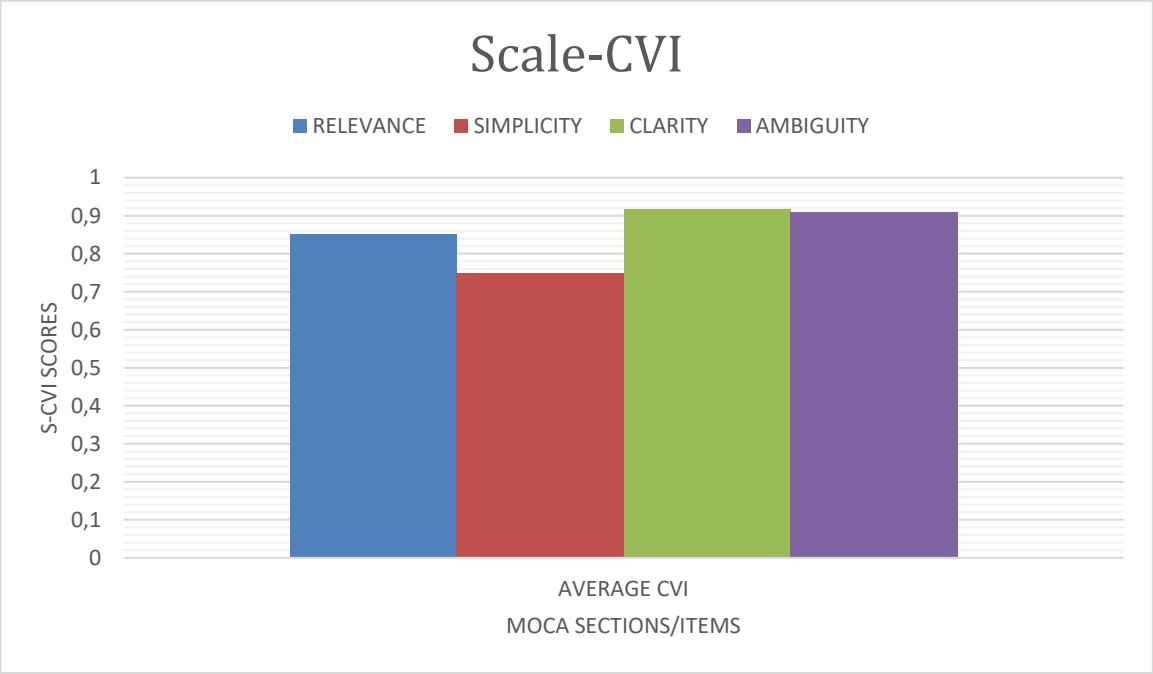
- Between 0.7 and 0.79 is questionable, and the item may need revision
- Scores below 0.7 are unacceptable, and the item needs to be revised/removed

The executive functioning and visuospatial skills section of the MoCA had the lowest I-CVI scores for: Relevance- 0.75; Simplicity and Ambiguity- 0.643, and Clarity- 0.679. This indicates that participants found this section did not sufficiently screen visuospatial and executive functioning skills to ascertain the presence of impairment in South African stroke survivors. Revision of this section may be warranted for this population, based on the scores provided by clinicians.

The wording used in the MoCA task instructions is not easily understandable for moderate to severely impaired South African stroke survivors. All items, except Orientation, had *simplicity* as their lowest I-CVI scores; and the first 5 sections of the MoCA had *simplicity* I-CVI scores below acceptable. Participants highlighted that the language, naming and abstraction sections as “not culturally relevant’ for many of the population, and they introduce bias into the administration of the MoCA. This can impact effective engagement in test tasks, leading to false positives for impairments. Revision of this may warrant better validity in screening for the presence of PSCI, reducing the confounding effect of demographic factors and stroke-related communicated impairments on MoCA performance.

Orientation obtained item-level CVI scores of 1 across all CVI components. This demonstrates the agreement of all participants for the validity of this item.

Figure 2.9. presents the S-CVI of the MoCA tool as a whole, for relevance, simplicity, clarity and ambiguity.



An average S-CVI score of 0.9 demonstrates an excellent criterion. A score of 0.8 demonstrates an acceptable criterion, though on the lower end of acceptance [71].

Based on the scores allocated by the participants, the MoCA demonstrated S-CVI scores in clarity (0.917) and ambiguity (0.91) which demonstrated an excellent criterion. Relevance demonstrated a S-CVI which was acceptable (0.851) and simplicity demonstrated a S-CVI which was below acceptable (0.749).

The Match Between the MoCA and Commonly affected skills in PSCI

The extent to which commonly impaired cognitive skills in stroke survivors are screened using the MoCA was addressed in the second part of the survey instrument. This information was collected as three (3) yes/no questions.

80.95% Of study participants reported that they felt the MoCA did not sufficiently screen for the presence of PSCI. Furthermore, 52.38% felt that cognitive skills commonly affected following stroke were not sufficiently screened by the MoCA. 61.90% reported that they did not feel that there were cognitive skills which are repetitively screened in the MoCA.

These reports demonstrate that the MoCA, while widely used with stroke survivors in South Africa, does not sufficiently screen the aspects of cognition which are commonly affected following stroke. Thus, further in-depth assessment is required to ascertain the presence of PSCI in moderate to severely impaired South African stroke survivors.

2.9. Discussion

The MoCA is an easy and quick to administer cognitive screening tool recommended for use with stroke survivors in many clinical practice guidelines including the South African Contextualised Stroke Rehabilitation Guideline.[3,15,16] This study investigated the validity of the MoCA for use with moderate to severely impaired stroke survivors in South Africa.

Commonly affected cognitive skills in moderate to severely impaired stroke survivors

The first objective was set to provide information which would serve as a reference point against which the appropriateness of the MoCA could be evaluated, rather than providing an exhaustive list of commonly affected cognitive skills.

The consensus group served a dual purpose in this study. It allowed for experts to present and reach consensus on which cognitive skills they felt were commonly affected in moderate to severely impaired stroke survivors using the ICF Core Set for Stroke as a guide. Secondly, this process allowed for refinement of the survey instrument, creating a focused and concise tool.

14 of the categories in the ICF Core Set for Stroke[47] were identified as skills which could be assessed through the various items in the MoCA. These 14 skills included and expanded on cognitive skills identified in existing literature as being commonly affected following stroke. These were presented in the survey instrument, and there was a high level of agreement from survey participants, demonstrating that the MoCA could be used to screen other commonly affected cognitive skills in South African stroke survivors. This could facilitate a more comprehensive screening to guide further assessment, as well as appropriate treatment.

Despite strong agreement of the survey participants with the consensus group findings, the findings cannot be generalized due to small sample size and sample bias. The underrepresentation of the public sector, where most stroke survivors in South Africa access services, demonstrated a crucial gap in the study findings.

Furthermore, the consensus group nor survey explicitly asked participants for their feedback on what they perceived as commonly-impaired cognitive skills in stroke survivors based on their training and clinical experience.

The ICF Core Set for Stroke is a comprehensive list [46,47] which was used to guide the consensus group discussion; and this was more exhaustive than the skills discussed in both the consensus group; and those further proposed in the survey. However, both the ICF Core Set for Stroke and the list proposed by consensus group and survey participants were more comprehensive compared than those discussed in the MoCA training.[46,47,57] This demonstrates that while the MoCA does have capacity for clinicians to screen more cognitive skills in moderate to severe stoke; there are limitations to the extent to which it can fully screen for cognitive skills commonly affected in PSCI if only the MoCA training and original literature is considered for this population.

The Validity of the MoCA as a screening tool for PSCI in moderate to severely impaired South African stroke survivors

The CVI method with 4 domains (relevance, simplicity, clarity and ambiguity) [75] was used to evaluate the degree to which the MoCA related to the purpose of screening PSCI. It was evaluated at an item level (I-CVI) and at a scale level (S-CVI)[71].

This objective was addressed thoroughly in this study through data collection and analysis of the results using the CVI method. However, the sample was small and not necessarily representative of the distribution of stroke survivors across health sectors. As such, there were limitations to the extent to which conclusions could be drawn about the validity of the MoCA for South African stroke survivors with moderate to severe stroke.

The executive functioning/ visuospatial section of the MoCA had the lowest mean I-CVI; with 3 CVI domains having scores which would warrant item revision; and a 4th domain (relevance) with a questionable score.

Executive functioning skills are a *"collection of supervisory cognitive processes"* which include attentional control, planning, organising, reasoning, problem solving, monitoring and inhibition. Impairments in these skills are associated with decreased capacity to perform ADLs and IADLs, participation in the greater community and capacity to participate in work.[76,77] The perceptions of the study participants that this section of the MoCA has reduced validity for this population is important. Without proper screening or assessment, appropriate treatment is difficult. The implication of poorly addressed executive dysfunction is inability to reintegrate into key life activities like ADLs, IADLs, and for the younger population, work[41,78]. This can exacerbate the effects of disability and reduce quality of life.

Simplicity is the degree to which the instructions or the item itself is easy to understand [74]. Five of the eight sections of the MoCA had *simplicity* I-CVI scores which were below what is considered acceptable for the CVI. Additionally, the *simplicity* S-CVI score was below what is considered acceptable.

The low *simplicity* scores for I-CVI, and S-CVI for the MoCA are statistically significant. They highlight OTs experiences of South African stroke survivors with moderate to severe stroke having difficulty responding appropriately to several items of the MoCA. The implication of this is that the items with low I-CVI scores do not appropriately measure the intended construct/concept; and thus, misclassification of impairment in skills measured by these items is probable.

Survey participants cited several items such as the language section, naming and memory sections having limited cultural relevance for stroke survivors in South Africa. This aligns with existing literature around the use of the MoCA in South African populations which has highlighted the significant impact of cultural and contextual factors on performance in the MoCA, even in clinically healthy, working and English-proficient populations [10–12]. These same studies demonstrated that performance on the language items, the second abstraction item, confrontation naming of a rhinoceros and the recall of "daisy" is worse in South African populations who are not first-

language English speaking, or from an African culture, when compared with the sample from the original study by Nasreddine et al.[10–12,57] The diversity seen within the South African population has been highlighted as a risk for falsely classifying individuals with cognitive impairment.

It is critical to consider that the majority of the stroke survivor population in South Africa access health and rehabilitation through the public sector; where these demographic factors may be more prominent.[28] Furthermore, medical management of stroke in the public sector may not be as comprehensive, and greater severity of other stroke-related symptoms may be more frequent.[28]

Aphasia, apraxia, visuospatial and perceptual impairments can also impact on item performance, requiring greater demands for simplicity. These factors are more probable and severe in moderate to severe stroke. It is, therefore, possible for these factors to compound the effects of cultural and contextual factors highlighted in Kirkbride et al.; Robbins et al.; and Van Wijk et al. [10–12]

The match between commonly impaired cognitive skills in moderate to severe stroke, and cognitive skills screened by the MoCA

The MoCA was originally developed to screen for MCI; though its use has been extended to screen for cognitive impairment in many other conditions despite not being normed for these populations.[57,58] Notwithstanding this information, many clinical practice guidelines, including SA-CSRG, include the MoCA as a recommended screening tool for PSCI.[3,15,16]

Attention, information processing, executive functioning, working memory, memory and learning are described in literature as commonly-impacted following stroke.[16] However, the Comprehensive ICF Core Set for Stroke provides a more comprehensive list comprising 15 categories representing “mental functions”, 7 categories representing learning and applying knowledge.[46,47] The expert consensus group found 14 of these categories included in the Comprehensive ICF Core Set for Stroke could be screened using the MoCA; with high levels of agreement from the survey participants.

Visuospatial skills, some aspects of executive function, short term and delayed recall, attention, concentration, working memory, language and orientation to time and place are cognitive skills which literature and the MoCA training report can be screened using the MoCA. [57,58] This list of skills is considerably fewer than the list included in the Comprehensive Core Set for Stroke, as well as the list developed by the study focus group.

This mismatch between the cognitive skills included in the ICF Core Set for Stroke[46,47], the list of skills developed by the focus group and survey participants, and the skills reportedly assessed by the MoCA indicates the possibility that the MoCA and the training provided to practitioners, does not allow for sufficient screening for the presence of PSCI.

80.95% of survey participants reported that they felt the MoCA did not sufficiently assess for the presence of PSCI, while 52.38% felt it did not sufficiently screen cognitive skills commonly impaired after stroke. Shi et al.'s systematic review and meta-analysis found the MoCA to demonstrate higher specificity and lower sensitivity in detecting PSCI.[60] It also found the superior specificity of the MoCA would be lost in stroke survivors with more moderate to severe cognitive impairments; where there are other confounding stroke-related impairments; but also, a greater range of cognitive impairments which may not necessarily be screened by the MoCA.[60] Considering the higher burden of more moderate to severe stroke impairment in South Africa, this becomes an important clinical consideration for practitioners administering the MoCA with stroke survivors.[3,24]

As with the previous objectives, the findings relating to the congruency between the MoCA and the ICF Core Set for Stroke bring to light important considerations for clinicians and researchers. However, the small sample size and sample bias again limit the generalisability of the findings for this objective; and further research will be required to confirm or refute these findings.

Conclusion and Limitations

This study has demonstrated that MoCA is perceived to be a largely valid tool in screening for PSCI in moderate to severely impaired stroke survivors in South Africa.

However, the participants did raise important considerations around the ease with which South African stroke survivors can understand the MoCA tasks and instructions may engage optimally in the test; as well as low validity for screening specific cognitive functions, such as executive functioning. Furthermore, the perceived mismatch between cognitive skills commonly affected after stroke and those skills acknowledged in the MoCA training and literature as part of the skills screened is evident. This highlights the importance of conducting further assessment of cognitive functioning (beyond screening) in this population to accurately ascertain the presence of PSCI, which aligns with recommendations of literature and many clinical practice guidelines for diagnosing PSCI.

This study partially met the first objective; though the 2 subsequent objectives were able to be explored thoroughly in this study. While the findings of this study are relevant and highlight a gap in current literature and clinical practice, there are limitations. Non-response bias for the survey does limit both the credibility and generalisability of the study findings. Moreover, the significant underrepresentation of the public sector (where most stroke survivors access their care) in the study sample further decreases generalisability of the study results.

Despite the critiques raised around the MoCA's utility with moderate to severely impaired stroke survivors; 52.38% of experts in this study reported they use the MoCA with the majority of their stroke survivor clients; and a further 19.05% use it with more than half of their stroke survivor clients. While this is in line with current CPG recommendations, it also highlights that South African occupational therapists are limited in the tools available and feasible to use with this stroke survivor population. The MoCA is frequently acknowledged in literature for good specificity and sensitivity for detecting PSCI, and its translation into several of the official South African languages is favourable for use with the local population despite other limitations on its validity and clinical utility.

Implications for future research and practice

This study brings to light crucial considerations for future research and occupational therapy practice when using the MoCA with stroke survivors in South Africa.

Future research on the MoCA and stroke in the South African context should focus on collecting data to work towards developing normative data for this population. This would allow for improved accuracy in diagnosing PSCI. Additionally, qualitative and quantitative research should be conducted to continue to build the body of knowledge around the MoCA and stroke in South Africa.

While the MoCA is a recommended by the South African Contextualised Stroke Rehabilitation Guidelines, occupational therapists need to use and interpret the results of this tool with some caution. The impact of demographic variables and stroke-related factors on MoCA performance are key considerations when administering the MoCA with stroke survivors in South Africa; and their impact may warrant that further assessment be conducted to confirm results. Utilising additional screening tools, such as the Cognitive Assessment for Stroke Patients, the MMSE, Oxford Cognitive Screen or SLUMs, to complement and confirm MoCA findings may be a viable option until a contextually relevant tool is developed.

Moreover, it may also be beneficial to draw on other available tools such as the Comprehensive ICF Core Set for Stroke to guide observation of other critical cognitive functions not included in the MoCA screening. This will aid in providing a comprehensive picture of cognitive function and the presence of PSCI and increasing the likelihood that frequently impacted skills in stroke are assessed, observed and adequately addressed during rehabilitation.

2.10. Data Availability

Raw Data for this study are available on request.

2.11. Disclaimer

The views and opinions expressed in this manuscript do not necessarily reflect the views of the institutions affiliated with the authors but rather reflect the views of the authors involved in this research.

CHAPTER 3
SYNTHESIS

3.1. Conclusion

This study explored the validity of the MoCA for detecting PSCI in moderate to severely impaired South African stroke survivors, using South African occupational therapists' perceptions from their clinical experience.

It highlighted important experiences and observations about the MoCA and PSCI based on the experience of occupational therapists working with stroke survivors in South Africa.

The consensus group, and subsequent strong agreement from survey participants, around common cognitive impairments in stroke aligned with global literature. However, the small sample and poor representation of the public sector bring to light the possible sample bias of this study and thus, the generalisability of the findings is limited. Additionally, neither the consensus group or survey overtly asked participants to identify what they perceived as commonly impaired cognitive skills post-stroke. Thus, the first objective was not addressed in its entirety.

Study participants found the MoCA to be a generally valid tool for cognitive screening in stroke; and tended to use it with a large portion of their stroke survivor clients. However, this was not without critique, as the majority of participants reported that the MoCA did not sufficiently screen for commonly affected cognitive skills in stroke; nor did it sufficiently screen for the presence of PSCI. These concerns are echoed in existing literature.

The MoCA remains widely used in stroke rehabilitation settings, though the training provided on the MoCA platform does not necessarily highlight the challenges in its use with clients that fall outside of the originally intended population. As a result, demographic factors, and stroke-specific factors may be overlooked when administering this test in practice; and other important observations of skills outside of those specified in the training. The implication of this is overlooked impairments, and treatment which does not address all facets of cognition adequately; resulting in

decreased achievement of more complex functional outcomes which result in persistent disability.

This objective was addressed thoroughly in this study. However, non-response bias and the resultant small sample (n=21) and the poor representation of the public sector limits the extent to which conclusions around the MoCA's validity for screening PSCI in moderate to severe stroke in South Africa can be made.

Participants of this study developed a list of cognitive skills from the Comprehensive ICF Core Set for Stroke which could be screened when using the MoCA. This highlighted the importance of occupational therapists using clinical reasoning and professional experience to observe other cognitive skills when administering the MoCA. This may also prompt reasoning to administer additional outcome measures to complement the MoCA and create a comprehensive picture of the stroke survivors' cognitive functioning; but also, to ensure that commonly affected skills in stroke survivors are adequately addressed in the evaluation stage of the OT Process. In doing so, we provide a sturdy foundation on which intervention can be based.

As occupational therapists working in a setting which boasts diversity in demographic factors, but also in disease aetiology, it is crucial to consider not only the test training, but also, pertinent literature on the MoCA within our context, and on the population we service, and other important health resources such as the ICF. Failure to do so has implications for the services we offer in rehabilitation, the overall achievement of improved functional outcomes and minimization of disability in our stroke survivor population.

3.2. Limitations

i. The majority of the participants in this study worked in the private sector. In a study by Ned et al., the majority of registered occupational therapy practitioners worked in the private sector, in provinces with better economic prospects.[29] This study sample, is representative of the distribution of occupational therapists across the South African healthcare system. However, the vast majority of the South African population access health care through the public sector.[28] As such, the responses

of the participants in this study, may not necessarily be representative of the validity of the MoCA for the majority of the stroke survivor population in South Africa.

ii. Formal training and certification for use of the MoCA was implemented from 1 September 2019, almost 14 years following the development and norming of this screening tool.[59] Occupational therapy practitioners have thus, been using the MoCA in practice for many years without formal training. Additionally, the MoCA training can be costly, and not necessarily affordable for South African occupational therapists. As such, some occupational therapy practitioners may have continued to use the MoCA without completing the formal training and certification.

iii. The exclusion of occupational therapists who had not completed formal training in the MoCA may have excluded a significant portion of experienced occupational therapy practitioners who had valuable insights into the use of this screening tool with the stroke survivor population.

3.3. Recommendations

i. Further Research

This research study demonstrated a sample which was overly-representative of the population which is served by the private sector of the South African healthcare system. 16% of the South African population is served by the private health care sector, while 84% is served by the public sector. Furthermore, the small sample size limited the generalisability of the results.

Much like existing literature on the MoCA and its use in both stroke and South African populations, this research found the MoCA to be valid for use with the South African stroke survivor population, providing clinicians with important information about cognitive functioning. However, critiques of its *simplicity*, and perceived inability to sufficiently diagnose PSCI and screen commonly affected cognitive skills post-stroke, warrant careful clinical consideration in its administration with moderate to severely impaired South African stroke survivors.

To the researcher's knowledge, this is the first study which has explored the validity of the MoCA for use with moderate to severely impaired south African stroke

survivors. As such, further research will be required to continue to build a body of knowledge around this subject. Both qualitative and quantitative studies would serve an important role in building a body of research in this topic.

Focus group methodologies could be beneficial to gain insight into occupational therapists' experiences with and perceptions of the utility and validity of the MoCA for detecting PSCI in South African stroke survivors. Quantitative methodologies would also be beneficial to gain insight into MoCA performance in stroke survivors of different demographic factors and other stroke-related factors. This would help develop important foundational knowledge and statistics to explore options for developing normative data in the future.

Additionally, the ICF is being brought to the forefront of healthcare in South African with the signing of the National Health Insurance (NHI) bill. In light of this, incorporation of ICF resources on stroke may be beneficial within a changing system. Resources such as the Comprehensive and Brief ICF Core Sets for Stroke can become important supplementary resources for occupational therapists when evaluating and treating stroke survivors. As such, further research on the use of these tools within our context and with the assessment tools already utilised, will be beneficial for clinical practice.

ii. Education and Training

The MoCA is currently considered a useful tool for screening for the presence of PSCI and is widely-recommended internationally in clinical practice guidelines. Its superiority over the MMSE for use with stroke survivors has been demonstrated in several studies.

As such, it remains a core component of best practice for stroke rehabilitation. Occupational therapy practitioners should complete the mandatory training and certification for the MoCA; to ensure reliability and standardisation for its application in clinical settings. In so doing, practitioners can develop professional insight and judgement into why this screening tool may or may not be valid for the South African stroke survivor population.

However, the MoCA training is expensive, and often not financially feasible for practitioners to pursue. It may be beneficial for organizations such as the HPCSA, as well as professional bodies like OTASA, to engage with the MoCA organization to negotiate a more affordable rate for occupational therapists and other relevant professionals in Global South countries to complete their training and certification. This will also allow for the MoCA to be administered, adhering to standardization in diverse populations. This in turn may spur further research on the MoCA in these settings.

iii. Policy Development

The *South African Contextualised Rehabilitation Guidelines for Stroke* published in 2019 recommends the MoCA as a valid and contextually relevant outcome measure for South African stroke survivors.[3] However, since 2019 there have been a number of studies which have refuted the validity of the MoCA for both the South African population and the stroke survivor populations.

The findings of the current study to a large degree, agreed with the recommendations of the *South African Contextualised Rehabilitation Guidelines for Stroke.* However, considering the limitations of this study, further research is required to either validate or refute the recommendations made in this clinical practice guideline. Therefore, this study alone does not present sufficient evidence to justify review and revision of current policy and clinical practice guidelines. Rather, it sets the scene for development of the body of evidence on this topic which may warrant revision of policy in the future.

An important consideration for future is the need to develop culturally and contextually relevant tools for assessing PSCI. Due to the high patient: therapist ratios, as well as short admission durations and consulting times in many South African healthcare settings, a screening tool may be more clinically practical than a full assessment battery. Policy should prompt research into the development of such a screening tool to optimise services offered to stroke survivors across all sectors of healthcare, levels of care and locations.

Additionally, research into the validity of commonly utilised screening and assessment tools for stroke is warranted to develop a foundation of information on norms and other crucial considerations for healthcare professionals administering these tests with our stroke survivor population. This will also prompt development of policy and CPGs that are both contextually relevant and clinically sound.

iv. Clinical Implications

As clinicians who administer the MoCA with stroke survivors in South Africa there are important considerations for its use with this population going forward.

1. Occupational therapists using the MoCA with stroke survivors in South Africa should start to keep record of items where there is consistent fallout. This will help grow empirical evidence on items which need revision.
2. Considering the concerns around the MoCA's validity with moderate to severe stroke in South Africa, administering the MoCA alongside another screening tool validated for the stroke population would allow for triangulation of information to accurately ascertain areas of impairment. The *Cognitive Assessment for Stroke Patients, the MMSE and the Oxford Cognitive Screen.*
3. In resource-constrained settings, where access to tests and training is limited, it may be beneficial to utilise a resource like the ICF Core Set for Stroke as a guide for skills to screen, even if this is done with non-standardised tests or activities. While it may not yield the same objectivity as a standardised test, this will guide practitioners on skills often affected following stroke.

3.4. References

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Appendices

Appendix A: Ethical Clearance Certificate from Human Research Ethics Committee, University of the Witwatersrand

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

Office of the Deputy Vice-Chancellor (Research and Innovation)

TO: Ms CL Harris
School of Therapeutic Sciences
Department of Occupational Therapy
Medical School
University

E-mail: 1090354@students.wits.ac.za

CC: Supervisor: Mlles B Bahgoo and F Jackson
<Bhavna.Bahgoo@wits.ac.za>
and <HREC-Medical Research Office@wits.ac.za>

FROM: Mr Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2023/03/10

REF: R14/49

PROTOCOL NO: **M221046** (This is your ethics application reference number. Please quote it in all enquiries, oral or written, relating to this study.)

PROJECT TITLE: *Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke survivors?*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG

R49 Ms CL Harris

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M221046

NAME: (Principal Investigator)	Ms CL Harris
DEPARTMENT:	School of Therapeutic Sciences Department of Occupational Therapy Medical School University
PROJECT TITLE:	*Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke survivors?*
DATE CONSIDERED:	2022/10/28
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Mlles B Babgoo and F Jackson
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2023/03/10

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

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

I/we fully understand the conditions under which I am/we are authorized 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 submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **October** and therefore reports and re-certification will be due in the month of **October** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator _____ Date _____

Appendix B: Approval of Title

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Ms Sandra Munesar
E-mail: Sandra.munesar@wits.ac.za

16 January 2025
Person No: 1090354
PAG

Miss CL Harris
PO Box 2283
Bedfordview
2008
South Africa

Dear Miss Christey Harris

Master of Science in Occupational Therapy: Approval of Title

We have pleasure in advising that your proposal entitled *Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Ms Sandra Munesar
Faculty Registrar
Faculty of Health Sciences

Appendix C: Proof of Registration

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

PROOF OF REGISTRATION

This document certifies the following information about the student's current status at the University of the Witwatersrand, as at 03-Mar-2025.

The student below is registered from January to December for the academic year 2024.

Student Details:

Student ID	: 1090354	Title	: Miss
Surname	: Harris		
Name(s)	: Christey Llara		
Date of Birth	: 18-Jun-1996	ID Number/ Passport Number	: 9606180054087

DATE FIRST REGISTERED: 05-Jan-2022

Programme of Study Details:

Program Code and Title	: MCA11 - Master of Science in Occupational Therapy
Programme Type	: Masters (C) Degree
Attendance Type	: Part-Time
Date of Registration	: 31-Jan-2024
Year of Study	: Year of Study 2

Courses Registered for in 2024:

COURSE	COURSE DESCRIPTION	SESSION	STATUS
OCCT7035A	Research Report II	Full Year	Enrolled

FACULTY REGISTRAR

Appendix D: Research Survey Instrument and Information

Good day

My name is Christey Harris. I am a Masters degree student currently enrolled at Department of Occupational Therapy, School of Therapeutic Sciences, University of the Witwatersrand. I am conducting research as part of the requirements to qualify for a Masters Degree in Occupational Therapy. This information document has been provided to inform you of the research study I am undertaking. Research is a process used in seeking new knowledge. In this study we want to gather information on occupational therapists' perceptions and views on the use of the Montreal Cognitive Assessment with the South African stroke survivor population.

The study will be conducted throughout South Africa with occupational therapists working in the field of neurological rehabilitation, more particularly those working with stroke. This study consists of a self-administered survey which explores the validity of the Montreal Cognitive Assessment for use with moderate-to-severely impaired South African stroke survivors in relation to the impairments listed in the ICF Core Set for Stroke. This research study aims to help grow the body of knowledge for occupational therapy practice with the South African stroke survivor; and guide occupational therapists' clinical reasoning when deciding on screening and assessment procedures for cognitive impairments in this population.

The ICF Core Set for Stroke was developed by the ICF Research Branch in conjunction with several universities with the intention of creating a list of categories which need to be taken into account when conducting a comprehensive assessment on a stroke survivor. It is inclusive of categories across various domains of the ICF model.

I would like to invite you to participate in this research, by giving your consent to be a participant by completing the survey. Completing the survey should take between 20 and 30 minutes of your time. You will be eligible to participate in this study if you meet the following inclusion criteria:
Qualified occupational therapists who have completed their community service year
• Actively working with stroke survivors
• In either the public or private sector, at any phase of the stroke rehabilitation process.
• With completed formal training and certification for using the MoCA in practice.
• Can be involved in only assessment-related procedures (example: ; occupational therapists conducting functional capacity evaluations)
The survey responses will be stored for 2 years if a scientific publication is made, and 6 years if there is no publication produced.
Should you consent to being a participant in this study, it is important to note that all of your information will be treated in confidence. The following measures have been put in place to ensure confidentiality of the research participants as far as possible:
• Only the researcher and research supervisors will have access to the information via a password protected profile on a research data management software.
• Neither your name, nor any identifying information will be published with the results of this study.
• Codes will be utilized for identifying your survey response to maintain your confidentiality and anonymity throughout the process of this research study.

There are no direct benefits or incentives for participation in this study; but there is also no cost incurred should you choose to participate. The opportunity to contribute knowledge and expertise to develop occupational therapy practice with stroke survivors in the South African context provides a benefit for fellow practitioners and hopefully future practitioners who will work with this population.
Should you have any questions or require further information on the study before choosing to participate, please do not hesitate to contact me using the email details listed at the top of this information sheet. It is of great importance that you are satisfied with the information provided on the study prior to making a decision as to whether or not you would like to be a participant in this research. Declining to participate in this research will not negatively impact you in any way. Participants are also free to withdraw from participation at any time in the study.

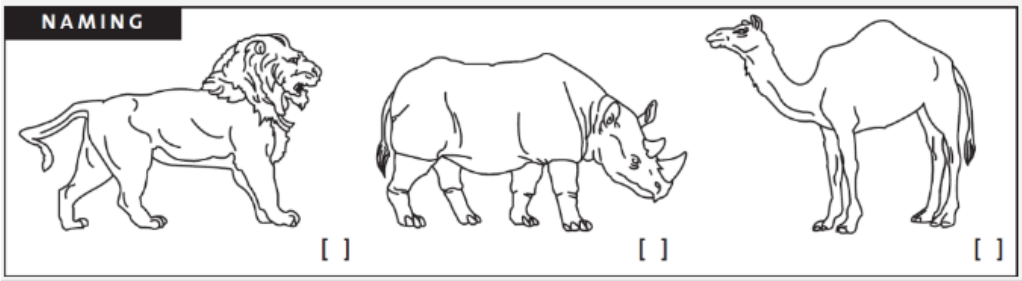
Demograhics Questionnaire: **Please complete the sections below:**	
What type of stroke rehabilitation services are offered in your place of work?	○ General care as part of day-to-day services ○ Specialized care in a stroke unit ○ assessment only (for example in vocational rehabilitation) reset
Which sector of healthcare do you currently work in:	☐ Private Sector ☐ Public Sector
Stage/Phase of Rehabilitation your workplace offers	○ Acute care ○ Sub-acute/In-patient rehabilitation ○ Outpatient rehabilitation reset
Years (experience) working with a stroke population	○ Less than 1 year (post-community service) ○ 1-5 years ○ 6-10 years ○ More than 10 years reset
Training and certification in the administration, scoring and interpretation of the Montreal Cognitive Assessment (MoCA)	○ Yes ○ No reset
Frequency of use of the MoCA with stroke survivors	○ All stroke survivor clients ○ Majority of stroke survivor clients ○ Half of stroke survivor clients ○ Less than half of stroke survivor clients ○ Less than 25% of stroke survivor clients ○ No stroke survivor clients reset
Postgraduate training (continuing education courses or courses)	○ Yes ○ No reset
Postgraduate qualification in neurology (degree/diploma/certificate in which field)	☐ NDT ☐ diploma ☐ Masters ☐ PHD ☐ Other
If other, please specify	
Other Field/s of experience as a qualified, independent practitioner	☐ Neurorehabilitation (paediatric) ☐ Orthopaedic ☐ Paediatric (Sensory-integration) ☐ Other
If other, please specify	

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Relevance	○ 1- irrelevant ○ 2- somewhat relevant, major revision of the section required ○ 3- relevant, with some minor revisions of the section required ○ 4- totally relevant reset
Simplicity * must provide value	○ 1- not simple, total revision required ○ 2- section requires some revision ○ 3- minor revisions of the section are required ○ 4- simple- no revisions required for section reset
Clarity	○ 1- not clear, total revision required ○ 2- section requires some revision ○ 3- clear, though minor revisions of the section are required ○ 4- very clear, no revisions required for section reset
Ambiguity	○ 1- confusing/vague, total revision required ○ 2- section requires some revision ○ 3- unambiguous, but minor revisions of the section are required ○ 4- meaning of the section is clear, no revisions required for section reset

Naming:

Refer to this section to answer the questions that follow.



The naming section of the MoCA was designed to assess:
conceptual thinking

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: higher-level cognitive functions, mental functions of language, seeing functions, speaking	○ yes ○ no reset

If no, please explain further.

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Simplicity

- ○ 1- not simple, total revision required
- ○ 2- section requires some revision
- ○ 3- minor revisions of the section are required
- ○ 4- simple- no revisions required for section

reset

Relevance

- ○ 1- irrelevant
- ○ 2- somewhat relevant, major revision of the section required
- ○ 3- relevant, with some minor revisions of the section required
- ○ 4- totally relevant

reset

Clarity

- ○ 1- not clear, total revision required
- ○ 2- section requires some revision
- ○ 3- clear, though minor revisions of the section are required
- ○ 4- very clear, no revisions required for section

reset

Ambiguity

- ○ 1- confusing/vague, total revision required
- ○ 2- section requires some revision
- ○ 3- unambiguous, but minor revisions of the section are required
- ○ 4- meaning of the section is clear, no revisions required for section

reset

Memory: Immediate Recall

Refer to this section to answer the questions that follow:

MEMORY	Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.		FACE	VELVET	CHURCH	DAISY	RED	No points
		1st trial						
		2nd trial						

The immediate recall section of the MoCA was designed to assess: attention and immediate memory (auditory)

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: attention functions, memory functions, mental functions of language, listening, focusing attention, communicating with- receiving- spoken messages, speaking

- ○ yes
- ○ no

reset

Do you agree that the "immediate recall" section assesses the cognitive skills and activities from the ICF Core Set for stroke listed above:

If no, please explain further.

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Simplicity

- ○ 1- not simple, total revision required
- ○ 2- section requires some revision
- ○ 3- minor revisions of the section are required
- ○ 4- simple- no revisions required for section

reset

Relevance

- ○ 1- irrelevant
- ○ 2- somewhat relevant, major revision of the section required
- ○ 3- relevant, with some minor revisions of the section required
- ○ 4- totally relevant

reset

Clarity

- ○ 1- not clear, total revision required
- ○ 2- section requires some revision
- ○ 3- clear, though minor revisions of the section are required
- ○ 4- very clear, no revisions required for section

reset

Ambiguity

- ○ 1- confusing/vague, total revision required
- ○ 2- section requires some revision
- ○ 3- unambiguous, but minor revisions of the section are required
- ○ 4- meaning of the section is clear, no revisions required for section

reset

Attention:

Refer to this section to answer the questions that follow.

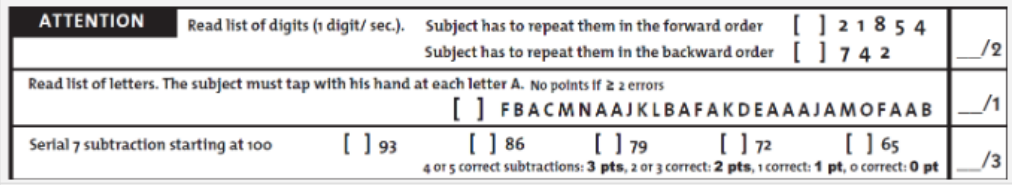
ATTENTION	Read list of digits (1 digit/ sec.).	Subject has to repeat them in the forward order [ ] 2 1 8 5 4 Subject has to repeat them in the backward order [ ] 7 4 2	__/2
Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors		[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B	__/1
Serial 7 subtraction starting at 100	[ ] 93	[ ] 86 [ ] 79 [ ] 72 [ ] 65 4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**	__/3

The attention section of the MoCA was designed to assess: focused attention, divided attention and calculation ability

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: attention functions, intellectual functions, memory functions, higher-level cognitive functions, mental functions of language, calculation functions, listening, focusing attention, communicating with- receiving- spoken messages,

- ○ yes
- ○ no

reset



The attention section of the MoCA was designed to assess: focused attention, divided attention and calculation ability

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: attention functions, intellectual functions, memory functions, higher-level cognitive functions, mental functions of language, calculation functions, listening, focusing attention, communicating with- receiving- spoken messages, calculating, speaking.

Do you agree that the "attention" section assesses the cognitive skills and activities from the ICF Core Set for stroke listed above:

- ○ yes
- ○ no

reset

If no, please explain further.

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Simplicity

- ○ 1- not simple, total revision required
- ○ 2- section requires some revision
- ○ 3- minor revisions of the section are required
- ○ 4- simple- no revisions required for section

reset

Relevance

- ○ 1- irrelevant
- ○ 2- somewhat relevant, major revision of the section required
- ○ 3- relevant, with some minor revisions of the section required
- ○ 4- totally relevant

reset

Clarity

- ○ 1- not clear, total revision required
- ○ 2- section requires some revision
- ○ 3- clear, though minor revisions of the section are required
- ○ 4- very clear, no revisions required for section

reset

Ambiguity

- ○ 1- confusing/vague, total revision required
- ○ 2- section requires some revision
- ○ 3- unambiguous, but minor revisions of the section are required
- ○ 4- meaning of the section is clear, no revisions required for section

reset

Language:

Refer to this section to answer the questions that follow.

LANGUAGE	Repeat : I only know that John is the one to help today. [ ] The cat always hid under the couch when dogs were in the room. [ ]	___/2
	Fluency / Name maximum number of words in one minute that begin with the letter F [ ] _____ (N ≥ 11 words)	___/1

The language section of the MoCA was designed to assess: attention, memory, repetition and word finding.

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: attention functions, intellectual functions, memory functions, mental functions of language, fluency and rhythm of speech functions, focusing attention, listening, communicating with - receiving- spoken messages, and speaking.

Do you agree that the "language" section assesses the cognitive skills and activities from the ICF Core Set for stroke listed above:

- ○ yes
- ○ no

reset

If no, please explain further.

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Simplicity

- ○ 1- not simple, total revision required
- ○ 2- section requires some revision
- ○ 3- minor revisions of the section are required
- ○ 4- simple- no revisions required for section

reset

Relevance

- ○ 1- irrelevant
- ○ 2- somewhat relevant, major revision of the section required
- ○ 3- relevant, with some minor revisions of the section required
- ○ 4- totally relevant

reset

Clarity

- ○ 1- not clear, total revision required
- ○ 2- section requires some revision
- ○ 3- clear, though minor revisions of the section are required
- ○ 4- very clear, no revisions required for section

reset

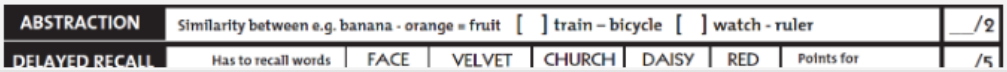
Ambiguity

- ○ 1- confusing/vague, total revision required
- ○ 2- section requires some revision
- ○ 3- unambiguous, but minor revisions of the section are required
- ○ 4- meaning of the section is clear, no revisions required for section

reset

Abstraction:

Refer to this section to answer the questions that follow.



The abstraction section of the MoCA was designed to assess: abstract thinking and conceptual thinking.

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: intellectual functions, higher-level cognitive functions, mental functions of language, communicating with -receiving- spoken messages.

Do you agree that the "abstraction" section assesses the cognitive skills and activities from the ICF Core Set for stroke listed above:

- ○ yes
- ○ no

reset

If no, please explain further.

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Simplicity

- ○ 1- not simple, total revision required
- ○ 2- section requires some revision
- ○ 3- minor revisions of the section are required
- ○ 4- simple- no revisions required for section

reset

Relevance

- ○ 1- irrelevant
- ○ 2- somewhat relevant, major revision of the section required
- ○ 3- relevant, with some minor revisions of the section required
- ○ 4- totally relevant

reset

Clarity

- ○ 1- not clear, total revision required
- ○ 2- section requires some revision
- ○ 3- clear, though minor revisions of the section are required
- ○ 4- very clear, no revisions required for section

reset

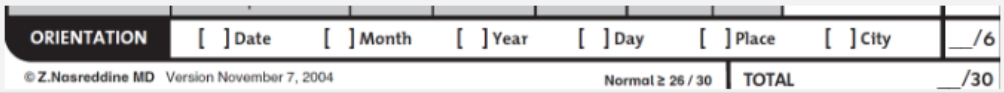
Ambiguity

- ○ 1- confusing/vague, total revision required
- ○ 2- section requires some revision
- ○ 3- unambiguous, but minor revisions of the section are required
- ○ 4- meaning of the section is clear, no revisions required for section

reset

Orientation:

Refer to this section and answer the questions that follow.



The orientation section of the MoCA was designed to assess: attention, memory and orientation to time and place.

A focus group for this study found this section to assess the following from the ICF Core set for Stroke: orientation functions, memory functions, attention functions.

Do you agree that the "orientation" section assesses the cognitive skills and activities from the ICF Core Set for stroke listed above:

- ○ yes
- ○ no

reset

If no, please explain further.

Rate this section of the MoCA on its validity for use with stroke patients with moderate-to-severe impairment using the criteria below:

Simplicity

- ○ 1- not simple, total revision required
- ○ 2- section requires some revision
- ○ 3- minor revisions of the section are required
- ○ 4- simple- no revisions required for section

reset

Relevance

- ○ 1- irrelevant
- ○ 2- somewhat relevant, major revision of the section required
- ○ 3- relevant, with some minor revisions of the section required
- ○ 4- totally relevant

reset

Clarity

- ○ 1- not clear, total revision required
- ○ 2- section requires some revision
- ○ 3- clear, though minor revisions of the section are required
- ○ 4- very clear, no revisions required for section

reset

Ambiguity

- ○ 1- confusing/vague, total revision required
- ○ 2- section requires some revision
- ○ 3- unambiguous, but minor revisions of the section are required
- ○ 4- meaning of the section is clear, no revisions required for section

reset

Section 3: The Match Between the Comprehensive ICF Core Set for Stroke and the MoCA

Consider the cognitive skills included in the Comprehensive ICF Core Set for Stroke, and the cognitive skills assessed in the MoCA.

Do you feel that the MoCA sufficiently assesses all of the areas of cognitive functioning described in the Comprehensive ICF Core Set for Stroke?	○ Yes ○ No reset
Are there any commonly-affected cognitive skill, as specified in the Comprehensive ICF Core Set for Stroke, which you feel the MoCA does not assess?	○ Yes ○ No reset
If yes, please specify	
Are there any cognitive skills, specified in the Comprehensive ICF Core Set for Stroke, which you feel are assessed repetitively in the MoCA?	○ Yes ○ No reset
If yes, please specify	Expand

Appendix E: Participant Information Sheet

Principal Researcher: Christey Harris

Contact Details: Cell: 079 015 1157

Email: 1090354@students.wits.ac.za

Ethical Clearance Number: M221046

Good day

My name is Christey Harris. I am a Masters degree student currently enrolled at Department of Occupational Therapy, School of Therapeutic Sciences. I am conducting research as part of the requirements to qualify for a Masters Degree in Occupational Therapy. This information document has been provided to inform you of the research study I am undertaking. Research is a process used in seeking new knowledge. In this study we want to gather information on occupational therapists' perceptions and views on the use of the Montreal Cognitive Assessment with the South African stroke survivor population.

The study will be conducted throughout South Africa with occupational therapists working in the field of neurological rehabilitation, more particularly those working with stroke. This study consists of a self-administered survey which explores the validity of the Montreal Cognitive Assessment for use with moderate-to-severely impaired South African stroke survivors in relation to the impairments listed in the ICF Core Set for Stroke. This research study aims to help grow the body of knowledge for occupational therapy practice with the South African stroke survivor; and guide occupational

therapists' clinical reasoning when deciding on screening and assessment procedures for cognitive impairments in this population.

The ICF Core Set for Stroke was developed by the ICF Research Branch in conjunction with several universities with the intention of creating a list of categories which need to be considered when conducting a comprehensive assessment on a stroke survivor. It is inclusive of categories across various domains of the ICF model.

I would like to invite you to participate in this research, by giving your consent to be a participant by completing the survey. Completing the survey should take between 20 and 30 minutes of your time. You will be eligible to participate in this study if you meet the following inclusion criteria:

Qualified occupational therapists (Expert Occupational Therapists)

- Actively working with stroke survivors
- In either the public or private sector, at any phase of the stroke rehabilitation process.
- Who have completed their community service year
- With completed formal training and certification for using the MoCA in practice.
- Can be involved in only assessment-related procedures (example; occupational therapists conducting functional capacity evaluations)

The survey responses will be stored for 2 years if a scientific publication is made, and 6 years if there is no publication produced.

Should you consent to being a participant in this study, it is important to note that all of your information will be treated in confidence. The following measures have been put in place to ensure confidentiality of the research participants as far as possible:

- Only the researcher and research supervisors will have access to the information via a password protected profile on a research data management software.

- Neither your name, nor any identifying information will be published with the results of this study.

- Codes will be utilized for identifying your survey response to maintain your confidentiality and anonymity throughout the process of this research study.

There are no direct benefits or incentives for participation in this study; but there is also no cost incurred should you choose to participate. The opportunity to contribute knowledge and expertise to develop occupational therapy practice with stroke survivors in the South African context provides a benefit for fellow practitioners and hopefully future practitioners who will work with this population.

Should you have any questions or require further information on the study before choosing to participate, please do not hesitate to contact me using the email details listed at the top of this information sheet. It is of great importance that you are satisfied with the information provided on the study prior to making a decision as to whether or not you would like to be a participant in this research. Declining to participate in this research will not negatively impact you in any way. Participants are also free to withdraw from participation at any time in the study.

Should you wish to participate in this study, your completion of the survey will serve as consent for participation.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Christey Harris

Appendix F: Consent Form

PARTICIPANT CONSENT SHEET

Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts.

Contact details:

Principal Researcher: Christey Harris

Telephone no.: 079 015 1157, or by

E-mail: 1090354@students.wits.ac.za

Supervisor: Faye Jackson

Telephone no.: 011 717-3704

E-mail: faye.jackson@wits.ac.za

Supervisor: Bhavna Bahgoo

Telephone no.: 011 717 3272

E-mail: Bhavna.Bahgoo@wits.ac.za

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.
Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Name of Participant: _____

Email Address: _____

Date: _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____

Appendix G: International Journal of Stroke Submission Guidelines

The submission guidelines for the International Journal of Stroke for an original research article is described below. This information was provided on the following url: Submission Guidelines: International Journal of Stroke: Sage Journals (sagepub.com)

Submission Status	
Formatting	Word or LaTEX
Cover Letter	A brief letter explaining why your research article should be published in the *International Journal of Stroke*.
Title Page	• Title • Author name(s)Affiliation(s) • Address of all authors • Three-seven key words • Word count • Itemized list of tables and figures.
Abstract for Research Report	Should be no longer than 500 words. Requires a structured abstract: • Background (description of reason for study) • Aims • Methods (brief description of methods) • Results (presentation of significant results) • Conclusions (succinct statement of data interpretation) • Data access statement

Presentation of Research Article	• Abstract • Introduction • Aims and/or hypothesis • Methods • Results • Discussion • References • Data availability
Figures and graphics	Information on figure and graphic presentation not available
Journal Layout	Conforms to the Sage house style
Reference Style	Sage Vancouver reference style
Word Limit	5000 words including 500-word abstract, references, and figures
Supplementary Material	Supplementary material can be hosted online by the journal. Supplementary materials will be subject to peer-review, alongside the article

Appendix H: Submission Confirmation

Submission Confirmation

Print

Thank you for your submission

Submitted to
International Journal of Stroke

Manuscript ID
IJS-03-25-13424

Title
Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?

Authors
Harris, Christey
Jackson, Faye
Bahgoo , Bhavna

Date Submitted
03-Mar-2025

Appendix I: Table of Skills from the ICF Core Set for Stroke assessed by the MoCA, developed by the expert focus group.

MoCA Section	MoCA Skills Assessed	ICF Core Set Skills Assessed	
Executive functioning /visuospatial	Various aspects of executive functioning Visuospatial skills	B117	Intellectual functions
		B140	Attention functions
		B144	Memory functions
		B156	Perceptual functions
		B164	Higher level cognitive functions
		B167	Mental functions of language
		B210	Seeing functions
		D160	Focusing attention
		D440	Fine hand use
		D310	Communication with receiving spoken messages
		D210	Undertaking a single task
Naming	Language skills	B144	Memory functions

		B167	Mental functions of language
		B164	Higher level cognitive functions (especially concepts)
		B210	Seeing functions
		B330	Speaking
Immediate Recall	Short-term memory recall	B140	Attention functions
		B144	Memory functions
		B167	Mental functions of language
		D115	Listening
		D310	Communicating; receiving spoken messages
		D160	Focusing attention
		D330	Speaking
Attention	Attention, concentration and working memory	B140	Attention functions
		B117	Intellectual functions
		B144	Memory functions

		B167	Mental functions of language
		B172	Calculation functions
		D310	Communicating with; receiving spoken messages
		D115	Listening
		D160	Focusing attention
		D172	Calculating
		D330	Speaking
Language	Language and executive functioning	B140	Attention functions
		B117	Intellectual functions
		B144	Memory functions
		B167	Mental functions of language
		B330	Fluency and rhythm speech functions
		D115	Listening
		D150	Focusing attention

		D310	Communicating with; receiving spoken messages
		D330	Speaking
Abstraction	Executive functioning	B117	Intellectual functions
		B164	Higher level cognitive functions
		B167	Mental functions of language
		D310	Communicating with; receiving spoken messages
Delayed Recall	Short term memory recall	B140	Attention functions
		B144	Memory functions
		B167	Mental functions of language
		D115	Listening
		D310	Communicating; receiving spoken messages
		D160	Focusing attention
		D330	Speaking

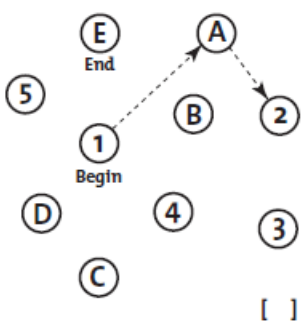
Orientation	Orientation to time and place	B114	Orientation functions
		B117	Intellectual functions
		B140	Attention functions

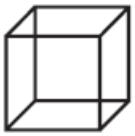
Appendix J: Copy of the Montreal Cognitive Assessment (Original version)

MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME :
Education :
Sex :
Date of birth :
DATE :

VISUOSPATIAL / EXECUTIVE





Copy cube [ ]

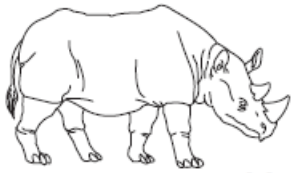
Draw CLOCK (Ten past eleven) (3 points) [ ]

[ ] Contour [ ] Numbers [ ] Hands

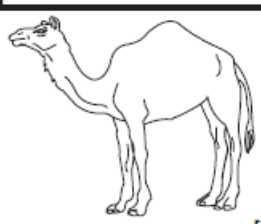
POINTS __/5

NAMING

[ ]



[ ]



[ ]

__/3

MEMORY Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

No points

ATTENTION Read list of digits (1 digit/ sec.).
Subject has to repeat them in the forward order [ ] 2 1 8 5 4
Subject has to repeat them in the backward order [ ] 7 4 2 __/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors
[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B __/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65
4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt** __/3

LANGUAGE Repeat : I only know that John is the one to help today. [ ]
The cat always hid under the couch when dogs were in the room. [ ] __/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words) __/1

ABSTRACTION Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler __/2

DELAYED RECALL

		FACE	VELVET	CHURCH	DAISY	RED	
	Has to recall words WITH NO CUE	[ ]	[ ]	[ ]	[ ]	[ ]	Points for UNCUED recall only
Optional	Category cue						
	Multiple choice cue						

__/5

ORIENTATION [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City __/6

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www.mocatest.org

Normal ≥ 26/ 30

TOTAL __/30
Add 1 point if ≤ 12 yr edu

Montreal Cognitive Assessment
(MoCA)

Administration and Scoring Instructions

The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

1. **Alternating Trail Making:**

Administration: The examiner instructs the subject: *"Please draw a line, going from a number to a letter in ascending order. Begin here* [point to (1)] *and draw a line from 1 then to A then to 2 and so on. End here* [point to (E)]."

Scoring: Allocate one point if the subject successfully draws the following pattern: 1 –A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

2. **Visuoconstructional Skills (Cube):**

Administration: The examiner gives the following instructions, pointing to the **cube**: *"Copy this drawing as accurately as you can, in the space below".*

Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional
- All lines are drawn
- No line is added
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met.

3. **Visuoconstructional Skills (Clock):**

Administration: Indicate the right third of the space and give the following instructions: *"Draw a clock. Put in all the numbers and set the time to 10 after 11".*

Scoring: One point is allocated for each of the following three criteria:

- Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
- Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
- Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centred within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met.

4. **Naming:**

Administration: Beginning on the left, point to each figure and say: *"Tell me the name of this animal".*

Scoring: One point each is given for the following responses: (1) camel or dromedary, (2) lion, (3) rhinoceros or rhino.

5. **Memory:**

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: *"This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them".* Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: *"I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time."* Put a check in the allocated space for each word the subject recalls after the second trial.

At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, *"I will ask you to recall those words again at the end of the test."*

Scoring: No points are given for Trials One and Two.

6. **Attention:**

Forward Digit Span: Administration: Give the following instruction: *"I am going to say some numbers and when I am through, repeat them to me exactly as I said them".* Read the five number sequence at a rate of one digit per second.

Backward Digit Span: Administration: Give the following instruction: *"Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order."* Read the three number sequence at a rate of one digit per second.

Scoring: Allocate one point for each sequence correctly repeated, (*N.B.*: the correct response for the backwards trial is 2-4-7).

Vigilance: Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: *"I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand".*

Scoring: Give one point if there is zero to one errors (an error is a tap on a wrong letter or a failure to tap on letter A).

Serial 7s: Administration: The examiner gives the following instruction: *"Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop."* Give this instruction twice if necessary.

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correction subtraction, 2 points for two-to-three correct subtractions, and 3 points if the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond "92 – 85 – 78 – 71 – 64" where the "92" is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

7. **Sentence repetition:**

Administration: The examiner gives the following instructions: *"I am going to read you a sentence. Repeat it after me, exactly as I say it* [pause]: *I only know that John is the one to help today."* Following the response, say: *"Now I am going to read you another sentence. Repeat it after me, exactly as I say it* [pause]: *The cat always hid under the couch when dogs were in the room."*

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

8. **Verbal fluency:**

Administration: The examiner gives the following instruction: *"Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready?* [Pause] *Now, tell me as many words as you can think of that begin with the letter F.* [time for 60 sec]. *Stop."*

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins.

9. **Abstraction:**

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: *"Tell me how an orange and a banana are alike"*. If the subject answers in a concrete manner, then say only one additional time: *"Tell me another way in which those items are alike"*. If the subject does not give the appropriate response (*fruit*), say, *"Yes, and they are also both fruit."* Do not give any additional instructions or clarification.

After the practice trial, say: *"Now, tell me how a train and a bicycle are alike"*. Following the response, administer the second trial, saying: *"Now tell me how a ruler and a watch are alike"*. Do not give any additional instructions or prompts.

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered. The following responses are acceptable:

Train-bicycle = means of transportation, means of travelling, you take trips in both;
Ruler-watch = measuring instruments, used to measure.

The following responses are **not** acceptable: Train-bicycle = they have wheels; Ruler-watch = they have numbers.

10. Delayed recall:

Administration: The examiner gives the following instruction: "*I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember.* Make a check mark (✓) for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Scoring: **Allocate 1 point for each word recalled freely without any cues.**

Optional:

Following the delayed free recall trial, prompt the subject with the semantic category cue provided below for any word not recalled. Make a check mark (✓) in the allocated space if the subject remembered the word with the help of a category or multiple-choice cue. Prompt all non-recalled words in this manner. If the subject does not recall the word after the category cue, give him/her a multiple choice trial, using the following example instruction, "*Which of the following words do you think it was, NOSE, FACE, or HAND?*"

Use the following category and/or multiple-choice cues for each word, when appropriate:

FACE:	category cue: part of the body	multiple choice: nose, face, hand
VELVET:	category cue: type of fabric	multiple choice: denim, cotton, velvet
CHURCH:	category cue: type of building	multiple choice: church, school, hospital
DAISY:	category cue: type of flower	multiple choice: rose, daisy, tulip
RED:	category cue: a colour	multiple choice: red, blue, green

Scoring: **No points are allocated for words recalled with a cue.** A cue is used for clinical information purposes only and can give the test interpreter additional information about the type of memory disorder. For memory deficits due to retrieval failures, performance can be improved with a cue. For memory deficits due to encoding failures, performance does not improve with a cue.

11. Orientation:

Administration: The examiner gives the following instructions: "*Tell me the date today*". If the subject does not give a complete answer, then prompt accordingly by saying: "*Tell me the [year, month, exact date, and day of the week].*" Then say: "*Now, tell me the name of this place, and which city it is in.*"

Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

TOTAL SCORE: Sum all subscores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

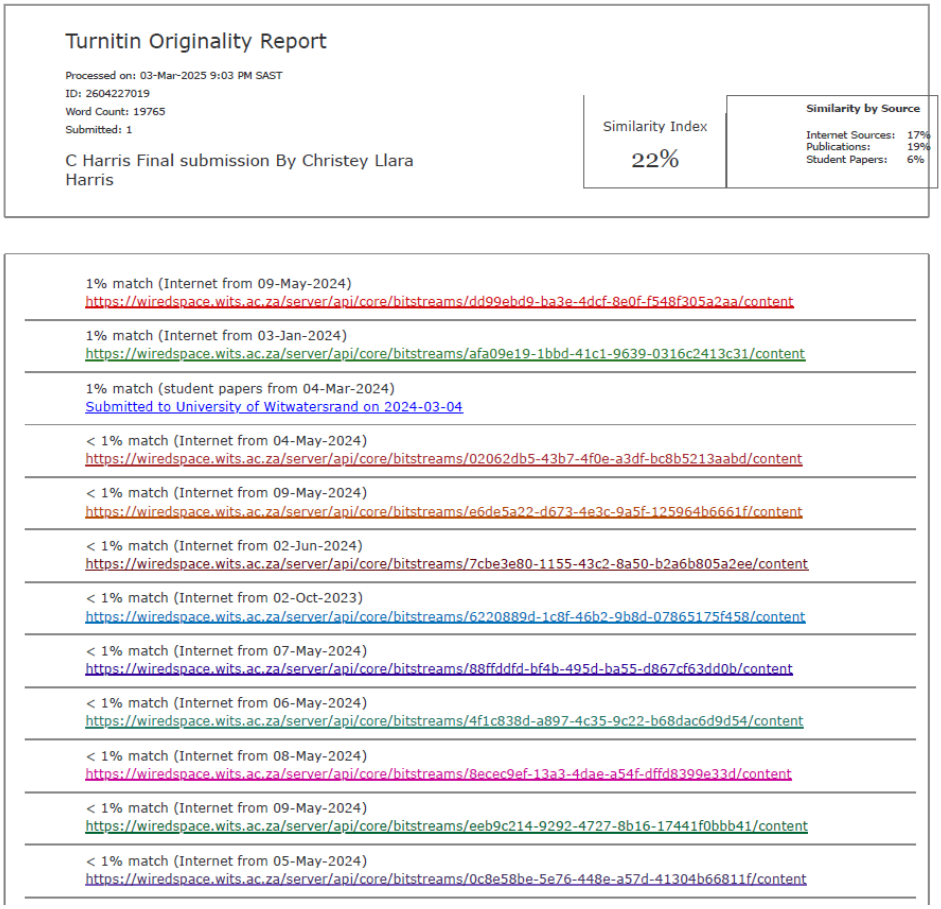
Appendix K: Copy of the ICF Core Set for Stroke

COMPREHENSIVE ICF CORE SET for STROKE

BODY FUNCTIONS = physiological functions of body systems (including psychological functions)	
b110	**Consciousness functions**
	General mental functions of the state of awareness and alertness, including the clarity and continuity of the wakeful state. *Inclusions: functions of the state, continuity and quality of consciousness; loss of consciousness, coma, vegetative states, fugues, trance states, possession states, drug-induced altered consciousness, delirium, stupor* *Exclusions: orientation functions (b114); energy and drive functions (b130); sleep functions (b134)*
b114	**Orientation functions**
	General mental functions of knowing and ascertaining one's relation to self, to others, to time and to one's surroundings. *Inclusions: functions of orientation to time, place and person; orientation to self and others; disorientation to time, place and person* *Exclusions: consciousness functions (b110); attention functions (b140); memory functions (b144)*
b117	**Intellectual functions**
	General mental functions, required to understand and constructively integrate the various mental functions, including all cognitive functions and their development over the life span. *Inclusions: functions of intellectual growth; intellectual retardation, mental retardation, dementia* *Exclusions: memory functions (b144); thought functions (b160); higher-level cognitive functions (b164)*
b126	**Temperament and personality functions**
	General mental functions of constitutional disposition of the individual to react in a particular way to situations, including the set of mental characteristics that makes the individual distinct from others. *Inclusions: functions of extraversion, introversion, agreeableness, conscientiousness, psychic and emotional stability, and openness to experience; optimism; novelty seeking; confidence; trustworthiness* *Exclusions: intellectual functions (b117); energy and drive functions (b130); psychomotor functions (b147); emotional functions (b152)*
b130	**Energy and drive functions**
	General mental functions of physiological and psychological mechanisms that cause the individual to move towards satisfying specific needs and general goals in a persistent manner. *Inclusions: functions of energy level, motivation, appetite, craving (including craving for substances that can be abused), and impulse control* *Exclusions: consciousness functions (b110); temperament and personality functions (b126); sleep functions (b134); psychomotor functions (b147); emotional functions (b152)*
b134	**Sleep functions**
	General mental functions of periodic, reversible and selective physical and mental disengagement from one's immediate environment accompanied by characteristic physiological changes. *Inclusions: functions of amount of sleeping, and onset, maintenance and quality of sleep; functions involving the sleep cycle, such as in insomnia, hypersomnia and narcolepsy* *Exclusions: consciousness functions (b110); energy and drive functions (b130); attention functions (b140); psychomotor functions (b147)*
b140	**Attention functions**
	Specific mental functions of focusing on an external stimulus or internal experience for the required period of time. *Inclusions: functions of sustaining attention, shifting attention, dividing attention, sharing attention; concentration; distractibility* *Exclusions: consciousness functions (b110); energy and drive functions (b130); sleep functions (b134); memory functions (b144); psychomotor functions (b147); perceptual functions (b156)*
b144	**Memory functions**
	Specific mental functions of registering and storing information and retrieving it as needed. *Inclusions: functions of short-term and long-term memory, immediate, recent and remote memory; memory span; retrieval of memory; remembering; functions used in recalling and learning, such as in nominal, selective and dissociative amnesia* *Exclusions: consciousness functions (b110); orientation functions (b114); intellectual functions (b117); attention functions (b140); perceptual functions (b156); thought functions (b160); higher-level cognitive functions (b164); mental functions of language (b167); calculation functions (b172)*
b152	**Emotional functions**
	Specific mental functions related to the feeling and affective components of the processes of the mind. *Inclusions: functions of appropriateness of emotion, regulation and range of emotion; affect; sadness, happiness, love, fear, anger, hate, tension, anxiety, joy, sorrow; lability of emotion; flattening of affect* *Exclusions: temperament and personality functions (b126); energy and drive functions (b130)*
b156	**Perceptual functions**
	Specific mental functions of recognizing and interpreting sensory stimuli. *Inclusions: functions of auditory, visual, olfactory, gustatory, tactile and visuospatial perception, such as a hallucination or illusion* *Exclusions: consciousness functions (b110); orientation functions (b114); attention functions (b140); memory functions (b144); mental functions of language (b167); seeing and related functions (b210-b229); hearing and vestibular functions (b230-b249); additional sensory functions (b250-b279)*

b164	Higher-level cognitive functions
	Specific mental functions especially dependent on the frontal lobes of the brain, including complex goal-directed behaviours such as decision-making, abstract thinking, planning and carrying out plans, mental flexibility, and deciding which behaviours are appropriate under what circumstances; often called executive functions. *Inclusions: functions of abstraction and organization of ideas; time management, insight and judgement; concept formation, categorization and cognitive flexibility* *Exclusions: memory functions (b144); thought functions (b160); mental functions of language (b167); calculation functions (b172)*
b167	Mental functions of language
	Specific mental functions of recognizing and using signs, symbols and other components of a language. *Inclusions: functions of reception and decryption of spoken, written or other forms of language such as sign language; functions of expression of spoken, written or other forms of language; integrative language functions, spoken and written, such as involved in receptive, expressive, Broca's, Wernicke's and conduction aphasia* *Exclusions: attention functions (b140); memory functions (b144); perceptual functions (b156); thought functions (b160); higher-level cognitive functions (b164); calculation functions (b172); mental functions of complex movements (b176); Chapter 2 Sensory Functions and Pain; Chapter 3 Voice and Speech Functions*
b172	Calculation functions
	Specific mental functions of determination, approximation and manipulation of mathematical symbols and processes. *Inclusions: functions of addition, subtraction, and other simple mathematical calculations; functions of complex mathematical operations* *Exclusions: attention functions (b140); memory functions (b144); thought functions (b160); higher-level cognitive functions (b164); mental functions of language (b167)*
b176	Mental functions of sequencing complex movements
	Specific mental functions of sequencing and coordinating complex, purposeful movements. *Inclusions: impairments such as in ideation, ideomotor, dressing, oculomotor and speech apraxia* *Exclusions: psychomotor functions (b147); higher-level cognitive functions (b164); Chapter 7 Neuromusculoskeletal and Movement-Related Functions*
b180	Experience of self and time functions
	Specific mental functions related to the awareness of one's identity, one's body, one's position in the reality of one's environment and of time. *Inclusions: functions of experience of self, body image and time*

Appendix L: Plagiarism Report



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Appendix M: Plagiarism Declaration

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Christey Harris (Student number: 1090354) am a student registered for the degree of Master of Science in Occupational Therapy in the academic year 2024/2025.

I hereby declare the following:

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

Signature:  Date: 03/03/2025

Appendix N: Protocol Submitted to Ethics

CANDIDATE'S SURNAME: [Please print]	Harris	FIRST NAME/S:	Christey Llara	STUDENT NUMBER:	1090354
CURRENT QUALIFICATIONS: BSc (OT)					
TEL:	CELL: 079 015 1157	E-MAIL: 1090354@students.wits.ac.za	FAX:		
DEGREE FOR WHICH PROTOCOL IS BEING SUBMITTED: MSc OT					
PART-TIME/FULL-TIME: Part-Time	Sex :	F	**x**	M	
DISSERTATION/RESEARCH REPORT: Research Report	% contribution towards degree				
FIRST REGISTERED FOR THIS DEGREE:	TERM : 1	YEAR: 2022			
DEPARTMENT: Occupational Therapy					
TITLE OF PROPOSED RESEARCH: Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?					
CANDIDATE'S SIGNATURE: 	DATE: 30/06/2022				
SUPERVISOR'S NAME/QUALIFICATIONS: Bhavna Bahgoo BSc OT, MSc OT	50 % Supervision				
SUPERVISOR'S DEPARTMENT: Occupational Therapy					
SUPERVISOR'S ADDRESS / TEL / E-MAIL: Wits Occupational Therapy Department, 7 York Rd., Parktown, Johannesburg, 2193./ 011 717-3701/					
SUPERVISOR'S NAME/QUALIFICATIONS Faye Jackson BSc OT, MSc OT	50 % Supervision				

SUPERVISOR'S DEPARTMENT: Occupational Therapy

SUPERVISOR'S ADDRESS / TEL / E-MAIL: Wits Occupational Therapy Department, 7 York Rd., Parktown, Johannesburg, 2193./ 011 717-3704

SYNOPSIS OF RESEARCH:

[Use reverse side of this page if more space is required]

See overleaf

WITS ETHICS NOT REQUIRED: No	(Yes)	
WITS ETHICS PENDING: No	Yes	IF Y SUPPLY ETHICS
WITS ETHICS APPROVED: No	Yes	CLEARANCE CERTIFICATE AS ATTACHMENT AND INCLUDE ETHICS NUMBER HERE:
(circle appropriate symbol)*		
***Please note the final human ethics clearance certificate or animal ethics certificate must be available prior to starting research**		

As supervisor/s, I/we confirm that I have read the protocol which has been submitted for assessment

SIGNATURE OF SUPERVISOR/S:	 …… ……	 …… ……
PROTOCOL ACCEPTED BY HEAD OF DEPARTMENT	 ……	14/07/2022 …… DATE

	SIGNATURE	
SIGNATURE PG OFFICE STAFF …… ……..	REGISTERED YES….. NO…..	STAMP

Synopsis of Research

Introduction:

Cognitive impairment following stroke, known as post-stroke cognitive impairment (PSCI), has been found to have high incidence in stroke survivors [80]. Clinical practice guidelines promote the administration of standardised screening and assessment tools with all stroke survivors to ascertain the presence and nature of PSCI [3,16]. The Montreal Cognitive Assessment (MoCA) has been identified in several studies as a clinically valid tool for screening of cognitive impairment in stroke survivors despite its original development and standardization on mild cognitive impairment and Alzheimer's disease [63,81]. However, the presence of impairments such as hemiparesis and aphasia have posed challenges to successfully administering this screening tool with the stroke population [8]. Cultural and language-based challenges also require careful consideration when administering the MoCA.

Justification

The stroke survivor population has been described as having relatively high incidence of moderate and severe post-stroke impairments including physical, speech and cognitive impairments [23]. This, coupled with the extensive cultural and language diversity in the South African population could contest the use of the MoCA as a screening tool for PSCI in the South African stroke population; especially those with moderate to severe impairment.

This research will explore the appropriateness of the MoCA as a cognitive screening tool, used by occupational therapists with the South African stroke survivor population, which will contribute to exploration of more contextually relevant practice in future research.

Aims:

To determine whether the Montreal Cognitive Assessment (MoCA) is an appropriate screening tool for cognitive impairment in moderate to severely impaired stroke survivors in South Africa.

Methodology:

This study will make use of a quantitative, descriptive, cross-sectional design. A survey methodology will be employed; using expert occupational therapists to use the Content Validity Index Method to determine the validity of the MoCA as a tool for screening cognitive impairment in moderate and severely impaired stroke survivors. The Comprehensive ICF Core Set for Stroke will be used as a tool to guide the expert occupational therapy experts in considering cognitive skills commonly affected in moderate and severe stroke.

Expected Outcomes:

It is expected that the panel of expert occupational therapists will find that sections of the MoCA will have limited appropriateness for the cultural and language diversity, as well as the stroke impairment severity profile of the South African stroke survivor population.

Contents

Background and need for the study

Introduction and Literature Review

The global and national burden of stroke

The World Health Organization (WHO) published that stroke ranks second and third in the leading causes of mortality and morbidity globally, also acknowledging it as a principal cause of depression and dementia [1]. In South Africa, cerebral infarction and other cerebrovascular disease accounted for approximately 22 259 deaths in 2017 [20]. The Stroke Survivor Foundation expanded on the stroke statistics, reporting that approximately 240 South Africans suffer strokes daily, with 70 of these strokes being fatal. This means that approximately 140 individuals survive the stroke incident and are often left with some impairment. [21]. It has been reported that approximately 40% of stroke survivors suffer moderate impairments, while a further 15-30% are left to suffer consequent severe impairment [22,23].

The severity of post stroke impairment

Distinguishing between mild, moderate and severe stroke impairment is commonly performed through quantitative scores on impairment scales, rather than by specific symptoms. One could use the brief descriptions on the ICF checklist to describe the severity of an impairment in body functions. However, other descriptions are available. McGlinchey et al. (2020) described severe stroke as encompassing a multitude of neurological impairments, which cause a loss of function and residual disability. These impairments have a slow, and often poor response to rehabilitation, leaving these individuals with high levels of dependency [38]. Outside of the impairment rating scales, specific impairments and dysfunction of moderate impairment appear ill-defined, and inconsistent.

Post-Stroke Cognitive Impairment

Physical and functional deficits are more easily observable and are often placed at the forefront of rehabilitation intervention programs [42]. An estimated 20 to 80% of stroke survivors experience cognitive impairment, often termed post-stroke cognitive impairment (PSCI) [41,79,80]. These impairments in cognitive skills have the potential to reduce the ability of a stroke survivor to successfully engage in rehabilitation, reduce their potential to achieve greater levels of functional independence, as well as negatively impact their overall quality of life [41,42]. This evidence leads one to deduce that insufficiently-addressed PSCI will have a negative impact on a stroke survivor's functional prognosis.

Effectively addressing PSCI in practice requires an understanding of what constitutes this phenomenon. PSCI is reported to exist on a continuum extending from mild cognitive impairment (MCI) to post-stroke dementia (PSD) [16]. In occupational therapy literature, PSCI is defined as alterations to cognitive or behavioural abilities which succeed the emergence of cerebrovascular conditions, such as stroke. It is characterised by impairments in at least one

cognitive domain [16]. Areas of cognitive functioning commonly affected in PSCI include attention, information processing, executive functioning, working memory, memory and learning [16]. Mijajlović et al. (2017). The International Classification of Functioning (ICF) has expanded on what is included in cognitive functioning or dysfunction. When the Comprehensive ICF Core Set for Stroke was published, cognitive skills or what the ICF terms as “mental functions” includes cognitive skills, as well as perceptual, emotional and language functions [47]. Therefore, post-stroke cognitive impairment, or impairments in “mental functions” following stroke will be inclusive of cognitive, perceptual, emotional and language skills.

The Montreal Cognitive Assessment (MoCA) as a screening for PSCI

Several clinical practice guidelines for stroke rehabilitation recommend screening and assessment for PSCI in all stroke survivors using standardized tools and batteries [3,16]. The Montreal Cognitive Assessment (MoCA) is a screening tool which is often recommended and utilized to evaluate the presence of PSCI symptoms.

The MoCA was originally developed and standardized for individuals with mild cognitive impairment and Alzheimer's Disease; and can be administered by any clinician, health care practitioner, researcher or worker who has undergone formal training and certification for administering, scoring and interpreting the MoCA [81]. It is now frequently used by occupational therapists to screen for cognitive impairment in stroke survivors which may impact on performance of occupations such as activities of daily living (ADLs), work or driving [63]. Studies have found the MoCA to demonstrate superior sensitivity to vascular-related cognitive changes when compared with other screening tools such as the Mini Mental Status Exam [64]. However, the test design can pose barriers to its use with stroke survivors with impairments such as aphasia or other speech-related impairments, hemiplegia and hemiparesis, and visual neglect syndromes [8]. The greater the severity of these symptoms, the more likely it will be that performance on a screening tool, such as the MoCA, will be negatively affected. The negative effects on performance resulting from stroke-specific symptoms can be further compounded by education levels and lack of understanding of instructions due to language barriers. Thus, careful consideration should be employed when selecting the MoCA for screening in stroke survivors, especially in countries considered part of the global South.

Problem statement

The MoCA is a frequently recommended and utilised screening tool for detecting post-stroke cognitive impairment in the South African stroke survivor population [3]. A systematic review published in 2017 found there to be great variability in the accuracy of the MoCA in detecting cognitive impairments, especially in non-western countries [17]. Furthermore, many studies

exploring the MoCA validity in these countries looks at non-stroke related conditions, or examines the validity of the MoCA in mild stroke [17,82].

There is limited research exploring the impact of impairments associated with moderate-to-severe stroke on the accuracy of the MoCA.

Research question

Is the Montreal Cognitive Assessment (MoCA) a valid tool for screening cognitive impairment in moderate to severely impaired stroke survivors in South Africa?

Aim of the study

The aim of the study is to determine whether the Montreal Cognitive Assessment (MoCA) is a valid tool for screening cognitive impairment in moderate to severely impaired stroke survivors in South Africa.

Objectives of the study

The objectives of the study are to:

- To explore cognitive client factors and performance skills which are commonly affected in moderate to severely impaired South African stroke survivors.
- To explore the validity of the MoCA for use with moderate to severely-impaired stroke survivors in South Africa using the Content Validity Index Method.
- To explore whether there is a match between common cognitive impairments in moderate to severely impaired stroke survivors, and the cognitive skills assessed by the MoCA.

Significance of the study

The MoCA is cognitive screening tool that is widely recommended and utilized by occupational therapists with the stroke survivor population. The South African-Contextualized Stroke Rehabilitation Guideline references the MoCA as a tool to be included for use in the comprehensive assessment of the South African stroke survivor population. However, there is limited research to support the accuracy of the use of the MoCA in culturally, and socio-economically diverse contexts [17]; and in stroke survivor populations with more significant impairments [82].

The South African stroke survivor population includes a relatively high incidence of moderate to severely impaired stroke survivors who have a greater tendency to present with more

severe stroke-related impairments [18,82]. Low levels of education, cultural and language diversity may also reduce the appropriateness of the MoCA for the South African stroke survivor population [83]. These stroke-related factors and context-related factors, in isolation or in conjunction with one another, pose challenges to be able to administer the MoCA to these patients, and these patients' ability to complete the tasks required in these tests [82].

This study serves as the first step towards determining the validity of the MoCA for use with the South African stroke population. It is the goal of this research to help prompt clinicians' clinical reasoning around selecting standardized outcome measures to ascertain the presence of post-stroke cognitive impairments; so that patients are not disadvantaged by the intrinsic properties of the test, and the interaction with the contextual and stroke-related factors inherent for the patient.

Methodology

Study design/Type of research

This research study will utilise a quantitative descriptive, cross-sectional design. This type of study design is a non-experimental study, whose results are reported as descriptive statistics. This type of study is often used for identify problems with or justify current practice [84]. This matches the purpose of this research study.

Quantitative data will be performed through a self-administered, online survey completed by occupational therapy experts trained in the MoCA and working with stroke survivor population. The survey will consist of 3 sections exploring: 1) the "mental functions" component of Comprehensive ICF Core Set for Stroke, 2) the validity of the MoCA using the Content Validity Index Method (CVI), and 3) The match between the Comprehensive ICF Core Set for Stroke and the MoCA. The types of questions in this study include "yes-no" questions, with space for explanation; as well as some Likert-scale questions. The section using the CVI makes use of 4-point Likert scales, as described in [75].

Research context

This research project is set within the South African health care context, spanning both the public and private healthcare sectors, as well as all settings and phases of occupational therapy stroke rehabilitation in South Africa.

Research population/participants

The population to be used for this research study is occupational therapists in the public or private sectors, at any level of care, who are considered experts in this field of practice. An 'expert occupational therapist has been defined in several ways in occupational therapy

literature. Holmqvist, Holmefur & Ivarsson (2013) defined an expert occupational therapist as an occupational therapist actively practicing in the field of interest of the study, with a minimum of 5 years of clinical experience working with the population of interest [66]. This study requires information from practicing clinicians, using the MoCA with stroke survivors. As such, the definition of an expert occupational therapist described above may limit the information collected. This study will define an expert occupational therapist as *a qualified occupational therapist trained in the administration, scoring and interpretation of the MoCA, actively working with the South African stroke survivor population.*

Sample and sample size

Total population sampling will be used for this research study. This sampling method falls under purposive sampling. In this type of purposive sampling, the total population demonstrating a specific set of attributes or features (i.e., all of the population) is examined in the study [67].

In order to calculate the estimated sample size required for this study, an estimation of the population of occupational therapists working in the field of adult neurorehabilitation was made. 5876 occupational therapists were registered with the HPCSA in 2021 (Health Professions Council of South Africa 2021). We have estimated that one third of this population, or 1958 occupational therapists, work in the field of neurorehabilitation in the South African setting. Furthermore, it is likely that the population of expert occupational therapists (as described under “Research Population/Participants”) is even smaller than the estimated population size of 1958. This relatively smaller population makes this research study suitable for employing total population sampling [67].

Inclusion and Exclusion Criteria

The inclusion criteria for this study are as follows:

(Please refer back to the definition of an expert occupational therapist for this study: an *occupational therapist actively working with the South African stroke survivor population at any stage of the rehabilitation process; with at least 5 years of working experience post-community service)*

- Qualified occupational therapists (Expert Occupational Therapists)
    - Actively working with stroke survivors
    - In either the public or private sector, at any phase of the stroke rehabilitation process.
    - Who have completed their community service year
    - with completed formal training and certification for using the MoCA in practice.

- Can be involved in only assessment-related procedures (example; occupational therapists conducting functional capacity evaluations)

The following exclusion criteria have been adopted for this research study:

- Qualified occupational therapists who are not certified in the administration, scoring and interpretation of the MoCA.
- Qualified occupational therapists who are certified in the administration, scoring and interpretation of the MoCA; but are not actively working in the field of stroke rehabilitation.

Data collection methods and procedure

Data collection will commence following approved corrections suggested by the Human Research Ethics Committee (HREC). Prior to commencing data collection, permission for use of the use of the MoCA in this study will be requested with the approval from the HREC. A pilot study will be conducted to establish validity for the survey questionnaire.

Data will be collected via a single survey hosted on REDcap. This survey will consist of 3 sections, as follows: 1) the Comprehensive ICF Core Set for stroke with focus on the "mental functions" section, 2) the validity of each section of the MoCA using the CVI method, and 3) the match between the cognitive skills discussed in the Comprehensive ICF Core Set for Stroke and the cognitive skills assessed by the MoCA.

The link for the survey, and the accompanying demographic questionnaire, information sheet and consent form will be distributed via OTASA, RURESA and SANDTA. These organisations often include members who are occupational therapists interested in the field of neurological rehabilitation. The survey will also be distributed to occupational therapists working with stroke survivor groups or organisations. A first reminder for survey completion will be sent out 1 month after the initial distribution, and a second reminder will be sent 1 month thereafter. Snowballing sampling will be initiated following the first reminder for survey completion, through distribution of the survey link, and accompanying information sheet, demographic questionnaire and consent forms via various networking platforms for occupational therapists. Data collection will be finalised 1 month after the second reminder was distributed.

Pilot study

A pilot study will be conducted with a small group, of 3 to 5 participants. It is necessary to pilot the survey to be used to determine the validity of the questions included; as this is a non-standardised survey. This pilot study will be conducted with members of the academic staff from the Department of Occupational Therapy at the University of the Witwatersrand.

(Refer to appendix G for survey)

Analysis and interpretation

Data analysis will be conducted through the use of descriptive statistics and the CVI method.

Demographic data will be represented using frequency proportions to demonstrate the characteristics of the expert occupational therapists. Descriptive statistics will also be used to demonstrate relative frequency of participant responses for sections 1 and 3 of the survey.

Section 2 of the survey will be analysed using the CVI. This will be preceded by recoding of the relevance for each item; with a score of 1 allocated to items scored originally as a 3 or 4, and a 0 is allocated to items originally scored as a 1 or 2 [69,85].

Item-level CVI is used to determine the validity of each item, by adding together the number of experts who originally rated the items as 3 or 4, and then dividing this by the total number of experts. This demonstrates the portion of the agreement between experts on the validity of the item [69,85].

Mean item/ Average level CVI will be calculated by adding the item-CVIs and then dividing it by the number of items. This is the same as the scale level CVI based on the average method [69,85].

Scale level CVI will be calculated to demonstrate the overall validity of the MoCA to screen for post-stroke cognitive impairment. This will be done using the universal agreement method, where the sum of the universally agreed upon items (items with a score of 1) is divided by the total number of items [69,85].

Data management

All data generated from the surveys will be stored on REDcap under a password protected profile, accessible to only the researcher and the two research supervisors. A second copy of the survey responses will be backed up onto an access-controlled server provided by the university. This will ensure safety of the data, while also maintaining anonymity and confidentiality of the study participants.

Survey responses will be stored for 2 years on Redcap if no publication is released, or for 6 years following publication.

Ethical considerations

Autonomy refers to the right of an individual to make their own decisions; and can relate to participation and non-participation [72]. Surveys will be distributed to as many relevant occupational therapists as possible via professional organizations, as well as through snowball sampling. An informed consent and information sheet will be attached with the survey, providing practitioners with the pertinent information to guide their decision as to whether or not to participate in the study, and that their response can be withdrawn from the study at any time without consequence. Only surveys with completed consent forms will be included as part of the study.

The research survey will be distributed to relevant occupational therapy practitioners by three organisations of which occupational therapists are members. This way, the researcher does not have access to the participants personal or identifying information. Furthermore, neither the survey itself, nor the demographic questionnaire require participants to provide information from which their identity can be deduced. These steps will assist in maintaining participant confidentiality and anonymity.

Beneficence is the ethical principle which explains that participants should either have some benefit from the research study, or the risk-benefit ratio should be balanced [72]. This study does not provide participants with any direct benefits for their participation. However, it provides an opportunity for participants to contribute to growing the body of knowledge in their field, which could contribute to furthering the development of evidence-based practice in their field of interest.

Non-maleficence refers to the notion of “do no harm”, which, in part, encompasses avoidance of offending others through research or practice and avoiding harm to participants[72]. In this research project, participants are not in a position where they can be harmed. However, careful consideration of the phrasing of the survey questions was crucial in ensuring no offense or judgment to the study participants.

Time frame of the project

	Aug 2022	Sep 2022	Nov-Dec 2022	Jan 2023	Feb - Apr 2023	May 2023	Jun 2023	July 2023	Aug 2023	Sep 2023	Oct – Nov 2023
Assessors meeting	17/8/ 2022										
Corrections and submit for ethics		7/09/ 2022									
Corrections from HREC											
Pilot study and corrections											
Data collection											
Write up: Literature review and methodology											
Data analysis											
Results											
Discussion and conclusion											
Final article draft											

Budget

Item/task	**Cost per unit**	**Total cost for task**
OTASA distribution fee	R600.00	R600.00

RURESA distribution fee	R0.00	R0.00
SANDTA distribution fee	R0.00	R0.00
MoCA training course	Free for students R0.00	R0.00
Statistics consultation costs (With biostatisticians available at Wits)	R0.00	R0.00
Total	R600.00	R600.00

Funding will be required to cover the cost of the OTASA distribution fee. Training on the Montreal Cognitive Assessment (MoCA) is needed to ensure the researcher is appropriately qualified to develop a survey and have insight into understanding participant responses. The researcher will apply for funding through the Faculty Research Grant (FRG).

Dissemination and Translation

Dissemination of Research

Wilson et al. (2010) defines dissemination as follows “a planned process that involves consideration of target audiences and the settings in which research findings are to be received and, where appropriate, communicating and interacting with wider policy and health service audiences in ways that will facilitate research uptake in decision-making processes and practice” (p. 2).

The primary means of dissemination for this research would be through being able to publish a research article in a journal which is accessible for the South African occupational therapy community, as well as other rehabilitative services. A secondary means is to distribute this article via the three organizations who assisted in distributing the research survey during data collection; namely OTASA, RURESA and SANDTA. These methods will allow for accessibility of the research and its findings to both the occupational therapy community in South Africa; as well as the rehabilitation community (physiotherapists, speech therapists and other health care professionals) who serve the South African stroke survivor community.

Translation of Research

Translation of research was discussed by Lynch et al. (2018) as being the process of adaptation of research results and findings, so that they can be applied in a different setting or with a different group of participants [87]. Research translation can also be described as the means of addressing the gap between information and practice, so that there is potential for research to have a real-world impact [88].

This study serves to determine the validity of the MoCA as a tool for occupational therapists to use to tscreen for cognitive impairments moderate to severely impaired stroke survivors in South Africa. The translation of this research will thus be focused on taking the results of the study, and disseminating them to as many practitioners and organizations as possible to contribute to the current guidelines for screening and assessment of the South African stroke survivor population. The current stroke rehabilitation guidelines for the South African context published by Tshivhase (2019) have drawn from international recommendations and research which may not necessarily be relevant to the challenges experienced by South African stroke survivors or the health care professionals who treat them. It is the hope that the results of this research will serve to help inform occupational therapy practice, and guide clinical reasoning in South African occupational therapists when selecting an appropriate tool for screening cognitive impairment in the South African stroke survivor population.

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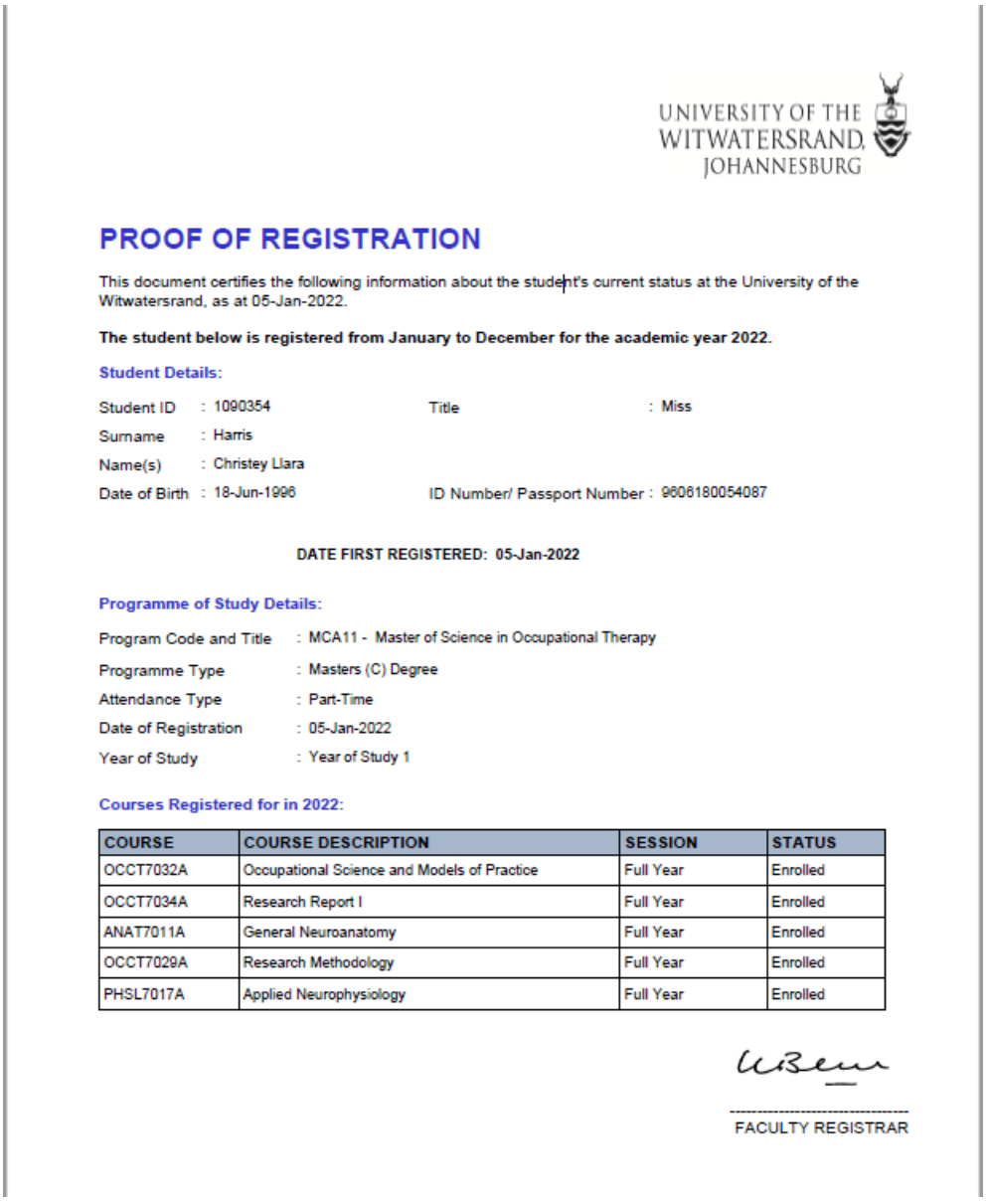
APPENDICES

APPENDIX A: PROOF OF REGISTRATION



UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

PROOF OF REGISTRATION

This document certifies the following information about the student's current status at the University of the Witwatersrand, as at 05-Jan-2022.

The student below is registered from January to December for the academic year 2022.

Student Details:

Student ID : 1090354
Title : Miss
Surname : Harris
Name(s) : Christey Llara
Date of Birth : 18-Jun-1996
ID Number/ Passport Number : 9606180054087

DATE FIRST REGISTERED: 05-Jan-2022

Programme of Study Details:

Program Code and Title : MCA11 - Master of Science in Occupational Therapy
Programme Type : Masters (C) Degree
Attendance Type : Part-Time
Date of Registration : 05-Jan-2022
Year of Study : Year of Study 1

Courses Registered for in 2022:

COURSE	COURSE DESCRIPTION	SESSION	STATUS
OCCT7032A	Occupational Science and Models of Practice	Full Year	Enrolled
OCCT7034A	Research Report I	Full Year	Enrolled
ANAT7011A	General Neuroanatomy	Full Year	Enrolled
OCCT7029A	Research Methodology	Full Year	Enrolled
PHSL7017A	Applied Neurophysiology	Full Year	Enrolled

FACULTY REGISTRAR

APPENDIX B: APPOINTMENT OF SUPERVISOR

RECOMMENDATION FOR APPOINTMENT OF SUPERVISOR(S) OF RESEARCH REPORT, DISSERTATION OR THESIS

Motivation / Reason for Appointment:
Both the supervisors are experienced in stroke research and will be able to guide the student to a successful study.

Recommendation of Division / Department / School:
Both supervisors are recommended to assist this student.

Student Surname and Full name(s)	Harris, Christey Llara
Student number	1090354
Degree	MSc(OT)
Div / Dept / School	Department of Occupational Therapy
Title	Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?

(Supervisor 1): Faye Jackson
(Name &Surname)
Supervision %: 50_____

Supervisor Qualifications: _MSc OT_____

Supervisor Department: __Occupational therapy _____

Supervisor Telephone: _0117173704_____ E-mail: faye.jackson@wits.ac.za

Supervisor 2: __Bhavna Bahgoo

Supervision %: 50

Supervisor Qualifications: MSc OT

Supervisor Department: _Occupational Therapy

Supervisor Telephone: _011 717 3272 E-mail: Bhavna.Bahgoo@wits.ac.za

Student Signature:

Supervisor 1 Signature: ___ _____

Supervisor 2 Signature: _____  _____

RECOMMENDATION BY HEAD OF DIVISION / DEPARTMENT / SCHOOL:

__Dr. Janine van der Linde_____ _____ __14/07/2022_____
(Full name(s) and Surname) (Sign) (Date)

APPROVAL BY CHAIR OF ASSESSOR GROUP:
(On behalf of the FGSC)

_____ _____
_____
(Full name(s) and Surname) (Sign) (Date)

PLEASE NOTE: RECOMMENDATION FOR APPOINTMENT OF SUPERVISOR(S) FOR CIRCULATION TO THE FGSC FOR APPROVAL

APPENDIX C: MEMORANDUM OF AGREEMENT

Statement of principles for postgraduate supervision

In a context of academic freedom and within a framework of individual autonomy and the pursuit of knowledge, this statement is written in the belief that there is a reciprocal relationship and mutual accountability between supervisor and student

THE SUPERVISOR AND THE STUDENT:

1. Will establish agreed roles and clear processes to be maintained by both parties. In the case of joint supervision, the roles and responsibilities of each supervisor and the student need to be clarified.
2. Will meet regularly and as frequently as is reasonable to ensure steady progress towards the completion of the proposal, research report, dissertation or thesis. This time varies but the normal minimum requirement for face-to-face contact spread across each year of registration is: 10 contact hours for an Honours project, 15 contact hours for a Masters by coursework and research report and 24 contact hours for a Masters by dissertation and a PhD.
3. Will keep appointments, be punctual and respond timeously to messages.
4. Will keep one another informed of any planned vacations or absences as well as changes in his or her personal circumstances that might impact on the work schedule. Unplanned absences or delays should be discussed as soon as possible and arrangements should be made, to catch up lost time.
5. Will ensure that research on animal or human subjects is conducted with prior approval and according to the procedures and the requirements of the relevant Ethics committee.
6. Will both complete Progress Reports on the research project as required/requested by the relevant Faculty Graduate Studies Committee.

THE SUPERVISOR:

1. Undertakes to provide guidance for the student's research project in relation to the design and scope of the project, the relevant literature and information sources, research methods and techniques and methods of data analysis.
2. Will provide guidance at the commensurate NQF level requirements for autonomy and accountability that the student is expected to demonstrate.
3. Has a responsibility to be reasonably accessible to the students.
4. Will be prepared for meetings with the student. This includes being up-to-date on the latest work in his/her area of expertise.
5. Will expect written work as jointly agreed, and will return that work with constructive criticism within a timeframe (a suggestion of 2-4 weeks) jointly agreed at the outset of the research.
6. Will provide advice that can help the student to improve his/her writing. This may include referrals for language training and academic writing. The supervisor will provide guidance on technical aspects of

THE STUDENT:

1. Takes full responsibility for the research and its successful completion; including managing the process under the guidance of supervisor (s).
2. Will attend such courses and lectures that are compulsory for the degree, and undertakes to catch up fully on any work, lectures and/or assignments, that are missed.
3. Undertakes to work independently under the guidance of the supervisor(s). This includes reading widely and critically to ensure that the seminal **and** current literature pertinent to his/her chosen topic has been identified, consulted and critiqued.
4. Undertakes to work in accordance with the academic standards expected by the University for the commensurate NQF level of qualification.
5. Is obliged to make appointments to consult the supervisor(s) and arrange meeting times convenient to both parties well in advance.
6. Should submit written work for discussion with the supervisor(s) well in advance of a scheduled meeting. The kind and frequency of written work

We confirm that we have read and understood this statement and agree to be guided by its principles for as long as we continue to work together.

Name of student: Christey Harris

Student Number: 1090354

Student's signature:

writing such as referencing as well as on discipline specific requirements. Detailed correction of drafts and instruction in aspects of language and style are **not** the responsibility of the supervisor. 7. Will guide the student in the production of a research report, dissertation or thesis. Provision should be allowed for adequate, mutually respectful, discussion around recommendations made. 8. Will assist with the construction of a written time schedule, which outlines the expected completion dates of successive stages of the work. 9. Will encourage the student to present work at postgraduate/ staff seminars/national/international conferences as appropriate. 10. Will assist with the publication of research articles as appropriate. 11. Will discuss the ownership of research conducted by the student in accordance with the University rules on intellectual property, copyright, **guidelines on authorship/co-authorship**, and **policy on research integrity.** 12. Will ensure that the student is aware of the University's Plagiarism Policy, knows what plagiarism is, and what the consequences are for academic dishonesty and violation of research integrity and intellectual property. 13. Will ensure that the student is made aware in writing of the inadequacy of progress and/or of any work where the standard is below par. Acceptability will be according to criteria previously supplied to the student. 14. Has a duty to refuse to allow the submission of sub-standard work for examination, regardless of the circumstances. If the student chooses to submit without the consent of the supervisor, then this should be clearly recorded and the appropriate procedures followed.	should be agreed with the supervisor(s) at the outset of the research. 7. Written work that is submitted to the supervisor, including final submissions to examiners, should be relatively free from basic spelling mistakes, incorrect punctuation and grammatical errors. Responsibility for the accuracy of language, the overall structure and coherence of the final research report, dissertation or thesis rests with the student. 8. Cannot expect the supervisor to be proof-reader and editor of his/her work or to approve work with any of the weaknesses spelt out in **7** above. 9. Undertakes to heed the advice given by the supervisor(s) and to engage in discussion around suggestions made. Ultimately the student has to take responsibility for the quality, integrity and presentation of the work. 10. Should strive to maintain a focus on his/her research area and to work diligently within the agreed time schedule. 11. Agrees to honour agreements about ownership of the research and in accordance with the University's guidelines and rules in relation to co-authorship, copyright and intellectual property. 12. Will ensure that the work contains no instances of plagiarism, violation of intellectual property and research integrity standards, that all citations are properly referenced, and that the list of references is accurate, complete and consistent. 13. Agrees to work in accordance with the criteria of acceptability as supplied by the supervisor(s). 14. Undertakes not to place the supervisor(s) under undue pressure to submit work for examination until the supervisor is satisfied that it has reached an acceptable, **examinable*** level of quality.	Name of Supervisor: Faye Jackson Supervisor's signature:  Name of Co-Supervisor: Bhavna Bahgoo Co-Supervisor's signature:  The broad area of study is: Screening and Assessment of Post Stroke Cognitive Impairment in South African Stroke Survivors Provisional submission date is: 19/07/2022 Degree: MSc(OT) School: Therapeutic Sciences Faculty: Health Sciences Date:18/07/2022 **Specific agreements pertaining to:** ownership, joint publication, funding, confidentiality and disclosures pertinent to the Certificate of Clearance and ETD Form which the student and/or supervisor

		are required to sign, must be attached to this agreement as and when appropriate and kept in the Faculty Office. In the event of disagreements between the supervisor(s) and student, the parties should act in accordance with the University Grievance Policy. *__Note: Consent by supervisor__(s) to submit work for examination does NOT guarantee that the work will pass. The appointed examiners assess and determine whether the work is of a passable standard.

APPENDIX D: STUDY INFORMATION SHEET

STUDY INFORMATION DOCUMENT

Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?

Principal Researcher: Christey Harris

Contact Details: Cell: 079 015 1157

Email: 1090354@students.wits.ac.za

Good day

My name is Christey Harris. I am a Masters degree student currently enrolled at University of the Witwatersrand in the School of Occupational Therapy. I am conducting research as part of the requirements to qualify for a Masters Degree in Occupational Therapy. This information document has been provided to inform you of the research study I am undertaking. Research is a process used in seeking new knowledge. In this study we want to gather information on occupational therapists' perceptions and views on the use of the Montreal Cognitive Assessment with the South African stroke survivor population.

The study will be conducted throughout South Africa with occupational therapists working in the field of neurological rehabilitation, more particularly those working with stroke. This study

consists of a self-administered survey comprised of 3 sections which explore 1) the Comprehensive ICF Core Set for stroke, 2) the validity of the MoCA as a tool for screening cognitive impairment in stroke, and 3) the match between the cognitive skills included in the Comprehensive ICF Core Set for stroke, and the MoCA. This research study aims to help grow the body of knowledge for occupational therapy practice with the South African stroke survivor; and guide occupational therapists' clinical reasoning when deciding on screening and assessment procedures for cognitive impairments in this population.

I would like to invite you to participate in this research, by giving your consent to be a participant by completing the survey. Completing the survey should take between 20 and 30 minutes of your time. You will be eligible to participate in this study if you meet the following inclusion criteria:

Qualified occupational therapists (Expert Occupational Therapists)

- Actively working with stroke survivors
- In either the public or private sector, at any phase of the stroke rehabilitation process.
- Who have completed their community service year
- With completed formal training and certification for using the MoCA in practice.
- Can be involved in only assessment-related procedures (example; occupational therapists conducting functional capacity evaluations)

The survey responses will be stored for 2 years if a scientific publication is made, and 6 years if there is no publication produced.

Should you consent to being a participant in this study, it is important to note that all of your information will be treated in confidence. The following measures have been put in place to ensure confidentiality of the research participants as far as possible:

- Only the researcher and research supervisors will have access to the information via a password protected profile on a research data management software.
- Neither your name, nor any identifying information will be published with the results of this study.
- Codes will be utilized for identifying your survey response to maintain your confidentiality and anonymity throughout the process of this research study.

There are no direct benefits or incentives for participation in this study; but there is also no cost incurred should you choose to participate. The opportunity to contribute knowledge and

expertise to develop occupational therapy practice with stroke survivors in the South African context provides a benefit for fellow practitioners and hopefully future practitioners who will work with this population.

Should you have any questions or require further information on the study before choosing to participate, please do not hesitate to contact me using the email details listed at the top of this information sheet. It is of great importance that you are satisfied with the information provided on the study prior to making a decision as to whether or not you would like to be a participant in this research. Declining to participate in this research will not negatively impact you in any way. Participants are also free to withdraw from participation at any time in the study.

Should you wish to participate in this study, please complete both the consent form and demographic questionnaire (below) and email it back to me 1090354@students.wits.ac.za . I will then contact you with further details about the study.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for reading this Study Information Sheet.

Christey Harris

APPENDIX E: PARTICIPANT CONSENT SHEET

WITS UNIVERSITY

PARTICIPANT CONSENT SHEET

Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?

8. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
9. I was given time to read it, or had it read to me, in the language I best understand;
10. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
11. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
12. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
13. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
14. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts.

Contact details:

Principal Researcher: Christey Harris

Telephone no.: 079 015 1157, or by

E-mail: 1090354@students.wits.ac.za

Supervisor: Faye Jackson

Telephone no.: 011 717-3704

E-mail: faye.jackson@wits.ac.za

Supervisor: Bhavna Bahgoo

Telephone no.: 011 717 3272

E-mail: Bhavna.Bahgoo@wits.ac.za

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.
Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Name of Participant: _____

Email Address: _____

Date: _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____

APPENDIX F: DEMOGRAPHICS QUESTIONNAIRE

Please tick the applicable box:

1. Which setting do you currently work in:
    - ❑ Private Sector
    - ❑ Public Sector
2. What type of stroke rehabilitation services are offered in your place of work?
    - ❑ General care as part of day-to-day services
    - ❑ Specialized care in a stroke unit
3. Stage/Phase of Rehabilitation
    - ❑ Acute care
    - ❑ Sub-acute/In-patient rehabilitation
    - ❑ Outpatient rehabilitation
4. Years (experience) working with a stroke population
    - ❑ Less than 1 year
    - ❑ 1-5 years
    - ❑ 5-10 years
    - ❑ More than 10 years
5. Postgraduate training (yes/no)
6. Postgraduate qualification in neurology (degree/diploma/certificate in which field)
    - ☐ NDT
    - ☐ Masters
    - ☐ PhD
7. Other Field/s of experience
    - ❑ Neurorehabilitation (adult)
    - ❑ Neurorehabilitation (paediatric)
    - ❑ Orthopaedic
    - ❑ Paediatric (Sensory-integration)
    - ❑ Other
    - ❑ If other please specify_____

APPENDIX G: SURVEY

The MoCA as a screening tool for moderate to severe stroke impairment in South African stroke survivors

Section 1: The Comprehensive ICF Core Set for Stroke

(Please refer to the attachment "Comprehensive ICF Core Set for Stroke", focusing on the "mental functions", from item b110 to b180)

1. In your experience, are the skills listed under "mental functions" the same as the cognitive skills you find to be affected in moderate to severely impaired stroke survivors?
   - ❑ Always
   - ❑ Often
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never
2. In your experience, does the presence of impairments in "seeing functions (b210)" affect your ability to accurately assess the presence, or severity of cognitive impairments as they are described under "mental functions"?
   - ❑ Always
   - ❑ Often
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never
3. In your experience, does the presence of impairments in "mental functions of language" and/or "articulation functions" affect your ability to accurately assess the presence, or severity of cognitive impairments as they are described under "mental functions"?
   - ❑ Always
   - ❑ Often
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never
4. In your experience, does the presence of other physical impairments in skills such as "control of voluntary movement" functions, affect your ability to accurately assess the presence or severity of cognitive impairments as they are described under "mental functions"?
   - ❑ Always
   - ❑ Often

- ❑ Sometimes
- ❑ Seldom
- ❑ Never

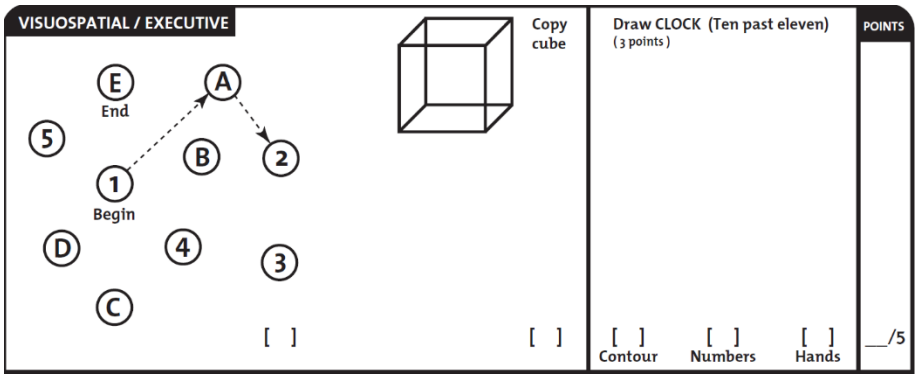
5. Are there cognitive impairments which you see with stroke survivors in your daily practice which are not detailed on the Comprehensive ICF Core Set for Stroke?
   - ❑ Yes
   - ❑ No
   - ❑ If yes, please provide further explanation

     _____
     _____
     _____

Section 2: The Validity of the MoCA as a tool for screening cognitive impairment in South African Stroke Survivors:

The MoCA has been separated into its various sections, accompanied by each section's instructions. You are to evaluate the validity of each section using the following scales of the CVI:

6. **Please rate the following section of the MoCA according to the content validity scales:**



The examiner instructs the subject: "Please draw a line, going from a number to a letter in ascending order. Begin here [point to (1)] and draw a line from 1 then to A then to 2 and so on. End here [point to (E)]."

*The examiner gives the following instructions, pointing to the **cube**: "Copy this drawing as accurately as you can, in the space below".*

*Indicate the right third of the space and give the following instructions: "Draw a **clock**. Put in all the numbers and set the time to 10 after 11"*

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

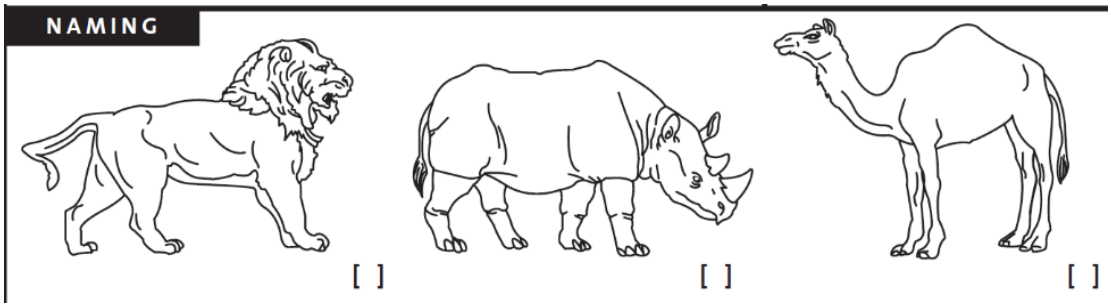
Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

7. **Please rate the following section of the MoCA according to the content validity scales**:



Beginning on the left, point to each figure and say: "Tell me the name of this animal".

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

8. **Please rate the following section of the MoCA according to the content validity scales**:

MEMORY	Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.		FACE	VELVET	CHURCH	DAISY	RED
		1st trial					
		2nd trial					

The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: "This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them". Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: "I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time." Put a check in the allocated space for each word the subject recalls after the second trial.

At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, "I will ask you to recall those words again at the end of the test."

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required

- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

9. **Please rate the following section of the MoCA according to the content validity scales**:

ATTENTION	Read list of digits (1 digit/ sec.).	Subject has to repeat them in the forward order	[ ] 2 1 8 5 4
		Subject has to repeat them in the backward order	[ ] 7 4 2
Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors			[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B
Serial 7 subtraction starting at 100	[ ] 93	[ ] 86	[ ] 79 [ ] 72 [ ] 65
		4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**	

Forward Digit Span: Administration: Give the following instruction: "I am going to say some numbers and when I am through, repeat them to me exactly as I said them". Read the five number sequence at a rate of one digit per second.

Backward Digit Span: Administration: Give the following instruction: "Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order." Read the three number sequence at a rate of one digit per second.

Serial 7s: Administration: The examiner gives the following instruction: "Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop." Give this instruction twice if necessary.

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

Clarity

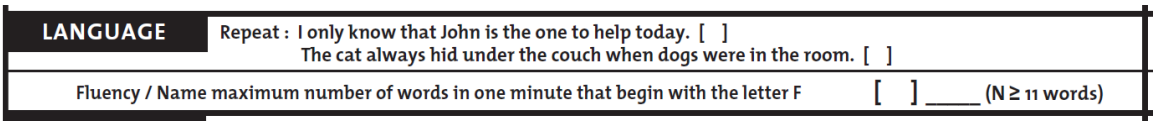
- 1- not clear, total revision required

- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

10. **Please rate the following section of the MoCA according to the content validity scales**:



*<u>Sentence repetition</u>**:** The examiner gives the following instructions: "I am going to read you a sentence. Repeat it after me, exactly as I say it [pause]:* ***I only know that John is the one to help today."*** *Following the response, say: "Now I am going to read you another sentence. Repeat it after me, exactly as I say it [pause]:* ***The cat always hid under the couch when dogs were in the room.****"*

<u>Verbal fluency</u>: The examiner gives the following instruction: "Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? [Pause] Now, tell me as many words as you can think of that begin with the letter F. [time for 60 sec]. Stop."

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required

- 4- totally relevant

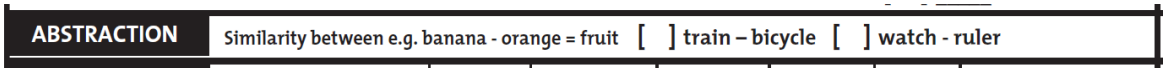
Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

11. **Please rate the following section of the MoCA according to the content validity scales**:



*<u>Abstraction</u>**:** The examiner asks the subject to explain what each pair of words has in common, starting with the example: "Tell me how an orange and a banana are alike". If the subject answers in a concrete manner, then say only one additional time: "Tell me another way in which those items are alike". If the subject does not give the appropriate response (fruit), say, "Yes, and they are also both fruit." Do not give any additional instructions or clarification.*

After the practice trial, say: "Now, tell me how a train and a bicycle are alike". Following the response, administer the second trial, saying: "Now tell me how a ruler and a watch are alike". Do not give any additional instructions or prompts.

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

12. **Please rate the following section of the MoCA according to the content validity scales**:

DELAYED RECALL	Has to recall words WITH NO CUE	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only
Optional	Category cue						
	Multiple choice cue						

<u>Delayed recall:</u> The examiner gives the following instruction: "I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember. Make a check mark (☐) for each of the words correctly recalled spontaneously without any cues, in the allocated space

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required

- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

13. **Please rate the following section of the MoCA according to the content validity scales**:

Orientation: The examiner gives the following instructions: "Tell me the date today". If the subject does not give a complete answer, then prompt accordingly by saying: "Tell me the [year, month, exact date, and day of the week]." Then say: "Now, tell me the name of this place, and which city it is in."

Simplicity

- 1- not simple, total revision required
- 2- section requires some revision
- 3- minor revisions of the section are required
- 4- simple- no revisions required for section

Relevance

- 1- irrelevant
- 2- somewhat relevant, major revision of the section required
- 3- relevant, with some minor revisions of the section required
- 4- totally relevant

Clarity

- 1- not clear, total revision required
- 2- section requires some revision
- 3- clear, though minor revisions of the section are required
- 4- very clear, no revisions required for section

Ambiguity

- 1- confusing/vague, total revision required
- 2- section requires some revision
- 3- unambiguous, but minor revisions of the section are required
- 4- meaning of the section is clear, no revisions required for section

Section 3: The Match Between the Comprehensive ICF Core Set for Stroke and the MoCA

Consider the cognitive skills included in the Comprehensive ICF Core Set for Stroke, and the cognitive skills assessed in the MoCA.

14. **Do you feel that the MoCA sufficiently assesses all of the areas of cognitive functioning described in the Comprehensive ICF Core Set for Stroke?**
    - ❑ Yes
    - ❑ No
15. **Are there any commonly-affected cognitive skill, as specified in the Comprehensive ICF Core Set for Stroke, which you feel the MoCA does not assess?**
    - ❑ Yes
    - ❑ No
    - ❑ If yes, please specify.

      _____
      _____
      _____
16. **Are there any cognitive skills, specified in the Comprehensive ICF Core Set for Stroke, which you feel are assessed repetitively in the MoCA?**
    - ❑ Yes
    - ❑ No
    - ❑ If yes, please specify

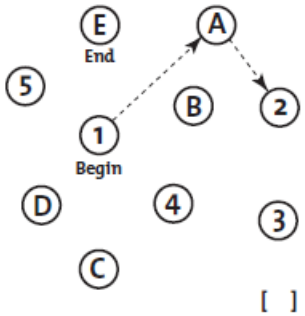
      _____
      _____
      _____

APPENDIX H: The Montreal Cognitive Assessment (MoCA)

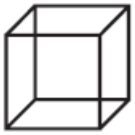
MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME :
Education : Date of birth :
Sex : DATE :

VISUOSPATIAL / EXECUTIVE



Copy cube



[ ] [ ]

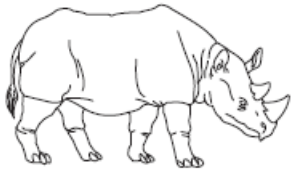
Draw CLOCK (Ten past eleven) (3 points)

[ ] Contour [ ] Numbers [ ] Hands

POINTS __/5

NAMING

[ ]



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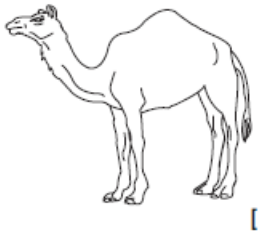

[ ]

__/3

MEMORY Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

No points

ATTENTION Read list of digits (1 digit/ sec.).

Subject has to repeat them in the forward order [ ] 2 1 8 5 4

Subject has to repeat them in the backward order [ ] 7 4 2

__/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B

__/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65

4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**

__/3

LANGUAGE Repeat : I only know that John is the one to help today. [ ]

The cat always hid under the couch when dogs were in the room. [ ]

__/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words)

__/1

ABSTRACTION Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler

__/2

DELAYED RECALL

	Has to recall words WITH NO CUE	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only
Optional	Category cue						
	Multiple choice cue						

__/5

ORIENTATION [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City

__/6

 Version November 7, 2004

www.mocatest.org

Normal ≥ 26/ 30

TOTAL __/30

Add 1 point if ≤ 12 yr edu

Montreal Cognitive Assessment
(MoCA)

Administration and Scoring Instructions

The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

1. **Alternating Trail Making:**

Administration: The examiner instructs the subject: *"Please draw a line, going from a number to a letter in ascending order. Begin here* [point to (1)] *and draw a line from 1 then to A then to 2 and so on. End here* [point to (E)]."

Scoring: Allocate one point if the subject successfully draws the following pattern: 1 –A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

2. **Visuoconstructional Skills (Cube):**

Administration: The examiner gives the following instructions, pointing to the **cube**: *"Copy this drawing as accurately as you can, in the space below".*

Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional
- All lines are drawn
- No line is added
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met.

3. **Visuoconstructional Skills (Clock):**

Administration: Indicate the right third of the space and give the following instructions: *"Draw a clock. Put in all the numbers and set the time to 10 after 11".*

Scoring: One point is allocated for each of the following three criteria:

- Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
- Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
- Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centred within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met.

4. **Naming:**

Administration: Beginning on the left, point to each figure and say: *"Tell me the name of this animal".*

Scoring: One point each is given for the following responses: (1) camel or dromedary, (2) lion, (3) rhinoceros or rhino.

5. **Memory:**

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: *"This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them".* Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: *"I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time."* Put a check in the allocated space for each word the subject recalls after the second trial.

At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, *"I will ask you to recall those words again at the end of the test."*

Scoring: No points are given for Trials One and Two.

6. **Attention:**

Forward Digit Span: Administration: Give the following instruction: *"I am going to say some numbers and when I am through, repeat them to me exactly as I said them".* Read the five number sequence at a rate of one digit per second.

Backward Digit Span: Administration: Give the following instruction: *"Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order."* Read the three number sequence at a rate of one digit per second.

Scoring: Allocate one point for each sequence correctly repeated, (*N.B.*: the correct response for the backwards trial is 2-4-7).

Vigilance: Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: *"I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand".*

Scoring: Give one point if there is zero to one errors (an error is a tap on a wrong letter or a failure to tap on letter A).

Serial 7s: Administration: The examiner gives the following instruction: *"Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop."* Give this instruction twice if necessary.

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correction subtraction, 2 points for two-to-three correct subtractions, and 3 points if the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond "92 – 85 – 78 – 71 – 64" where the "92" is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

7. **Sentence repetition:**

Administration: The examiner gives the following instructions: *"I am going to read you a sentence. Repeat it after me, exactly as I say it* [pause]: *I only know that John is the one to help today."* Following the response, say: *"Now I am going to read you another sentence. Repeat it after me, exactly as I say it* [pause]: *The cat always hid under the couch when dogs were in the room."*

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

8. **Verbal fluency:**

Administration: The examiner gives the following instruction: *"Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready?* [Pause] *Now, tell me as many words as you can think of that begin with the letter F.* [time for 60 sec]. *Stop."*

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins.

9. **Abstraction:**

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: *"Tell me how an orange and a banana are alike"*. If the subject answers in a concrete manner, then say only one additional time: *"Tell me another way in which those items are alike"*. If the subject does not give the appropriate response (*fruit*), say, *"Yes, and they are also both fruit."* Do not give any additional instructions or clarification.

After the practice trial, say: *"Now, tell me how a train and a bicycle are alike"*. Following the response, administer the second trial, saying: *"Now tell me how a ruler and a watch are alike"*. Do not give any additional instructions or prompts.

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered. The following responses are acceptable:

Train-bicycle = means of transportation, means of travelling, you take trips in both;
Ruler-watch = measuring instruments, used to measure.

The following responses are **not** acceptable: Train-bicycle = they have wheels; Ruler-watch = they have numbers.

10. Delayed recall:

Administration: The examiner gives the following instruction: "*I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember.* Make a check mark (✓) for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Scoring: **Allocate 1 point for each word recalled freely without any cues.**

Optional:

Following the delayed free recall trial, prompt the subject with the semantic category cue provided below for any word not recalled. Make a check mark (✓) in the allocated space if the subject remembered the word with the help of a category or multiple-choice cue. Prompt all non-recalled words in this manner. If the subject does not recall the word after the category cue, give him/her a multiple choice trial, using the following example instruction, "*Which of the following words do you think it was, NOSE, FACE, or HAND?*"

Use the following category and/or multiple-choice cues for each word, when appropriate:

FACE:	category cue: part of the body	multiple choice: nose, face, hand
VELVET:	category cue: type of fabric	multiple choice: denim, cotton, velvet
CHURCH:	category cue: type of building	multiple choice: church, school, hospital
DAISY:	category cue: type of flower	multiple choice: rose, daisy, tulip
RED:	category cue: a colour	multiple choice: red, blue, green

Scoring: **No points are allocated for words recalled with a cue.** A cue is used for clinical information purposes only and can give the test interpreter additional information about the type of memory disorder. For memory deficits due to retrieval failures, performance can be improved with a cue. For memory deficits due to encoding failures, performance does not improve with a cue.

11. Orientation:

Administration: The examiner gives the following instructions: "*Tell me the date today*". If the subject does not give a complete answer, then prompt accordingly by saying: "*Tell me the [year, month, exact date, and day of the week].*" Then say: "*Now, tell me the name of this place, and which city it is in.*"

Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

TOTAL SCORE: Sum all subscores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

APPENDIX I: COMPREHENSIVE ICF CORE SET FOR STROKE (MENTAL FUNCTIONS COMPONENT)

COMPREHENSIVE ICF CORE SET for STROKE

BODY FUNCTIONS = physiological functions of body systems (including psychological functions)	
b110	**Consciousness functions**
	General mental functions of the state of awareness and alertness, including the clarity and continuity of the wakeful state. *Inclusions: functions of the state, continuity and quality of consciousness; loss of consciousness, coma, vegetative states, fugues, trance states, possession states, drug-induced altered consciousness, delirium, stupor* *Exclusions: orientation functions (b114); energy and drive functions (b130); sleep functions (b134)*
b114	**Orientation functions**
	General mental functions of knowing and ascertaining one's relation to self, to others, to time and to one's surroundings. *Inclusions: functions of orientation to time, place and person; orientation to self and others; disorientation to time, place and person* *Exclusions: consciousness functions (b110); attention functions (b140); memory functions (b144)*
b117	**Intellectual functions**
	General mental functions, required to understand and constructively integrate the various mental functions, including all cognitive functions and their development over the life span. *Inclusions: functions of intellectual growth; intellectual retardation, mental retardation, dementia* *Exclusions: memory functions (b144); thought functions (b160); higher-level cognitive functions (b164)*
b126	**Temperament and personality functions**
	General mental functions of constitutional disposition of the individual to react in a particular way to situations, including the set of mental characteristics that makes the individual distinct from others. *Inclusions: functions of extraversion, introversion, agreeableness, conscientiousness, psychic and emotional stability, and openness to experience; optimism; novelty seeking; confidence; trustworthiness* *Exclusions: intellectual functions (b117); energy and drive functions (b130); psychomotor functions (b147); emotional functions (b152)*
b130	**Energy and drive functions**
	General mental functions of physiological and psychological mechanisms that cause the individual to move towards satisfying specific needs and general goals in a persistent manner. *Inclusions: functions of energy level, motivation, appetite, craving (including craving for substances that can be abused), and impulse control* *Exclusions: consciousness functions (b110); temperament and personality functions (b126); sleep functions (b134); psychomotor functions (b147); emotional functions (b152)*
b134	**Sleep functions**
	General mental functions of periodic, reversible and selective physical and mental disengagement from one's immediate environment accompanied by characteristic physiological changes. *Inclusions: functions of amount of sleeping, and onset, maintenance and quality of sleep; functions involving the sleep cycle, such as in insomnia, hypersomnia and narcolepsy* *Exclusions: consciousness functions (b110); energy and drive functions (b130); attention functions (b140); psychomotor functions (b147)*
b140	**Attention functions**
	Specific mental functions of focusing on an external stimulus or internal experience for the required period of time. *Inclusions: functions of sustaining attention, shifting attention, dividing attention, sharing attention; concentration; distractibility* *Exclusions: consciousness functions (b110); energy and drive functions (b130); sleep functions (b134); memory functions (b144); psychomotor functions (b147); perceptual functions (b156)*
b144	**Memory functions**
	Specific mental functions of registering and storing information and retrieving it as needed. *Inclusions: functions of short-term and long-term memory, immediate, recent and remote memory; memory span; retrieval of memory; remembering; functions used in recalling and learning, such as in nominal, selective and dissociative amnesia* *Exclusions: consciousness functions (b110); orientation functions (b114); intellectual functions (b117); attention functions (b140); perceptual functions (b156); thought functions (b160); higher-level cognitive functions (b164); mental functions of language (b167); calculation functions (b172)*
b152	**Emotional functions**
	Specific mental functions related to the feeling and affective components of the processes of the mind. *Inclusions: functions of appropriateness of emotion, regulation and range of emotion; affect; sadness, happiness, love, fear, anger, hate, tension, anxiety, joy, sorrow; lability of emotion; flattening of affect* *Exclusions: temperament and personality functions (b126); energy and drive functions (b130)*
b156	**Perceptual functions**
	Specific mental functions of recognizing and interpreting sensory stimuli. *Inclusions: functions of auditory, visual, olfactory, gustatory, tactile and visuospatial perception, such as a hallucination or illusion* *Exclusions: consciousness functions (b110); orientation functions (b114); attention functions (b140); memory functions (b144); mental functions of language (b167); seeing and related functions (b210-b229); hearing and vestibular functions (b230-b249); additional sensory functions (b250-b279)*

b164	Higher-level cognitive functions
	Specific mental functions especially dependent on the frontal lobes of the brain, including complex goal-directed behaviours such as decision-making, abstract thinking, planning and carrying out plans, mental flexibility, and deciding which behaviours are appropriate under what circumstances; often called executive functions. *Inclusions: functions of abstraction and organization of ideas; time management, insight and judgement; concept formation, categorization and cognitive flexibility* *Exclusions: memory functions (b144); thought functions (b160); mental functions of language (b167); calculation functions (b172)*
b167	Mental functions of language
	Specific mental functions of recognizing and using signs, symbols and other components of a language. *Inclusions: functions of reception and decryption of spoken, written or other forms of language such as sign language; functions of expression of spoken, written or other forms of language; integrative language functions, spoken and written, such as involved in receptive, expressive, Broca's, Wernicke's and conduction aphasia* *Exclusions: attention functions (b140); memory functions (b144); perceptual functions (b156); thought functions (b160); higher-level cognitive functions (b164); calculation functions (b172); mental functions of complex movements (b176); Chapter 2 Sensory Functions and Pain; Chapter 3 Voice and Speech Functions*
b172	Calculation functions
	Specific mental functions of determination, approximation and manipulation of mathematical symbols and processes. *Inclusions: functions of addition, subtraction, and other simple mathematical calculations; functions of complex mathematical operations* *Exclusions: attention functions (b140); memory functions (b144); thought functions (b160); higher-level cognitive functions (b164); mental functions of language (b167)*
b176	Mental functions of sequencing complex movements
	Specific mental functions of sequencing and coordinating complex, purposeful movements. *Inclusions: impairments such as in ideation, ideomotor, dressing, oculomotor and speech apraxia* *Exclusions: psychomotor functions (b147); higher-level cognitive functions (b164); Chapter 7 Neuromusculoskeletal and Movement-Related Functions*
b180	Experience of self and time functions
	Specific mental functions related to the awareness of one's identity, one's body, one's position in the reality of one's environment and of time. *Inclusions: functions of experience of self, body image and time*

APPENDIX J: PLAGIARISM DELCARATION

Faculty of Health Sciences, Postgraduate Office
Phillip V Tobias Building, 2nd Floor
Cnr York & Princess of Wales Terrace, Parktown 2193
Tel: (011) 717 2745 | Fax: (011) 717 2119
Email: Mathoto.senamela@wits.ac.za

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I, Christey Llara Harris (Student number: 1090354) am a student

registered for the degree of Masters of Science in Occupational Therapy in the academic year 2022.

I hereby declare the following:

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

Signature:  Date: 07/07/2022

APPENDIX K: TURNITIN SIMILARITY REPORT

Turnitin ***Originality Report***

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- ID: 1865374517
- Word Count: 4361
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protocol revised *By Christey Harris*

Similarity Index

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Similarity by Source

Internet Sources:

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Gambrell, Alan D. "An examination of preferred and perceived required work style differences between men and women managers", Proquest, 20111109
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Nilton Custodio, Lissette Duque, Rosa Montesinos, Carlos Alva-Diaz, Martin Mellado, Andrea Slachevsky. "Systematic Review of the Diagnostic Validity of Brief Cognitive Screenings for Early Dementia Detection in Spanish-Speaking Adults in Latin America", Frontiers in Aging Neuroscience, 2020
1% match (student papers from 23-Aug-2016)
Submitted to University of Witwatersrand on 2016-08-23
< 1% match ()
Robbertse, Andrea. "Nurses' perceptions of barriers to care for patients with dysphagia and their information delivery preferences regarding dysphagia care", Stellenbosch : Stellenbosch University, 2018
< 1% match ()

Tavener, Meredith, Thijsen, Amanda, Hubbard, Isobel J., Francis, J. Lynn, Grennall, Claire, Levi, Christopher, Byles, Julie. "Acknowledging How Older Australian Women Experience Life After Stroke:How Does the WHO 18-Item Brief ICF Core Set for Stroke Compare?", 'Informa UK Limited', 2015
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< 1% match (S. Geyh, A. Cieza, B. Kollerits, G. Grimby, G. Stucki. "Content comparison of health-related quality of life measures used in stroke based on the international classification of functioning, disability and health (ICF): a systematic review", Quality of Life Research, 2007)
S. Geyh, A. Cieza, B. Kollerits, G. Grimby, G. Stucki. "Content comparison of health-related quality of life measures used in stroke based on the international classification of functioning, disability and health (ICF): a systematic review", Quality of Life Research, 2007
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< 1% match (Internet from 25-Sep-2022)
https://scholarworks.uni.edu/cgi/viewcontent.cgi?article=2211&context=etd
< 1% match (Campbell, Nerissa, Danielle Rice, Lauren Friedman, Mark Speechley, and Robert W. Teasell. "Screening and facilitating further assessment for cognitive impairment after stroke: application of a shortened Montreal Cognitive Assessment (miniMoCA)", Disability and Rehabilitation, 2016.)
Campbell, Nerissa, Danielle Rice, Lauren Friedman, Mark Speechley, and Robert W. Teasell. "Screening and facilitating further assessment for cognitive impairment after stroke: application of a shortened Montreal Cognitive Assessment (miniMoCA)", Disability and Rehabilitation, 2016.
< 1% match (student papers from 11-Oct-2017)
Submitted to Australian Catholic University on 2017-10-11
< 1% match (student papers from 02-Jul-2022)
Submitted to Coventry University on 2022-07-02
< 1% match (student papers from 04-Apr-2016)
Submitted to Trinity College Dublin on 2016-04-04
< 1% match (Chan, Edgar, Sabah Khan, Rupert Oliver, Sumanjit K. Gill, David J. Werring, and Lisa Cipolotti. "Underestimation of cognitive impairments by the Montreal Cognitive Assessment (MoCA) in an acute stroke unit population", Journal of the Neurological Sciences, 2014.)
Chan, Edgar, Sabah Khan, Rupert Oliver, Sumanjit K. Gill, David J. Werring, and Lisa Cipolotti. "Underestimation of cognitive impairments by the Montreal Cognitive

Assessment (MoCA) in an acute stroke unit population", Journal of the Neurological Sciences, 2014.
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APPENDIX L: HUMAN AND ANIMAL RESEARCH ETHICS DECLARATION

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

University of the Witwatersrand Student Ethics Declaration Form

(To be completed during the protocol assessor meeting)

Background

All Research conducted by a University of the Witwatersrand student, with human subjects or animals, requires approval by the Wits Human Research Ethics Committee or Animal Research Ethics Committee, respectively.

If research has been undertaken without the necessary ethics approvals, this is considered an ethics violation. This will be reported to the relevant structures, the data will have to be discarded, and in the case of students, they cannot use the data towards their degree.

To prevent any ethics violations, the ethics requirements for the proposed project will be discussed with you at the protocol assessment.

Declaration

Based on the current protocol assessment (and any proposed changes suggested by the assessor committee), we, the undersigned, understand that the proposed research requires

1. Human Research Ethics clearance certificate — (Yes) / No
    a. Covered under existing supervisor ethics — Yes / (No)
    b. Requires a new HREC application — (Yes) / No
2. Animal Research Ethics clearance certificate — Yes / (No)
3. No Human or Animal Ethics Clearance — Yes / (No)
4. Unclear, will seek appropriate guidance from the HREC/AREC committees (whichever relevant) — Yes / (No)

Signatures

Supervisor/s: Student:

Bhavna Bahgoo Faye Jackson

Date: 18/07/2022

APPENDIX M: Ethics Training Certificates

TRREE

Zertifikat
Certificat
Certificado
Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Clinical Trials Centre
The University of Hong Kong

Christey Harris

a complété avec succès - has successfully completed

Introduction to Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2022/09/14
CID : CQvihLfGQ

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

APPROVED BY
SIWF FMH
ISFM
Programmes de formation continue (2 crédits)
Continuing Education Programs (2 credits)

Foederatio Pharmaceutica Helvetiae
FPH
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Ce programme est soutenu par - This program is supported by :
European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20220217]

TRREE

Zertifikat
Certificat
Certificado
Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

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The University of Hong Kong

Christey Harris

a complété avec succès - has successfully completed

Informed Consent

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2022/09/14
CID : UnwKtSBGzT

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

APPROVED BY SIWF FMH ISFM
Programmes de formation continue (2 crédits)
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Foederatio Pharmaceutica Helvetiae
FPH Programmes de formation postgraduée et continue
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[REV : 20220217]

Appendix N: Permission Request Letter

PERMISSION REQUEST LETTER

Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?

Principal Researcher: Christey Harris

Contact Details: Cell: 079 015 1157

Email: 1090354@students.wits.ac.za

To whom it may concern,

RE: Request for Permission to use the Montreal Cognitive Assessment in Academic Research

My name is Christey Harris. I am a Masters degree student currently enrolled at University of the Witwatersrand in the School of Occupational Therapy. I am conducting research as part of the requirements to qualify for a Masters Degree in Occupational Therapy.

The research study I am undertaking is to determine the validity of the use of the Montreal Cognitive Assessment by South African occupational therapists as a tool for screening cognitive impairments in moderate to severely impaired South African stroke survivors.

In order to conduct this research, permission to use the MoCA as part of the study is required. As the primary researcher, I would like to formally request permission to use the MoCA in this

research study. A brief overview of the study is included in this letter; and the research protocol/proposal approved by the Human Research Ethics Committee (HREC) has been attached with this letter for your reference to provide any further detail you may require in making your decision.

This study will require expert occupational therapists within the field of neurological rehabilitation, particularly stroke rehabilitation, to complete a survey which is comprised of the following sections:

1. Exploring the Comprehensive ICF Core Set for Stroke, particularly comparing the cognitive skills included in this document to what cognitive impairments are commonly seen in moderate to severely impaired stroke survivors in South Africa.
2. Exploring the validity of each section of the MoCA, as well as the whole instrument using the Content Validity Index Method.
3. Exploring the match between the cognitive skills discussed Comprehensive ICF Core Set for Stroke, and the cognitive skills assessed by the MoCA.

It is the hope that this research study and its results can be used as part of the foundation to develop knowledge and occupational therapy practice recommendations for screening and assessing post-stroke cognitive impairment in the South African stroke survivor population. Furthermore, informing occupational therapy practitioners' clinical reasoning about selecting appropriate tools for screening cognitive impairments in the stroke survivor population in South Africa is also included as an important goal for this research.

It is the view of the researcher and supervisors that this study has the potential to contribute to the body of knowledge to propel occupational therapy stroke rehabilitation in South Africa towards a more evidence-based practice. I hope that you will concur with this statement, and consider providing permission for the MoCA to be used in this academic research.

Should you require any further information, or have any queries regarding the study, please do not hesitate to contact me directly using the details included on the first page of this letter.

Yours faithfully

Christey Harris (BsCOT)

(Primary Researcher)

Contact details:

Principal Researcher: Christey Harris

Telephone no.: 079 015 1157, or by

E-mail: 1090354@students.wits.ac.za

Supervisor: Faye Jackson

Telephone no.: 011 717-3704

E-mail: faye.jackson@wits.ac.za

Supervisor: Bhavna Bahgoo

Telephone no.: 011 717 3272

E-mail: Bhavna.Bahgoo@wits.ac.za

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.
Ms. Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at: Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Appendix O: Permission Agreement from MoCA Test Organisation

MoCA Test inc.

Copyright Permission To Use The Montreal Cognitive Assessment (MoCA ©)

You are welcome to use MoCA© for non-commercial purposes as you described below with no further permission requirements.

All modifications in any of the details below must be reported to info@mocatest.org, including the addition of a commercial sponsor.

No changes or adaptations to the MoCA© Test and instructions are permitted.

It is mandatory to follow the online MoCA© Training and Certification Program to administer and score MoCA© for clinical, research, and educational use. Training and certification are free for academic researchers involved in an ongoing academic study.

Study Title*:	Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?
Study Objectives*:	• To explore cognitive client factors and performance skills which are commonly affected in moderate to severely impaired South African stroke survivors. • To explore the validity of the MoCA for use with moderate to severely-impaired stroke survivors in South Africa using the Content Validity Index Method. • To explore whether there is a match between common cognitive impairments in moderate to severely impaired stroke survivors, and the cognitive skills assessed by the MoCA.
Source of Funding*:	Self-funded
Entities Involved Design of the Protocol*:	N/A
Name of Principal Investigator*:	Christey Llara Harris
Institution*:	University of the Witwatersrand
Country*:	South Africa
Email*:	1090354@students.wits.ac.za

By signing below, I hereby acknowledge that I have an affirmative duty to report all changes in the above permission request details.

Institution:	Unniversity of the Witwatersrand	**Signature:**	
Name:	Christey Llara Harris	**City:**	Johannesburg
Title:	Cognitive impairment in moderate to severe stroke: is the MoCA an appropriate tool for South	**Date:**	Feb 4, 2023

Appendix P: Approval of Title from Assessors Committee

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

19 October 2022
Person No: 1090354
PAG

Miss CL Harris
PO Box 2283
Bedfordview
2008
South Africa

Dear Miss Christey Harris

Master of Science in Occupational Therapy: Approval of Title

We have pleasure in advising that your proposal entitled *Cognitive impairment in moderate to severe stroke: Is the MoCA an appropriate tool for South African Stroke Survivors?* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix Q: Data Management Plan

Data storage and backup during the study period:

All data generated from the surveys will be:

- stored on REDcap under a password protected profile,
- accessible to only the researcher and the two research supervisors.
- A second copy of the survey responses will be backed up onto an access-controlled server provided by the university. This will ensure safety of the data, while also maintaining anonymity and confidentiality of the study participants.

Data storage following completion of the research study:

Survey responses will be stored for:

- 2 years on Redcap if no publication is released,
- or for 6 years following publication.