ASSESSMENT OF PHYSICAL DISABILITY AND THEIR DETERMINANTS AMONG STROKE SURVIVORS, SPINAL CORD AND TRAUMATIC BRAIN INJURED PATIENTS.

BY

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CERTIFICATION

This disertification by Igbinosun Grace Tamaramiepirite is accepted in its present form as satisfying the dissertification requirement of the degree of Bachelor of Physiotherapy of the School of Basic Medical Sciences, College of Medical sciences of the University of Benin.

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DEDICATION

This dissertation is dedicated to God Almighty, my parents; Mr and Mrs Johnbull Igbinosun and to my siblings who made this work a reality through their constant unrelenting support.

ABSTRACT

Background: Physical disabilities resulting from stroke, spinal cord injury (SCI), and traumatic brain injury (TBI) pose significant challenges to affected individuals, yet comparative assessments of these conditions remain limited in Nigeria. Understanding the determinants of disability in these populations is crucial for developing targeted rehabilitation strategies.

Aims: This study aimed to compare the level of physical disability and its determinants among stroke survivors, SCI patients, and TBI patients, providing insights into their unique rehabilitation needs.

Methods: A cross-sectional study was conducted involving 60 participants (20 per group). Data on demographic and health variables were collected using structured questionnaires and validated tools, including the WHO Disability Assessment Schedule (WHODAS 2.0), Berg Balance Scale (BBS), and Mini-Mental State Examination (MMSE). One-way ANOVA was used to identify significant differences among groups.

Results: The mean age of participants was 56.27 ± 10.70 years, with a mean condition duration of 5.60 ± 6.85 years the average score for the general health status (GS) was 32.05 ± 9.0. The WHO Disability Assessment Schedule (WHODAS) had a mean score of 21.65 ± 13.6. WHODAS scores suggested moderate disability across groups, with SCI patients showing higher scores, although not statistically significant ($p = 0.053$). Cognitive function remained preserved across all groups, as evidenced by high MMSE scores (mean: 29.97). the mean PHQ score was 5.70. ±4.3, the mean for PSS was 18.95 ±6.3, the mean BBS was 28.62 ±24.27.

Conclusion: SCI patients exhibit greater impairments in balance and mobility compared to stroke and TBI patients.

Keywords: Physical disability, stroke survivors, spinal cord injury, traumatic brain injury, rehabilitation, determinants

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

The World Health Organization defines disability as the incapacity to carry our vital daily tasks on one's own or as a limitation on one's capacity to carry out basic or instrumental daily tasks independently (WHO, 2023). Physical disabilities can take many various forms, but frequent ones include spinal cord injuries, amputations, strokes, and other conditions. Studies have indicated that a disability is typically associated with subpar physical function, performance in physical roles, and overall health. Disability may have a detrimental effect on social function, mobility, and emotion. Individuals with disabilities may encounter various limitations on their activities and participation options, which could impact their capacity to engage in day-to-day activities and their ability to reintegrate into society (WHO, 2020)

WHO (2011) estimates that 15% of the world's population has some form of disability, and 2–4% of them experience severe difficulties in functioning. A Global Burden of Disease (GBD) 2004 data analysis showed that 15.3% of the world’s population (approximately 978 million people) had moderate or severe disability, while around 2.9% of the population (185 million people) experienced severe disabilities.

Disability is not just a health problem or an attribute of individuals; it reflects the difficulties individuals may experience in interacting with society and physical movements (Fellinghauer et al., 2012). The term "disability" includes impairments, activity limitations, and participation restrictions (WHO, 2011).

The International Classification of Functioning, Disability, and Health (ICF) further elaborates on this definition by emphasizing that disability results from the interaction between a person's health condition and the environmental or personal factors that influence their capacity to function (World Health Organization, 2001).According to the Global Burden of Disease (GBD) 2013 report, disability is the loss of health, where health is defined as the ability to operate in a variety of health domains, including hearing, vision, movement, and cognition. Globally, neurological illnesses rank as the second most common cause of mortality and the primary cause of disability.. In the past 30 years, the absolute numbers of deaths and people with disabilities due to neurological diseases have risen substantially, particularly in low-income and middle-income countries, and further increases are expected globally as a result of population growth and aging. (Feigin et al., 2020).

Globally, in 2016, neurological disorders were the leading cause of DALYs (276 million; 95% UI 247–308 million) and the second leading cause of deaths (9.0 million; 95% UI 8.8–9.4 million). Among the three leading neurological causes of death globally, stroke accounts for 67.4%, followed by dementias (20.3%) and meningitis (3.7%). (Feigin et al., 2020). It has been reported that approximately 15 to 30% of stroke survivors live with permanent disability (AHA, 2002). This includes physical, social, and cognitive functions (Hommel et al., 2009; Sturm, 2002; Wolfe et al., 2011).

Stroke is a vascular disease that causes a loss of brain function or dysfunction in the area of the lesion, where brain cells have died due to insufficient blood supply, resulting from an obstruction or rupture of brain blood vessels (Waqas et al., 2020). Spinal cord injury and traumatic injuries are classified as traumatic neurologic conditions and affect society globally (Badhiwala et al., 2019; James and Theadom, 2016). TBI and SCI are primarily caused by falls and motor vehicle

collisions (MVCs). It is expected that the incidence of TBI and SCI will surge due to the increase in population density, aging, and the use of motor vehicles, motorcycles, and bicycles, which is concerning because of the specialized care that people with SCI may require (Badhiwala et al., 2019; James and Theadom, 2016). Traumatic brain injury (TBI) refers to a brain injury caused by an external force. TBI can result from a forceful bump, blow, or jolt to the head or body, or from an object penetrating the brain (National Institute of Neurological Disorders and Stroke, 2024). Spinal cord injury (SCI) is a multidimensional disorder arising from direct or indirect spinal cord damage (Bennett et al., 2024).

Despite the high prevalence of stroke, SCI, and TBI, and their substantial contribution to the global burden of physical disability, there is limited comparative research on the specific physical disabilities these conditions cause and the determinants of these disabilities. Understanding the differences and similarities in disability outcomes among these populations is crucial for developing targeted rehabilitation strategies that can improve the quality of life for individuals affected by these conditions.

The determinants of physical disabilities among stroke survivors, spinal cord and traumatic brain injured patients include demographic factors such as age, gender, socioeconomic status, occupation etc and clinical factors such as types, severity, location of injury, comorbidity etc.

This study aims to fill this gap by conducting a comparative assessment of physical disability and its determinants among stroke survivors, SCI patients, and TBI patients in Nigeria.

1.2 Statement of the Problem:

Stroke, spinal cord injury, and traumatic brain injury are leading causes of physical disability worldwide, significantly impacting an individual's functional abilities and quality of life (Kim

et al., 2014) (Cabral et al., 2018). A stroke, a common cause of long-term disability, often results in motor function deficits that affect the patient's mobility, daily life activities, and participation in society, ultimately contributing to a lower overall quality of life (Friel et al., 2016). Similarly, spinal cord injury and traumatic brain injury can result in a variety of behavioral, cognitive, and physical deficits that have a major influence on a person's independence and capacity to carry out everyday tasks.

While extensive research has focused on the rehabilitation of these patient populations, a comprehensive comparative assessment of physical disability and its determinants across these conditions is lacking. Through a comparative investigation, this work seeks to close this gap of physical disability and its underlying factors among stroke survivors, spinal cord injury patients, and traumatic brain injury patients. Specifically, the study investigated and compared the extent of physical disability and its contributing factors, such as age, injury severity, comorbidities, and access to rehabilitation services, across these three patient populations. The findings from this study will provide valuable insights to healthcare professionals and policymakers to develop more targeted and effective rehabilitation strategies to address the unique needs of each patient group and improve their overall quality of life.

1.3 Research Questions.

This study will therefore aim to answer the following questions:

1. What are the levels and types of physical disability experienced among stroke survivors, spinal cord and traumatic brain injured patient?

2. Is there any difference in physical disability among stroke survivors, spinal cord and traumatic brain injured patient?

3. What are the determinants of physical disability among stroke survivors, spiral cord and traumatic brain injured patient?

4. What role does access to rehabilitation services play in physical disability outcomes among stroke survivors, SCI, and TBI patients.

5. How does the severity of the initial injury relate to the long-term physical disability among stroke, SCI, and TBI patients?

6. What coping mechanisms are commonly used by stroke, SCI and TBI patients and hw does these impact their physical disability outcome.

1.4 Aim of the Study:

The aim of this study is to conduct a comparative assessment of physical disabilities and their determinants among stroke survivors, spinal cord and traumatic brain injured patients. Specifically, the study identified the nature and severity of physical disabilities across these groups, examine the key factors that influence disability outcomes, and explore the impact of these conditions on patients' quality of life, rehabilitation, and functional independence.

1.4.1 Specific Objectives:

i. To assess the types and severity of physical disabilities experienced by stroke survivors, spinal cord injury (SCI), and traumatic brain injury (TBI) patients.

ii. To identify and compare the key determinants (such as age, gender, injury severity, socioeconomic status, and access to care) influencing physical disability outcomes among stroke, SCI, and TBI patients.

iii. To examine the rehabilitation outcomes and recovery timelines for each patient group and identify the factors that contribute to successful rehabilitation and functional independence.

iv. To evaluate the impact of physical disabilities on the quality of life and psychological well-being of stroke, SCI, and TBI patients.

v. To analyze the role of social, environmental, and healthcare factors in influencing the level of physical disability and rehabilitation success among the three groups.

vi. To compare the long-term physical disability outcomes and barriers to functional independence across stroke survivors, SCI patients, and TBI patients.

vii. To provide recommendations for optimizing rehabilitation strategies and healthcare policies based on the comparative findings of disability outcomes and their determinants.

1.5 Hypothesis

1.5.1 Main Hypothesis:

There would be no significant difference in the physical disability among stroke survivors, spinal cord injury patients and traumatic brain injury patients

1.5.2 Sub-Hypothesis:

I. There would be no significant difference in the physical disability among stroke, TBI and SCI patients

II. There would be no significant relationship between age and physical disability among SCI and TBI patients

III. There would be no significant relationship between duration of condition and physical disability among SCI and TBI patients

IV. There would be no significant relationship between self-esteem and physical disability among SCI and TBI patients

V. There would be no significant relationship between balance and physical disability among SCI and TBI patients

VI. There would be no significant relationship between anxiety and physical disability among SCI and TBI patients

VII. There would be no significant relationship between Motor function and physical disability among SCI and TBI patients

VIII. There would be no significant relationship between depression and physical disability among SCI and TBI patients

IX. There would be no significant relationship between perceived stress and physical disability among SCI and TBI patients

X. There would be no significant relationship between cognitive function and physical disability among SCI and TBI patients

XI. There would be no significant difference in self-efficacy among stroke survivors, SCI and TBI patients

1.6 Significance of the Study:

This study is significant for several reasons:

1. Improved Understanding of Disability Patterns: By conducting a comparative assessment of physical disabilities among stroke survivors, spinal cord injury (SCI), and traumatic brain injured (TBI) patients, the study will provide a clearer understanding of the nature and severity of disabilities in these populations. This knowledge is crucial for healthcare providers to tailor interventions that meet the specific needs of each group.

2. Identification of Key Determinants: The study will identify the key factors that influence physical disability outcomes, such as injury type, age, socioeconomic status, and access to care. This information can be used by healthcare professionals and policymakers to better understand how to reduce the burden of disability and improve patient outcomes across different conditions.

3. Improved Quality of Life for Patients: By identifying the social, environmental, and psychological factors that affect the quality of life and well-being of these patients, the study can contribute to interventions that not only address physical disabilities but also promote mental health and social integration.

4. Filling a Research Gap:By directly comparing disability outcomes and factors among stroke, SCI, and TBI patients, this study fills a research gap.. The insights gained will be valuable for academics, clinicians, and researchers looking to further explore the complexities of physical disabilities in these populations.

1.7 Scope of the Study:

The scope of this study encompasses the following aspects:

i. Patient Groups: The study focuses on three distinct patient groups:

A. Stroke survivors

B. Spinal cord injury (SCI) patients

C. Traumatic brain injury (TBI) patients

These groups are selected due to the significant physical disabilities that typically result from their respective conditions.

ii: Determinants of Disability: The study examined various determinants of physical disability, including: Demographic factors (age, gender, socioeconomic status) and Clinical factors (type, severity, and location of injury).

iii: Comparative Analysis: The primary focus of the study is comparative. It will compare the types and severity of physical disabilities and their determinants among the three patient groups. Differences in rehabilitation outcomes, functional independence, and quality of life will be explored.

Instruments: The study would be delimited to the following

a. WHO Disability Assessment Schedule (WHODAS) Disability

b. The Motor Assessment Scale for assessing motor function

c. Mini -Mental State Examination for assessing cognition

d. The Berg Balance Scale for assessing balance

e. Rosenberg Self -Esteem Scale for assessing self-esteem

f. The Patient Health Questionaire 9 (PHQ-9)for assessing Depression

g. The Hospital anxiety and depression scale(HADS) for assessing anxiety

h. Percieved Stress Scale for assessing stress

i. General Self-Efficacy Scale (GSE) for assessing Self Efficacy

1.8 Limitation to the study:

Despite the efforts to ensure the success of this research, several limitations were encountered during the study:

I. Low Participation Rate: Many patients were reluctant to participate in the study, which limited the sample size and may have impacted the generalizability of the findings.

ii. Participant Fatigue: Some participants became fatigued while completing the questionnaire due to the extensive number of questions. This may have led to incomplete responses, reduced accuracy, or early withdrawal from the study.

iii. Hospital Setting: Conducting the study in a teaching hospital may have introduced selection bias, as the findings may not fully represent patients from non-teaching or community healthcare settings.

iv. Limited Availability of Traumatic Brain Injury (TBI) Patients: The low number of traumatic brain injury patients admitted during the data collection period delayed the process, as the study had to rely on new admissions to meet the required sample size.

v. Self-Reported Data: The use of self-reported questionnaires may have introduced recall bias or inaccuracies, as some participants might have misremembered or misunderstood certain questions.

These limitations highlight areas where future research could focus on improving participation strategies, streamlining data collection methods, and expanding the study population to enhance the robustness and applicability of findings.

1.9 Definition of terms:

1. Comparative: considered as if in comparison to something else as a standard not quite attained *(Merriam Webster).*

2. Assessment: the action or an instance of making a judgment about something: the act of assessing something *(Merriam Webster).*

3. Physical: having material existence: perceptible especially through the senses and subject to the laws of nature *(Merriam Webster).*

4. Disability: According to the World Health Organization, disability has three dimensions:

A. A person's physical or mental functionality is impaired; for instance, they may lose a limb, become blind, or experience memory loss.
B. Activity limitation, such as difficulty seeing, hearing, walking, or problem solving.
C. Restrictions on participation in regular activities of daily living, including employment, social and recreational activities, and access to preventive and medical treatment.

5. Determinant:something that fixes or conditions an outcome, or that identifies or establishes the essence of something.

6. **Stroke**: A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts (or ruptures). *(American Stroke Association).*

7. **Survivor: A** person who is able to continue living their life successfully despite experiencing difficulties. *(Cambridge dictionary).*

8. **Spinal cord injury:** The term spinal cord injury (SCI) refers to damage to the spinal cord resulting from trauma (e.g. from falls and road traffic injuries) or non-traumatic causes like tumors, degenerative and vascular conditions, infections, toxins or birth defects. *(WHO 2024)*

9. **Traumatic brain injury:** Traumatic brain injury (TBI) happens when a sudden, external, physical assault damages the brain. *(John Hopkins Medicine)*

10. **Patients:** A patient is a person who is receiving medical treatment from a doctor or hospital. A patient is also someone who is registered with a particular doctor. *(Collins English Dictionary).*

1.10 Abbreviations:

i . SCI: Spinal cord injury

ii . TBI: Traumatic brain injury

iii. GBD: Global Burden of Disease

CHAPTER TWO

LITERATURE REVIEW

2.1 Disability

2.1.1 Definition

Numerous activity and engagement limits may be faced by people with impairments, which could lead to decreased functional capacity and community reintegration.. The degree of a mixed group of disabled people's functional capacity and community reintegration is still unknown, though. (Ekechukwu et al, 2022)

2.2 The brains role in physical disability in stroke, spinal cord injury and traumatic brain injury

The brain is the body's command center, coordinating a complex system of nerves and impulses that control every bodily function, including our thoughts, feelings, movements, and sensations. The effects of stroke, spinal cord injury (SCI), or traumatic brain injury (TBI) on this fragile system can be severe and far-reaching. The complexity of these disorders' effects and the significance of successful treatment and rehabilitation depend on an understanding of the brain's participation in them (Mayo Clinic, 2023; National Institute of Neurological Disorders and Stroke), 2023; BrainLine, 2023).

2.3 Anatomy of The Brain

2.3.1 The Brain

The brain is a highly complex organ responsible for nearly all bodily functions, including thinking, memory, emotions, sensory processing, movement, vision, breathing, hunger, and temperature regulation. Along with the spinal cord, it forms the central nervous system (CNS), as described by Ackerman (1992). On average, an adult human brain weighs about three pounds, with approximately 60% of that weight consisting of fat. The remaining 40% is made up of water, proteins, carbohydrates, and salts. Unlike muscles, the brain is composed of intricate networks of blood vessels, nerves, and critical cell types such as neurons and glial cells.

2.3.2 Main Parts of The Brain And Their Functions

The cerebrum, brainstem, and cerebellum are the three main regions of the brain, each of which performs unique high-level activities (Maldonado & Alsayouri, 2023).

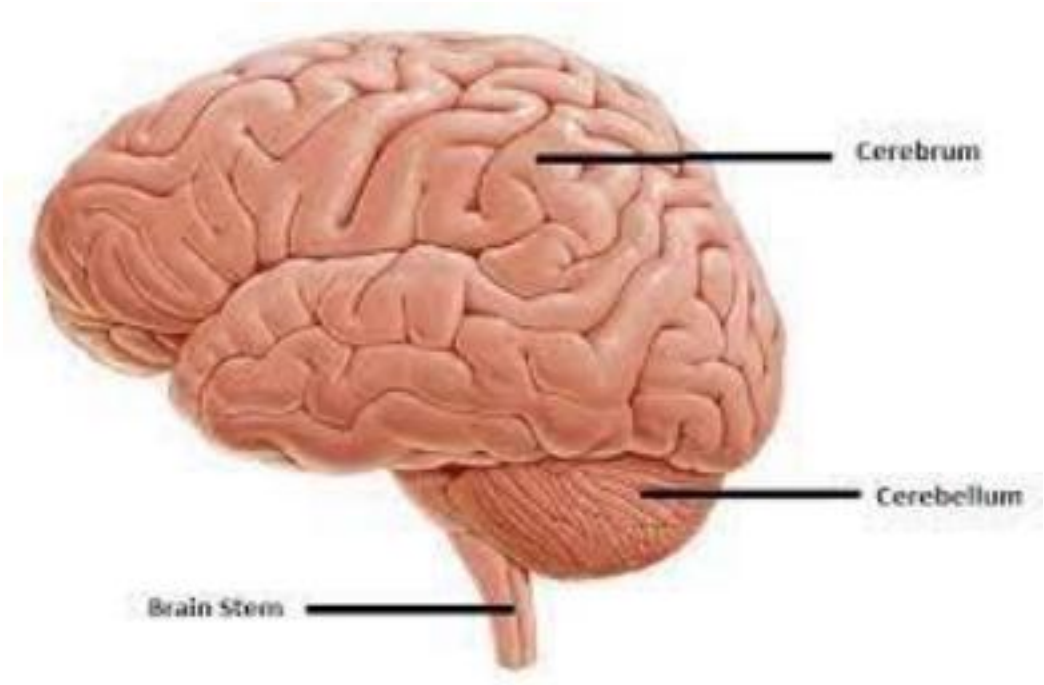


Figure 1: Lateral View of the Brain

Lateral view of the Brain showing the 3 main parts (cerebrum, cerebellum and brainstem)

Image source: www.myshepherdconnection.org

Cerebrum: Positioned at the front of the brain, the cerebrum consists of a central core of white matter surrounded by an outer layer of gray matter known as the cerebral cortex. As the largest part of the brain, the cerebrum is responsible for regulating body temperature, initiating and coordinating movement, and managing various cognitive functions (Maldonado & Alsayouri, 2023). These include sensory processing—such as vision, hearing, and touch—as well as communication, reasoning, judgment, problem-solving, emotional regulation, and learning. The cerebral cortex, whose name comes from the Latin word cortex meaning "bark," forms the cerebrum's outermost layer. Due to its many folds, it has a large surface area and accounts for roughly 50% of the brain's total mass. The cortex is divided into two hemispheres, each consisting of raised ridges (gyri) and grooves (sulci). These hemispheres are connected by the corpus callosum, a C-shaped bundle of white matter that allows communication between the two sides of the brain.

ii. **Brainstem:** The brainstem, located at the center of the brain, connects the cerebrum to the spinal cord and includes three main parts: the midbrain, pons, and medulla (Fernández-Gil et al., 2010).

a) Midbrain: This part of the brainstem is involved in several important functions such as hearing, movement, and responding to the environment. It contains clusters of neurons and nerve pathways, including the substantia nigra, which is affected in Parkinson's disease.

b) Pons: The word "pons" comes from Latin, meaning "bridge," which makes sense because it links the midbrain and medulla. It also plays a role in functions like blinking, chewing, and tear production, and is the origin of four cranial nerves.

c) Medulla: Found at the bottom of the brainstem, the medulla is vital for survival. It controls automatic actions such as breathing, heart rate, blood circulation, and reflexes like swallowing and sneezing. The spinal cord begins here and carries signals to and from the brain.

iii **The cerebellum:** sometimes referred to as the "little brain," is a fist-sized region situated behind the brainstem and above the temporal and occipital lobes. It maintains posture, balance, and equilibrium and uses its two hemispheres to coordinate voluntary muscular movements (Jimsheleishvili & Dididze, 2023). Research on its possible role in mind, feelings, and social behavior is still ongoing. It is also being investigated in relation to disorders like addiction, schizophrenia, and autism.

2.3.3Lobes of The Brain

The cerebrum, comprised of two brain hemispheres, is further divided into four separate regions known as lobes: frontal, parietal, temporal, and occipital. Every one of these lobes is in charge of particular brain processes.

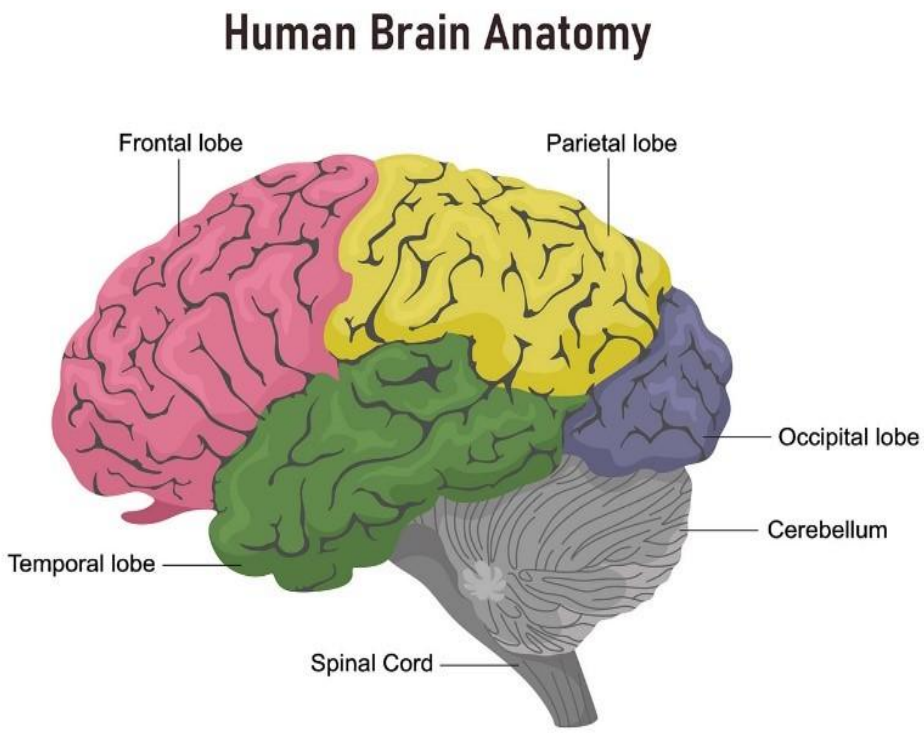


Figure 2: Lateral View of the Brain Showing the Four Lobes

Image source: Moore, Clinically Oriented Anatomy, 6th Edition. Pg. 879

Frontal Lobe:

The frontal lobe is the biggest part of the brain and plays a key role in shaping personality, making decisions, and controlling movement. It also includes Broca's area, which is important for speaking, and helps with recognizing smells (Neulinger et al., 2016).

Parietal Lobe:

Located in the middle part of the brain, the parietal lobe helps us understand where things are in space and recognize objects. It also plays a role in how we feel touch and pain. Wernicke's area, which helps us understand spoken language, is also found here (Berlucchi & Vallar, 2018).

Occipital Lobe:

Found at the back of the brain, the occipital lobe is mainly responsible for processing visual information (Huff et al., 2023).

Temporal Lobe:

The temporal lobes are on the sides of the brain and are involved in language, recognizing music and rhythm, short-term memory, and, to a smaller extent, identifying smells (Kiernan, 2012).

2.3.4 Anatomy of The Brain's Blood Supply

Because brain cells cannot store glucose or undertake glycolysis, they depend on the circulation for a constant supply of glucose to support ongoing cellular activity and proper functioning.Every minute, the brain's metabolic processes need 3.5 milliliters of oxygen per 100 grams of brain tissue. It's interesting to note that grey matter consumes twice as much oxygen as white matter. (Rink and Khanna, 2011).

2.3.5 The Brain's Arterial Supply

The two primary circulations that provide blood to the brain are the anterior and posterior circulations, together referred to as the "circle of Willis." The left and right internal carotid arteries supply the anterior circulation, whereas the left and right vertebral arteries supply the posterior circulation (Rhoton, 2002).

Anterior Circulation

The anterior circulation plays a vital role in providing blood supply to the following structures:

i. Cerebrum

ii. Ophthalmic artery

iii. Internal carotid arteries

Course and Branches

When the left and right common carotid arteries split at the C3/C4 level, the internal carotid arteries (ICA) are formed inside the carotid sheath.

The internal carotid arteries then travel via the carotid canal and the petrous portion of the temporal bone.

Prior to entering the cerebral cavity, the internal carotid arteries pass anteriorly through the cavernous sinus.

Each internal carotid artery splits off into the following after passing through the cavernous sinus:

i. **Ophthalmic artery:** supplies some of the structures in the nose, face, and meninges, in addition to the orbit..

ii**. Posterior communicating artery:** Before finally splitting into the anterior and middle cerebral arteries, it establishes an anterior link with the internal carotid artery.connects with the posterior cerebral artery posteriorly.

iii. **Anterior cerebral artery**: The internal carotid arteries, which continue as the middle cerebral arteries, supply oxygenated blood to the front temporal lobes, insular cortices, and lateral cerebral cortex. delivers oxygenated blood to the superior medial parietal lobes and most of the midline frontal lobes.

Posterior Circulation

The posterior circulation serves the critical function of supplying blood to the following areas:

i. Occipital lobes

ii. Cerebellum

iii. Brainstem

iv. Vertebral arteries

Course and Branches

On the posterosuperior aspect, the left and right subclavian arteries serve as the starting points for the vertebral arteries.

After that, these vertebral arteries proceed superiorly through the spine's transverse foramina, beginning at level C6.

The arteries leave the transverse foramen of C1 and proceed through the foramen magnum.

As the vertebral arteries penetrate the cerebral vault, they produce the following branches:

j. **Posterior Inferior Cerebellar Artery (PICA):** This large branch, one of the primary arteries supplying the cerebellum, originates from the vertebral artery.

k. **ii. Anterior and Posterior Meningeal Arteries:** These arteries supply the dura mater.

i. **Anterior and Posterior Spinal Arteries:**These arteries give blood to the spinal cord along its whole length.

The basilar artery, which is situated inside the skull at the base of the pons, is then formed by the union of the vertebral arteries.

Basilar Artery

Course and Branches: The basilar artery rises and generates many bran when the two vertebral arteries meet.

i. **Anterior Inferior Cerebellar Artery:** provides blood to the sixth, seventh, and eighth cranial nerves as well as the anteroinferior portion of the cerebellum.

ii. **ii. Pontine Branches:** These branches transverse the pons, supplying blood supply to the basilar section of the pons.

iii. Superior Cerebellar Artery: Provides blood to the middle cerebellar peduncle's superior surface as well as the pons' superior border.

iv. Labyrinthine Artery: Provides blood flow to the inner ear by traveling alongside the eighth cranial nerve.

iv. Posterior Cerebral Artery: Supplies the occipital lobe and the rest of the cerebrum's superolateral region with blood.

2.3.6 Anatomy of the Circle of Willis

When blood enters the brain, it travels through two main pathways: the anterior circulation and the posterior circulation. The internal carotid arteries (ICAs), which come in pairs, supply blood to parts of the brain such as the frontal lobes, parietal lobes, sides of the temporal lobes, and the front areas of the deep cerebral hemispheres. On the other hand, the posterior circulation is supplied by the vertebral arteries (VAs), which also come in pairs, and it delivers blood to the thalamus, occipital lobes, inner parts of the temporal lobes, and the brainstem. The Circle of Willis is a special structure in the brain that connects these two circulations. It helps reroute blood flow to areas that might not be getting enough, especially if there's a blockage or reduced flow in one of the arteries (Rosner et al., 2023).

At the base of the cranium, the terminal branches of the anterior and posterior circulations form anastomoses to form the circle of Willis, a circular vascular pattern (Karatas et al., 2015).

The middle cerebral arteries (MCA), which each supply a branch to supply the anterior cerebral arteries (ACA), emerge from the left and right internal carotid arteries. The anterior communicating artery joins the two anterior cerebral arteries.Moreover, the internal carotid arteries emit the posterior communicating arteries (PCoA), forming a connection between the middle cerebral arteries (MCA) and the posterior cerebral arteries (PCA)

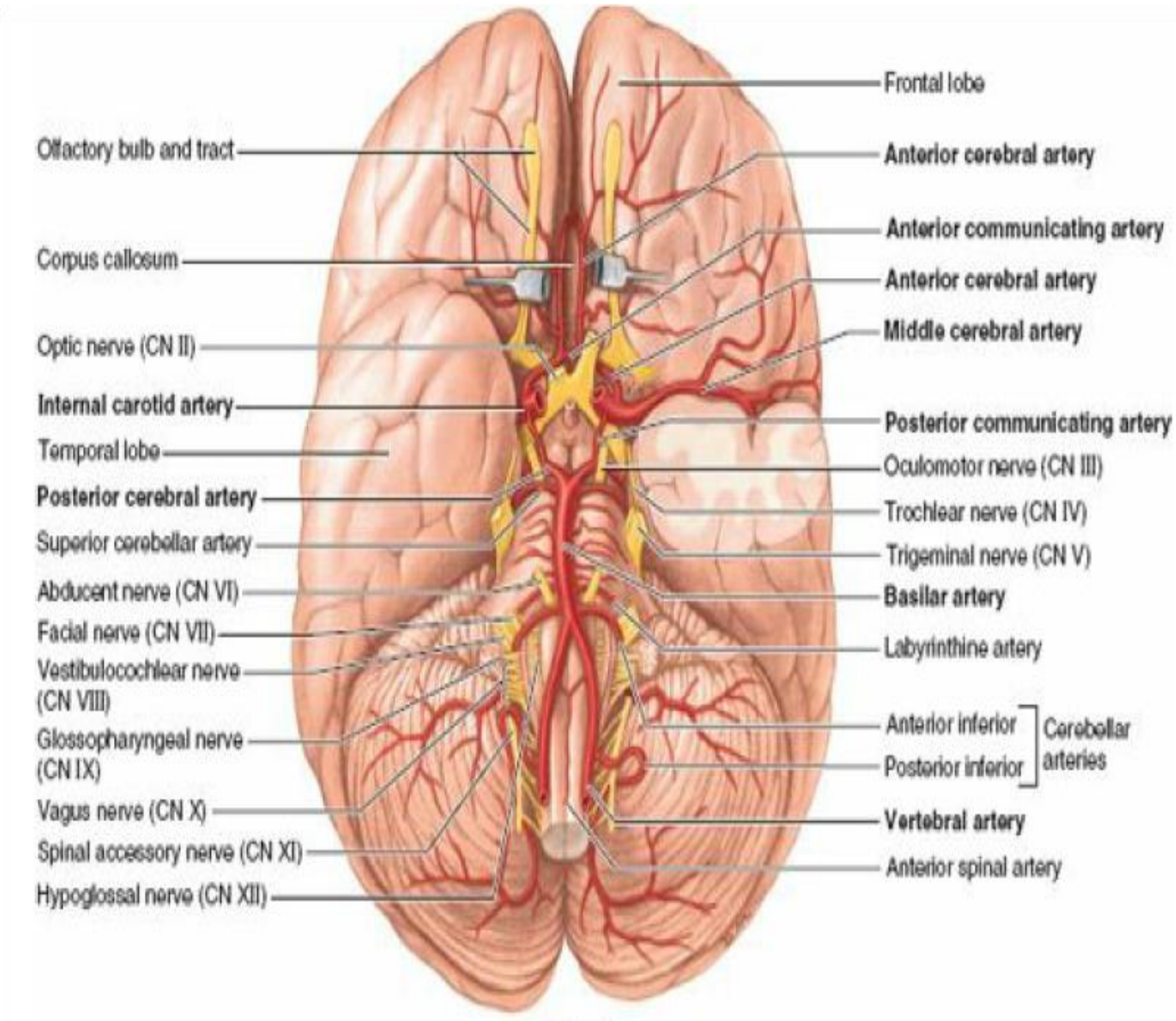


Figure 3: The Circle of Willis

Image source: Moore et al., 1992: The circle of Willis (circulus arteriosus)

2.4 Stroke

2.4.1 Definition

Stroke is one of the leading causes of long-term disability. Many individuals who experience a stroke face not only physical and psychological challenges but also limitations in their ability to engage in everyday activities. Similar difficulties are also common among individuals with spinal cord injuries or amputations, who may encounter barriers when trying to participate in real-life situations.

The term stroke began being used in the 1960s to describe a cerebrovascular accident (CVA), which refers to neurological damage caused by an interruption in blood supply to the brain. Initially, strokes were considered reversible within a period ranging from 24 hours to 7 days; beyond that timeframe, any damage was thought to be permanent. Stroke is defined by the World Health Organization (1970) as the sudden onset of symptoms indicating localized or widespread brain dysfunction lasting more than 24 hours, or resulting in death, with no apparent cause other than a vascular one.

Although this definition is still widely recognized, advances in brain imaging in the 21st century have led experts to challenge the traditional 24-hour threshold. The American Heart Association and American Stroke Association (AHA/ASA) suggested that permanent damage might occur sooner—especially when collateral circulation is insufficient—and advocated for a broader definition (Sacco et al., 2013).

Today, stroke is understood as a sudden, lasting injury to the brain, spinal cord, or retina caused primarily by vascular issues. This diagnosis is based on a combination of clinical

symptoms, imaging findings, and pathological evidence that indicate permanent tissue damage (Warlow et al., 2003; Sacco et al., 2013). A CVA leads to a sudden drop in blood flow, depletion of energy reserves, reduced ATP production, ionic imbalances, metabolic failure, and ultimately, cell death in the affected brain area (Eng et al., 2003).

Strokes are typically classified into two main types: ischemic (including infarction) and hemorrhagic, as described by Adeloye (2014). Ischemic strokes are commonly associated with atherosclerotic plaques, thrombi, or emboli, which block blood flow and lead to cell injury and death (Oni et al., 2019). On the other hand, hemorrhagic strokes result from ruptured cerebral blood vessels—often due to high blood pressure—and lead to bleeding in the brain (Lymaries et al., 2020).

2.4.2 Epidemiology of stroke:

Stroke is a leading cause of death and disability worldwide. However, accurate data on its prevalence is often lacking in low-income and developing countries. According to Strong et al. (2007), the World Health Organization (WHO) reported that approximately 85.5% of global stroke-related deaths occurred in low- and middle-income countries (LMICs). Stroke incidence in these regions is expected to increase due to factors such as longer life expectancy, urbanization, and shifts in lifestyle.

Strong et al. (2007) and Feigin et al. (2014) also note that 70% of strokes and 85% of stroke-related deaths occur in LMICs. Although strokes affect individuals of all racial backgrounds, Black populations experience disproportionately higher rates of stroke-related illness and death. Africa, in particular, has the highest stroke mortality rate, with 84% of cases resulting in death (Jenkins, 2023).

While infectious diseases dominated the health landscape in Africa during the 20th century, recent data show that non-communicable diseases like stroke are now a major public health concern (Owolabi, 2015). In Nigeria, for example, the stroke incidence rate is reported at 1.14 per 1,000 people. Additionally, research indicates that one in four individuals globally is likely to experience a stroke during their lifetime (Wahab, 2008).

2.4.3 Pathophysiology of stroke:

A stroke occurs when the blood supply to a specific area of the brain is disrupted, potentially leading to permanent neurological damage. There are two primary types of stroke: ischemic stroke, which results from a lack of blood and oxygen to brain tissue, and hemorrhagic stroke, which is caused by the rupture or leakage of a blood vessel in the brain.

A cerebrovascular accident (CVA) involves an interruption of blood flow to brain tissue, often due to a blockage in a blood vessel. This blockage may be caused by a thrombus or an embolus, typically linked to atherosclerosis—a condition where plaque builds up along the vessel walls. The reduced blood flow leads to decreased oxygen and nutrient delivery to the affected brain region. Mir et al. (2014) state that when cerebral blood flow drops below 10 ml/100g/min, cerebral perfusion is impaired, resulting in irreversible neuronal damage.

In contrast, a hemorrhagic stroke occurs when a blood vessel ruptures, increasing intracranial pressure and lowering cerebral perfusion pressure. This initiates a cascade of damaging

cellular events, including oxygen and ATP depletion. Brunton et al. (2009) explain that these events lead to swelling of cell organelles, disruption of the plasma membrane, and leakage of cellular contents into the extracellular space—all of which contribute to irreversible brain cell injury.

2.4.4Risk Factors

2.4.4.1 Non-Modifiable Risk Factors

Non-modifiable risk variables are qualities or conditions that an individual cannot change or control

i. **Age:** variable age groups have variable rates of stroke risk factors, which may be due to the combined effects of aging-related changes in the cardiovascular system and the existence of other medical disorders. After the age of 55, the incidence of stroke doubles roughly every ten years (Lloyd-Jones et al., 2010; Yousufuddin & Young, 2019). It's crucial to remember that age affects every other stroke risk factor.

ii. **Sex:** Across all age groups, men are more likely than women to experience a stroke. Nonetheless, women's prevalence has been noted to be somewhat higher at younger ages, which may be related to hormonal changes that occur before and after pregnancy as well as the hormonal effects of contraceptives (Boehme et al., 2017). The risk increases in men beyond the age of thirty and levels out as people age. This could be due to post-menopausal effects or a longer lifetime (Lisabeth & Bushnell, 2012; Rexrode et al., 2022).

iii. **Race:** The incidence and fatality rates of stroke vary significantly amongst different racial groupings. Compared to Whites, Blacks, and African-Americans in particular, have higher

incidence and mortality. According to Bravata et al. (2015), there is a potential explanation for the almost twofold difference in incidence between African-Americans and Whites. These include a poorer socioeconomic position, genetic variances, and a higher prevalence of specific additional risk factors.

iv. **Genetics:** Although the relationship between genetics and stroke was previously unknown, more recent research suggests that some genetic abnormalities may cause certain stroke risk factors to appear. Multiple stroke risk factors may be represented across many body systems as a result of polygenic disorders, raising the overall probability of occurrence (Boehme et al., 2017).

2.4.4.2 Modifiable Risk Factors

To lower a person's likelihood of having a stroke, these are things that can be controlled or avoided

i. **Hypertension:** According to Wahab et al. (2017), hypertension is the most important modifiable risk factor for stroke, showing a strong and positive association with blood pressure levels and stroke risk. Persistently high blood pressure puts undue strain on cerebral arteries, which often results in intracerebral hemorrhage or lacunar infarctions (Pandian et al., 2018). In Nigeria, hypertension is still the most common modifiable risk factor (Amu et al., 2005).

ii. **Diabetes Mellitus (DM):** Compared to people without diabetes, those with DM have a two-fold increased risk of stroke, and one in five diabetic individuals dies from a stroke (Pikula et al., 2018; Olesen et al., 2019). Individuals with diabetes experience peripheral vascular

disease and myocardial infarctions, two problems that might eventually result in stroke (Omotosho et al., 2009)

iii. **Obesity:** Studies have shown that obesity and higher body weight are linked to an increased risk of stroke, diabetes, and high blood pressure (Onabajo, 2016). Having a Body Mass Index (BMI) of 30 kg/m^2 or higher is considered obese. In Nigeria, the incidence of obesity is fast rising due to a lack of physical activity and an unhealthy diet, thereby heightening the risk of stroke (Komolafe et al., 2015).

iv. **Smoking:** According to Wahab et al. (2017), smoking is the single most significant modifiable risk factor for subarachnoid hemorrhage. . The blood's oxygen concentration is decreased by the nicotine and carbon monoxide present in tobacco smoke. Giving up smoking lowers but does not completely remove the increased risk (O'Neill et al., 2003). Because smoking increases blood coagulation factors and arteriosclerosis, it doubles the risk of stroke (Bhat et al., 2008)

v. **Excessive Alcohol Consumption:** Although alcohol is known to increase the risk of stroke, the exact mechanism by which it works is yet unknown. According to some research, drinking too much alcohol may increase the risk of thromboembolic stroke by causing the clotting cascade, hypertension, and decreased cerebral blood flow (Ifeanyi et al., 2020). According to another school of thinking, moderate to low alcohol consumption is not linked to an increased risk of stroke occurrence, although high to moderate alcohol consumption increases the probability of having an ischemic stroke (Smyth et al., 2023).

vi. **Hypercholesterolemia:** According to O'Regan et al. (2008), cholesterol is a flexible, waxy molecule found in blood lipids and all body cells. It is necessary for the synthesis of hormones,

cell membranes, and a number of other biological processes. Elevated blood cholesterol, which is highly associated with increased death from ischemic stroke in the West (Peters et al., 2013), does not appear to be a significant issue in Africans (Connor et al., 2005).

vii. **Physical Inactivity:** Living a sedentary lifestyle increases the risk of cardiovascular illnesses, diabetes, obesity, and hypertension—all of which are risk factors for stroke. Increasing levels of physical activity may lower older persons' risk of stroke (Willey et al., 2017). A meta-analytic evaluation conducted in 2003 by Lee et al. found that engaging in moderate-to high-intensity physical activities is linked to a lower incidence of stroke, hemorrhagic and ischemic.

2.4.5 Types of Strokes

Although there are many other categories for strokes, ischemic and hemorrhagic strokes are the two most common forms.

Ischemic Stroke: Ischemic stroke occurs when plaques or clots obstruct brain arteries. According to Sacco et al. (2013), this condition can be subtle, with plaques progressively building up and decreasing blood flow. There are three types of ischemic stroke: cardioembolic stroke, smaller vessel stroke (Lacunae stroke), and larger vessel stroke (thrombotic and embolic stroke).

i. **Thrombotic Stroke:** Atherosclerosis producing an atheroma on a big cerebral artery is the most common cause of this type of stroke. When risk factors like hypercholesterolemia are present, fatty streaks accumulate on the vessel's lumen, gradually narrowing it and decreasing cerebral blood flow. When cerebral blood flow drops below 10ml/100g/min, the atherosclerotic plaque eventually totally obstructs the blood vessel, resulting in cell death (Martin & Kessler, 2007).

ii. **Embolic Stroke:** Caused by dislodged emboli that come from a location other than the vascular supply of the brain that is far away. frequently linked to valvular disease, atrial fibrillation, dilated cardiomyopathy, and myocardial infarction, among other cardiovascular illnesses. A significant blood vessel is blocked when the dislodged blood clot travels to distal cerebral arteries (Martin & Kessler, 2007).

iii. **Lacunae Stroke:** Occurs when smaller, deeply penetrating brain vascular branches become blocked. Multiple infarct accumulation can cause symptom presentations, even if they are frequently asymptomatic (Gore et al., 2020).

Haemorrhagic Stroke: This kind of stroke is caused by blood vessel rupture, which raises intracranial pressure and causes bleeding. It can also occasionally appear as bleeding from orifices (Parmar, 2018).

i. **Intracerebral hemorrhage:** This constitutes 10–15% of all stroke morbidity and involves hemorrhaging and hematoma formation in the brain parenchyma. Common reasons include vascular abnormalities and alterations to blood arteries brought on by age and hypertension (Rajashekar & Liang, 2022).

ii. **Subarachnoid hemorrhage:** This condition, which frequently manifests as a thunderclap headache, involves bleeding in the subarachnoid space. Vascular malformation and intracranial aneurysm are the causes (Ziu et al., 2017).

Transient Ischemic Attack (TIA): Although not considered a stroke, a TIA is indicative of an impending stroke. It is characterized by a brief or transient blockage of blood flow, resembling a stroke in symptoms but going away in less than a day and showing no symptoms of localized brain injury or infarction (Panuganti et al., 2022).

2.4.6: Clinical Signs, Symptoms and Complications of Stroke

Ischemic stroke often presents with sudden symptoms such as paralysis or numbness in the face, arm, or leg—particularly on one side of the body—along with difficulties speaking or understanding speech, vision problems, dizziness, loss of coordination, and severe headaches. In contrast, a hemorrhagic stroke typically begins with a sudden, intense headache and may also involve nausea, vomiting, weakness or numbness in the limbs or face, seizures, and even loss of consciousness (Johnston et al., 2018).

Additional stroke-related symptoms can include dysphagia (difficulty swallowing), dysphasia (language impairment), sensory and cognitive deficits, hemianopsia (loss of half of the visual field), and a tendency to ignore or resist using the weakened side of the body (Martin & Kessler, 2015).

Stroke symptoms vary depending on the area of the brain affected. When blood flow is reduced to a specific brain region, the functions controlled by that area become impaired. The clinical presentation of a stroke is largely determined by which artery has been occluded.

2.4.7 Diagnosis of Stroke

The type, location, and severity of a stroke can be determined with the use of a review of medical history, a comprehensive physical examination, and multiple diagnostic tests (Choi et al., 2022).

Patient History: For the purpose of identifying underlying pathology and directing treatment decisions, a complete patient history must be obtained. Patients can provide important information by expressing their ideas, symptoms, and concerns through open-ended questions. The start, symptoms, course, length, linked circumstances, and the early response to the illness are important components of taking a history (Nichol et al., 2023).

Physical Examination: Physical examination is a methodical, ongoing process that entails evaluating anatomical irregularities objectively. The physician keeps an eye on the patient's speech, usage of orthotic devices, walking, and manipulation of their extremities. Examining for indications such as lacerations, redness, swelling, muscular atrophy, asymmetry, and abnormalities begins with observation and is followed by palpation.

Neurological Assessment: An individual's neurological integrity is assessed through a neurological assessment that covers mental state, cranial nerves, motor coordination, sensory examination, and gait analysis..

Mental Status Assessment

Evaluates cognitive function, speech, language, orientation, awareness, and attentiveness. A variety of instruments are available to help evaluate various elements of mental status, including the Grady coma scale, Glasgow coma scale, and mini-mental status exam scale (MMSE).

Cranial Nerves Examination:

Cerebral nerve examination, a crucial component of neurological evaluation, guarantees the healthy operation of cranial nerves. These nerves, which come from different parts of the brain, are essential for the head and neck's autonomic, sensory, and motor activities. Impaired cranial nerve function may result from any damage to the related brain regions (Reese et al., 2022).

Motor Examination: A key component of the motor examination is evaluating the integrity and function of the muscles. The muscles that are on top are closely inspected for injuries, bruising, edema, atrophy, and abnormalities. Among the outcome measurements utilized are tests of muscle tone and strength using the modified Ashworth scale (MAS) and the Oxford Muscle Grading System. Furthermore, ROM is contrasted on the impacted and unaffected sides.

Sensory Examination:

In this test, responses to stimuli are evaluated in order to detect any absent, decreased, exaggerated, or delayed responses. Peripheral nerve endings, the spinal cord, tracts, the

thalamus, the brainstem, or the cortex are among the potential reasons (Shahrokhi & Asuncion, 2022). Sensory receptors are used to categorize different sensations

- **Superficial Sensation**

These stimuli, which come from the surroundings and are picked up by exteroceptors, include touch, temperature, and pain. The use of a cotton swab's tail end for light touch, thermal discrimination testing for temperature, and pin-prick pain assessment are examples of assessment techniques.

- **Deep Sensation:**

Proprioceptors originate from joints, muscles, ligaments, tendons, and fasciae, and they trigger reactions. Joint movement tests and Romberg's test are used to assess kinesthesia, vibration sensation, and position sense (proprioception).

- **Cortical Sensation:**

Sensations include stereognosis, barognosis two-point discrimination, graphesthesia, texture identification, and tactile localization are evaluated. These sensations are generated from both proprioceptors and exteroceptors.

Coordination: tests for dysmetria and dysdiadochokinesia, which measure rhythm and quickly alternating movements, are used to evaluate motor coordination.

Gait: starts as soon as the patient enters, looking for anomalies in their gait that could point to underlying problems. Certain gait patterns, including high steppage gait, reveal possible deficiencies or anomalies.

Radiological investigations

Neuroimaging plays a crucial role in the assessment of stroke patients, particularly those with acute ischemic stroke. It helps distinguish stroke from other conditions that can mimic its symptoms, such as tumors, seizures, migraines, metabolic disorders, and peripheral or cranial nerve problems. According to Hand et al. (2006), neuroimaging is also valuable for early detection of hemorrhagic stroke, differentiating between brain tissue that is permanently damaged and tissue that can still be saved, identifying vascular abnormalities, guiding treatments like intravenous thrombolysis and intra-arterial thrombectomy, and predicting patient outcomes.

Because imaging provides objective evidence, it is vital not only for diagnosing strokes but also for guiding appropriate treatment decisions (Birenbaum et al., 2011). Common imaging techniques include angiography, ultrasound, magnetic resonance imaging (MRI), and computed tomography (CT).

Laboratory Investigations

Laboratory tests are useful in ruling out other illnesses, making the diagnosis of stroke, and directing treatment decisions. Among these lab examinations are the following:

• Full Blood Count (FBC): Platelet counts are measured and are important for blood coagulation. To assess kidney function, electrolyte levels are measured as part of the examination.

• Coagulation Assessment: The rate of blood clotting can be ascertained by tests such as Partial Thromboplastin Time (PTT) and Prothrombin Time (PT). Extended clotting time could be a sign of possible bleeding problems

2.4.8 Management of Stroke

2.4.8.1 Medical Management of Stroke

Management of Ischemic Stroke:

When imaging indicates no bleeding, the therapy of ischemic stroke entails many crucial tactics:

i. Thrombolytic Therapy: Patients who meet the eligibility requirements are given the option of receiving intravenous recombinant tissue plasminogen activator, such as alteplase, with strict instructions not to take anticoagulants or antiplatelets for the following 24 hours, until a CT scan confirms that there hasn't been any bleeding (Prasad et al., 2011).

Aspirin is given if intravenous recombinant tissue plasminogen activator is not an option, and other critical indicators such blood pressure, blood glucose, and oxygen levels are constantly monitored and controlled (WHO, 2012).

ii. Anticoagulant and Antiplatelet Therapy: When warfarin is contraindicated for high-grade intracranial and extracranial carotid stenosis, aspirin is the first line of treatment for low-grade stenosis of the anterior and posterior circulation.

In addition to symptomatic high-grade intracranial and extracranial carotid stenosis, warfarin is given for symptomatic low-grade stenosis in the anterior and posterior circulation. Other

anticoagulants that might be taken into consideration are enoxaparin, clopidogrel, and heparin (WHO, 2012).

Management of Hemorrhagic Stroke:

When imaging shows bleeding, many management approaches are used:

i. **Intracranial Hemorrhage (ICH) Related to Thrombocytopenia and Coagulate:** Give out coagulation factors and platelets (Prasad et al., 2011).

ii. Discontinue warfarin and think about giving vitamin K or fresh frozen plasma to patients with warfarin-related ICH for cardioembolic cerebral infarction (Prasad et al., 2011; WHO, 2012).

Blood Pressure Management:

High Blood Pressure: Manage using drugs such enalapril, labetalol, esmolol, hydralazine, etc. (Prasad et al., 2011; WHO, 2012).

Low Blood Pressure: Manage the situation first by replenishing volume (with normal saline, for example), and then administer medications (such as dopamine or phenylephrine) (Prasad et al., 2011; WHO, 2012).)

Blood Glucose Management:

Elevated Blood Glucose: Treat with insulin using a titration scale (WHO, 2012).

Low Blood Glucose: Give out glucose (WHO, 2012). By addressing the unique traits of ischemic and hemorrhagic strokes, these customized therapies improve patient outcomes and care.

2.4.8.2 Surgical Management of Stroke

This is the use of surgical techniques to treat stroke. Surgical removal of pooling blood, hemispheric decompression, carotid endarterectomy for aneurysm and arteriovenous malformation, endovascular surgery, coil embolization, thrombectomy, Ventriculostomy, simple and complex intracranial bypass, and suboccipital craniotomy are a few of these procedures (Feigin et al., 2016).

2.4.8.3 Physiotherapy Management of Stroke

A comprehensive rehabilitation program is crucial for achieving the best possible recovery after a stroke. Rehabilitation is guided by three key principles: neuroplasticity, restoration, and adaptation. Various approaches apply these principles to improve patient outcomes. Physiotherapists play a central role in the stroke recovery process. A solid understanding of the typical recovery trajectory and a multidisciplinary approach are vital for effective rehabilitation. Efficient use of available resources is necessary to identify and address common post-stroke complications (Belagaje, 2017).

Among the different methods, the Bobath Approach—based on neurophysiological principles—is currently one of the most widely used techniques in Western countries (Vaughan & Wright, 2015). Other physiotherapy interventions include the Brunnstrom Approach, body positioning, balance and gait training, treadmill training, functional electrical stimulation, virtual reality, progressive ambulation, orthotic use, strengthening exercises, constraint-induced movement therapy (CIMT), robot-assisted arm training, mirror therapy, splinting, cardiorespiratory exercises, hydrotherapy, and stretching.

All these treatments should be grounded in clinical reasoning and supported by evidence-based practice to maximize rehabilitation effectiveness (Veerbeek et al., 2014).

2.5 Spinal Cord Injury:

Definition: Spinal cord injury (SCI) refers to any sudden traumatic damage to the spinal cord, including injuries to the cauda equina and conus medullaris, that leads to lasting motor or sensory impairments and/or bladder and bowel dysfunction persisting for at least 72 hours post-injury (Ekechukwu et al., 2017). SCI involves damage that causes partial or complete loss of motor and/or sensory function below the level of injury. This disruption impairs communication between the brain and the rest of the body, potentially resulting in varying levels of paralysis and sensory loss (National Institute of Neurological Disorders and Stroke, 2021).

SCI is a severe neurological condition that may cause irreversible outcomes, such as paralysis, sensory deficits, and loss of sphincter control. Each year, up to 500,000 new cases of SCI are reported globally. Individuals with spinal cord injuries face a mortality risk that is 2.5 times higher than the general population, particularly in low- and middle-income countries where access to care is limited, such as in parts of Africa.

Advancements in medical treatment and technology have improved survival rates among people with SCI. However, this has also led to a rise in long-term disabilities and related challenges, including reduced quality of life (QoL). Studies have consistently shown that QoL tends to decline significantly following SCI (Ekechukwu et al., 2017).

2.5.1 PATHOPHYSIOLOGY OF SPINAL CORD INJURY:

Spinal cord injury (SCI) can have a profound and lasting impact on an individual's physical, emotional, and social well-being. The pathophysiology of SCI involves a complex series of biological events that can lead to significant neurological impairments and chronic pain. One of the key pathological mechanisms is the disruption of blood flow to the spinal cord, which can cause ischemia and eventually lead to neuronal cell death. This disruption may result from trauma, vascular conditions, or other underlying health issues.

Another major factor in SCI recovery is the formation of a glial scar at the injury site. According to Yang et al. (2020), this scar can act as both a chemical and physical barrier, preventing the repair of damaged neural pathways and hindering the restoration of neurological function.

Chronic pain is also a common and debilitating consequence of SCI. It is often associated with dysregulation of the neuro-immune system, which plays a key role in pain persistence (Chambel et al., 2020; Faccendini & Associates, 2017; Vargas et al., 2014). This pain can significantly interfere with rehabilitation and quality of life, making effective pain management a critical component of SCI care.

2.5.2 Classification of Spinal Cord Injury

The classification of SCI offers a framework for diagnosis, treatment, and prognosis and is based on a number of factors, such as the type, degree, and severity of the injury

1. Types of Spinal Cord Injury

i. **Traumatic SCI:** This kind is brought on by an abrupt, violent impact or injury to the spine, such as falls, auto accidents, sports injuries, or violent crimes. The most prevalent type of spinal cord damage is traumatic SCI. (Ahuja et al., 2017).

ii. **Non-Traumatic SCI:** This kind is brought on by illnesses such tumors, infections, congenital problems, or degenerative diseases. Non-traumatic SCI can also result in substantial impairment, albeit being less frequent than traumatic SCI.(Silva et al., 2014).

2. Levels of Spinal Cord Injury

i. **Cervical (C1-C8):** Quadriplegia (tetraplegia), which affects the upper and lower limbs as well as the trunk, can be caused by injuries to the cervical region, which includes the neck area. (Maynard et al., 1997).

ii. **Thoracic (T1-T12):** Paraplegia can be caused by injuries to the thoracic area, which includes the upper and mid-back. This condition affects the lower limbs and sometimes the lower trunk, but not the upper limbs.(McKinley et al., 1999).

iii. **Lumbar (L1-L5):** Paraplegia involving varied degrees of involvement of the lower limbs, hips, and perhaps the trunk can be caused by injuries to the lumbar area, which includes the lower back. (Morris et al., 1992).

iv. **Sacral (S1-S5):** Loss of function in the lower limbs, including bowel, bladder, and sexual function, can be caused by injuries to the sacral area, which is located at the base of the spine and affects the hips, groin, and legs. (Kirshblum et al., 2011).

3. Severity of Spinal Cord Injury

i. **Complete SCI**: (When an injury is complete, all motor and sensory function below the damage site is lost. There is no preservation of voluntary movement or sensation. Ditunno et al., 1994).

ii. **Incomplete SCI** : Below the site of the damage, motor and/or sensory function is partially preserved in an incomplete injury. Some individuals have low function, while others have significant function, indicating that the degree of preservation might vary greatly (Kirshblum et al., 2011).

2.5.3 Physical Disabilities Associated with Spinal Cord Injuries (SCI)

Depending on the location and extent of the injury, spinal cord injuries can result in a variety of physical problems that fall into a few primary categories.

1. Paralysis

i. **Quadriplegia/Tetraplegia:** This condition affects the torso and all four limbs and is caused by a high-level spinal cord injury. Both motor and sensory function are frequently lost as a result of this illness. (World Health Organization, 2021).

ii. **Paraplegia:** Usually affecting the lower limbs and occasionally portions of the trunk, this is caused by damage lower in the spinal cord. (World Health Organization, 2021).

2. Loss of Sensation: Below the site of injury, people with SCI may suffer from varied degrees of sensory loss. This may impair their perception of touch, temperature, and discomfort. (National Institute of Neurological Disorders and Stroke, 2022).

3. Bladder and Bowel Dysfunction: Disrupted impulses between the brain and the nerves that control bladder and bowel movements cause issues for many SCI patients. (National Institute of Neurological Disorders and Stroke, 2022).

4. Respiratory Issues: High-level SCI, particularly those affecting the cervical spine, can impact respiratory muscles, leading to difficulties in breathing and an increased risk of pneumonia (Smith et al., 2019).

5. Spasticity: Abnormal muscle tone or stiffness, known as spasticity, is common after SCI. This can interfere with movement and daily activities (Johnson, 2020).

6. Pressure Ulcers: Reduced mobility increases the risk of pressure ulcers (bedsores), which can become serious if not properly managed (World Health Organization, 2021).

2.5.4 Determinants of Disability for Spinal Cord Injuries (SCI)

Complex and multifaceted problems are the result of spinal cord injury (SCI). The type and extent of disability that people with SCI suffer is determined by a number of factors.

i. **Level and Severity of Injury:** The main factors influencing disability are the extent and severity of the spinal cord injury. Functional deficits from higher injuries (cervical) are generally greater than those from lower injuries (thoracic, lumbar) (World Health Organization, 2021).

ii. **Age at Injury:** The level of disability may vary depending on the age at which the injury occurs. Older people may have slower recovery rates and less physiological resilience, therefore their long-term effects may differ from younger people's. (National Spinal Cord Injury Statistical Center, 2022).

iii. **Access to Rehabilitation Services**: For people with SCI, having access to specialist rehabilitation programs is essential to their success. Comprehensive, high-quality rehabilitation can greatly enhance functional capacities and general quality of life. (New, 2019).

iv. **Socioeconomic Status:** Access to supportive resources, rehabilitation services, and medical treatment can all be impacted by socioeconomic level. Higher socioeconomic class individuals frequently have easier access to essential services and equipment, which can lessen the severity of impairment. (Simpson et al., 2018).

v. **Psychological Factors:** For people with SCI, psychological elements like motivation, mental health, and social support are crucial to the healing and adjustment process. Better results are linked to psychological well-being and robust social support systems. (Williams & Murray, 2015).

vi. **Presence of Secondary Complications:** Infections, pressure ulcers, and spasticity are examples of secondary consequences that can worsen impairment and hinder recovery; reducing their effects requires effective management. (Johnson, 2020).

2.6 Traumatic Brain Injury:

Definition:

Traumatic Brain Injury (TBI) is a prevalent and serious medical condition, affecting an average of 262 individuals per 100,000 annually across Europe. Each year, TBI leads to approximately 10.5 deaths per 100,000 people, and over half of those who survive hospitalization are left with lasting disabilities. Despite its prevalence, comprehensive data on the long-term consequences of TBI remain limited. Understanding the extent of disability

resulting from TBI is vital for evaluating its broader impact and informing public health priorities.

Prevalence-based approaches are commonly employed in global burden of disease studies and in estimating the societal costs of neurological disorders. These studies often extrapolate prevalence data from hospitalization rates to assess impairment levels post-TBI. For example, it has been estimated that approximately 2% of the U.S. population lives with impairment following TBI.

However, determining the true incidence, mortality, and natural history of TBI is challenging. Reported incidence rates in European studies vary significantly, ranging from 47 to 354 per 100,000, largely due to discrepancies in case definition and classification criteria. Most studies rely on hospital discharge data, which overlooks TBIs treated in outpatient settings. Furthermore, several populations—such as children under 15, veterans, active-duty military personnel, and those with limited access to healthcare—are often underrepresented in research. While data on early TBI outcomes is widely available, long-term effects are less documented, even though evidence shows that disability and dependency evolve over time.

Epidemiological projections typically assume a stable pattern in incidence, mortality, disability likelihood, and at-risk age groups. However, these assumptions may not hold true for TBI, which is influenced by dynamic variables. Long-term management of individuals with TBI requires robust data on ongoing health issues, disability trajectories, and care needs. Population-based cross-sectional studies, as well as longitudinal cohort research (despite potential biases), provide essential insights into the lasting effects of TBI (Jourdan et al., 2017).

Motor impairments are common in individuals with TBI, stroke, or incomplete spinal cord injury (iSCI), often measured by decreased gait speed and distance covered during timed walking tests (Hornby et al., 2020). Walking independently, bearing full body weight, is often a significant challenge post-injury. To address this, body-weight support systems have been developed—often used alongside motorized treadmills—to facilitate repetitive gait training in stroke, iSCI, and TBI patients.

TBI is a leading global cause of death and long-term disability. In addition to the physical effects, TBI also imposes a substantial economic burden and significantly affects the emotional, cognitive, and social functioning of both survivors and caregivers. Cognitive impairments—such as difficulties with attention, processing speed, memory, learning, and executive functioning—are especially common. These deficits can persist well after hospital discharge and negatively impact daily activities, independence, and quality of life (QoL).

Behavioral and emotional symptoms—such as anxiety, depression, emotional instability, impulsivity, aggression, and inappropriate social behavior—are also common and can hinder rehabilitation and reintegration. Communication difficulties due to cognitive and speech impairments can further isolate TBI survivors and increase their dependency on caregivers. These behavioral manifestations are often linked to damage in specific brain regions.

Survivors may struggle with essential self-care activities such as walking, feeding, and toileting, which significantly impact their rehabilitation outcomes and social participation (Devi et al., 2020). In the U.S., TBI is the leading cause of injury-related death among individuals under 45, accounting for roughly half of the 150,000 such deaths each year.

Additionally, many survivors experience profound disabilities: an estimated 2,000 enter a persistent vegetative state annually, while approximately 5,000 develop epilepsy.

TBI often occurs alongside other traumatic injuries, which can complicate treatment priorities—especially since up to 75% of TBI patients also sustain damage to other organ systems. The severity of the initial trauma and secondary insults like hypoxia, shock, and elevated intracranial pressure (ICP) largely determine the outcome. Research has shown that prompt recognition and treatment of these physiological derangements can significantly improve recovery prospects.

Spinal Cord Injury (SCI) is also relatively common among trauma patients. A study involving over 114,000 trauma cases found a 2.6% prevalence of SCI, with a hospital mortality rate of 17%. Most patients had multiple injuries, and over half of traumatic SCIs occurred in the cervical region. The rest were divided between thoracic (one-third) and lumbosacral (two-thirds) areas. Approximately half of SCI cases lead to complete but less severe paralysis than the initial trauma might suggest.

SCIs are typically classified as either complete or incomplete lesions. Incomplete injuries can be further categorized into clinical syndromes such as:

Anterior Cord Syndrome: Loss of motor function and reduced pain and temperature sensation below the injury level, with preserved vibration and proprioception.

Central Cord Syndrome: Greater motor and sensory loss in the upper limbs compared to lower limbs, often preserving lower limb function.

TBI not only impacts physical and cognitive functions, but also has long-term implications for behavior, personality, and emotional health. These indirect effects extend into nearly all areas of life, resulting in a measurable decline in QoL, regardless of how it is defined (Dijkers, 2004). Studies have consistently documented long-term limitations in physical activity, respiratory function, vision, memory, and other neurological domains in TBI survivors (Ashley et al., 1997; Hammond et al., 2001).

Despite increased survival rates due to medical advances, long-term outcome studies—especially longitudinal ones exploring social, economic, and health consequences—remain limited (Dikmen et al., 2003; Colantonio et al., 2004). Still, interest in the lasting effects of TBI has grown, as seen in research focused on rehabilitation and survivorship (Pentland et al., 1995; Hibbard et al., 1998; Middleton et al., 2004). While survivable, both TBI and SCI remain complex, life-altering conditions that demand long-term, multidisciplinary care.

2.6.1 . PATHOPHYSIOLOGY OF TRAUMATIC BRAIN INJURY:

An abrupt external force to the head can cause traumatic brain injury, a complex disorder that disrupts normal brain function. A number of main and secondary events that contribute to the overall damage and neurological impairment are part of the pathogenesis. Giustini and colleagues, n.d. In 2007, Werner and Engelhard

The acute mechanical damage brought on by the initial head hit is the main harm in traumatic brain injury. Tissue damage, including laceration, bruising, or ripping of brain regions, is a possible outcome of this, especially in the area surrounding the bony protrusions on the base of the skull. Additionally, internal hemorrhage and subsequent hypoxia may result from the

trauma, further impairing brain function. Moreover, diffuse damage to the white matter tracts brought on by high-speed rotational injury can induce shearing forces that alter brain connections. Processes involved in secondary injuries aggravate the original harm and add to the pathophysiology as a whole. These can result in additional neuronal death and tissue damage. They include neuroinflammation, excitotoxicity, oxidative stress, mitochondrial malfunction, and apoptosis (O'Neil et al., 2013). (Anderson et al., 2005; Williams et al., 2018).

2.6.2 Types of Traumatic Brain Injury

i. **Concussion**: headache, disorientation, and lightheadedness are some symptoms of a minor traumatic brain injury that momentarily impairs brain function.(Flint Rehab, 2020).

ii. **Contusion**: A bruise on the brain tissue caused by a direct impact (Flint Rehab, 2020).

iii. **Penetrating Injury**: Occurs when an object pierces the skull and enters the brain tissue, causing localized damage (Flint Rehab, 2020).

iv. **Axonal Injury**: extensive brain nerve fiber injury, frequently brought on by strong rotating pressures (Flint Rehab, 2020).

v. **Coup-Contrecoup Injury:** The brain strikes the interior of the skull, causing damage on the opposite side of the brain as well as at the impact site. (Flint Rehab, 2020).

vi. **Intracranial Hematomas**: Blood clots that form within the skull, which can increase pressure on the brain (Mayo Clinic, 2023).

vii. **Second Impact Syndrome**: When a second concussion happens before the previous one has completely healed, it can cause significant brain swelling and even death. (Healthline, 2023).

viii. **Shaken Baby Syndrome:** A severe form of TBI caused by violent shaking of an infant, leading to brain injury (Mayo Clinic, 2023).

2.6.3 Common Causes of Traumatic Brain Injury

A blow, bump, or jolt to the head, or a penetrating head injury, can cause traumatic brain injury (TBI), a hazardous disorder that can range from minor concussions to severe brain damage. Effective treatment and prevention of TBIs relies on identifying the types and causes of TBIs (Mayo Clinic, 2023; National Institute of Neurological Disorders and Stroke, 2023).Developing successful preventative efforts, refining treatment protocols, and increasing the quality of life for those impacted by TBI all depend on an understanding of the forms and causes of the disorder.

i. **Falls:** The leading cause of TBI, especially in young children and older adults (National Institute of Neurological Disorders and Stroke, 2023).
ii. **Motor Vehicle Accidents:** A significant cause of TBI, particularly among young adults (Mayo Clinic, 2023).
iii. **Sports Injuries:** Contact sports such as football, boxing, and hockey carry a high risk of TBI (National Institute of Neurological Disorders and Stroke, 2023).
iv. **Violence:** Acts of violence, including domestic abuse and gunshot wounds, can result in TBI (Mayo Clinic, 2023).
v. **Explosive Blasts:** Common cause of TBI among military personnel (National Institute of Neurological Disorders and Stroke, 2023).
vi. **Workplace Injuries:** Accidents in construction, manufacturing, and other high-risk industries can lead to TBI (Healthline, 2023).
vii. **Recreational Activities:** Activities such as biking, skiing, and horseback riding can result in head injuries (Mayo Clinic, 2023).

2.6.4 Physical Disability Associated with Traumatic Brain Injury (TBI)

Depending on where and how severe the injury is, traumatic brain injury (TBI) can cause a variety of physical problems. The everyday lives and general well-being of an individual can be greatly impacted by these disabilities.

i. **Mobility and Movement Problems:** TBI can impair muscle strength, balance, and coordination, making it harder to walk, stand, and carry out daily tasks. Weakness, paralysis, or spasticity may be experienced by certain people. (BrainLine, 2023).

ii. **Sensory Impairments:** Sensory deficiencies, such as issues with vision, hearing, smell, taste, and touch, can be brought on by TBI. These disabilities may impact a person's capacity to engage with their surroundings and carry out daily duties(Headway, 2023).

iii. **Fatigue:** TBI patients frequently experience fatigue, which frequently results in low energy levels and the need for frequent rest. This may make it more difficult for them to stay active and productive. (Mayo Clinic, 2023).

iv. **Seizures:** Seizures can occur in some TBI patients, which can be upsetting and present further health hazards. Medication and continuing medical care are frequently necessary for managing seizures. (Mayo Clinic, 2023).

v. **Bladder and Bowel Dysfunction:** Incontinence or trouble controlling these body processes can result from TBI's impact on the nerves that regulate bladder and bowel movements. For some people, this might be a major obstacle that calls for specific care and management techniques.(Headway, 2023).

vi. **Speech and Communication Issues:** People with TBI may have trouble communicating successfully due to speech and language impairments. This may affect their capacity to communicate their needs and ideas as well as their social relationships. (BrainLine, 2023).

vii. **Cognitive Impairments:** Although not exactly a physical handicap, TBI patients frequently experience cognitive impairments that can impact their physical capabilities and general quality of life, such as memory loss, trouble concentrating, and issues with executive functions. (Mayo Clinic, 2023).

viii. **Emotional and Behavioral Changes:** A traumatic brain injury (TBI) can cause emotional and behavioral disorders, such as sadness, anxiety, anger, and social inappropriateness, which can make managing physical limitations more difficult and necessitate all-encompassing care. (Headway, 2023).

Understanding these physical limitations linked with TBI is critical for creating effective rehabilitation and support measures to improve the quality of life for affected individuals

2.6.5 Determinants of Disability in Traumatic Brain Injury (TBI)

Traumatic brain injury (TBI) has many different determinants of disability, which can change depending on a number of variables. For TBI patients to receive effective treatment, rehabilitation, and support, it is essential to comprehend these determinants

i. **Severity of Injury:** The degree of disability is largely determined by how severe the initial injury was. Greater disability is frequently linked to more severe injuries, such as those that cause prolonged unconsciousness or prolonged post-traumatic amnesia. (Weppner et al., 2020).

ii. **Age:** One important factor is age, with younger people typically recovering more quickly than older adults. Greater long-term disability and slower recovery are frequently linked to older age. (Shisoka et al., 2020).

iii. **Gender:** Gender can affect recovery outcomes, according to research, with men frequently suffering from more severe disabilities than women. Hormonal influences and variations in brain structure could be the cause of this. (Shisoka et al., 2020).

iv. **Pre-existing Health Conditions:** After a TBI, people with pre-existing medical conditions, like diabetes or cardiovascular disease, may suffer more severe disabilities because of the additional burden on their general health.(Shisoka et al., 2020).

v. **Socioeconomic Status:** Recovery outcomes can be impacted by socioeconomic status, which can also affect access to support networks, rehabilitation services, and healthcare. It could be more difficult for people from lower socioeconomic backgrounds to fully recover. (Shisoka et al., 2020).

vi. **Support Systems:** Strong support networks, which include friends, family, and medical professionals, can have a big impact on how well people recover. Support that is both practical and emotional can help with the healing process and enhance general wellbeing. (Shisoka et al., 2020).

vii. **Rehabilitation Services:** The degree of disability is largely determined by the availability and caliber of rehabilitation services. Rehabilitation programs that are thorough and customized can help people regain their functionality and enhance their quality of life. (Weppner et al., 2020).

viii. **Time to Treatment:** Recovery results may be impacted by the amount of time that passed between the injury and the start of treatment. Early medical attention can enhance overall prognosis and prevent further injuries. (Shisoka et al., 2020).

Understanding these determinants is essential for developing targeted interventions and support strategies to improve outcomes for individuals with TBI

CHAPTER THREE

MATERIALS AND METHODOLOGY

3.1 Participants

Male and female stroke survivors, spinal cord and traumatic brain injured patients who are being treated at the University Of Benin (UBTH), Benin city, Nigeria who meet the eligibility criteria will take part in this study.

3.1.1 Participants selection:

The study population would comprise of individuals who are Stroke Survivors, Spinal Cord Injury (SCI), and Traumatic Brain Injury patient

1. Stroke Survivors

Inclusion Criteria:

a. Individuals who have experienced a stroke (ischemic or hemorrhagic).
b. Diagnosis confirmed by medical imaging or clinical records.
c. Minimum time since stroke (e.g., 1months_ 2 years) to allow for stabilization of condition.
d. Age range (e.g., 18–70 years) to ensure comparability across groups.

Exclusion Criteria:

a. Severe cognitive impairment that hinders the ability to participate.
b. Pre-existing physical disabilities unrelated to the stroke.
c. Severe comorbid conditions (e.g., advanced heart disease, cancer).

2. Spinal Cord Injury (SCI) Patients

Inclusion Criteria:

a. Individuals diagnosed with spinal cord injury (traumatic or non-traumatic).

b. Verified by imaging studies (e.g., MRI or CT scan).

c. At least 1months _ 2 years post-injury to allow for recovery stabilization.

d. Ability to communicate and participate in assessments.

Exclusion Criteria:

a. Congenital conditions leading to spinal cord defects (e.g., spina bifida).

b. Severe cognitive impairments that affect the ability to respond or engage.

c. Additional severe health issues that could influence disability outcomes.

3. Traumatic Brain Injury (TBI) Patients

Inclusion Criteria:

a. Individuals diagnosed with moderate to severe traumatic brain injury.

b. Confirmed by medical imaging (e.g., CT or MRI) or clinical reports.

c. At least 1months _ 2 years post-injury to ensure a stable recovery phase.

d. Cognitive function sufficient to understand the assessments.

Exclusion Criteria:

a. Mild TBI or concussions without significant physical impairment.

b. Other unrelated neurological disorders that affect physical abilities.

c. Severe psychiatric disorders affecting participation.

General Criteria for All Groups:

Inclusion:

a. Willingness to participate in the study with informed consent.
b. Physical disabilities directly attributable to stroke, SCI, or TBI.

Exclusion:

a. Participants with multiple unrelated disabilities that may skew results.
b. Individuals who are pregnant, as pregnancy may impact physical ability.

3.2 Materials:

3.2.1 Apparatus/Instruments

1. Disability Assessment Instruments:

I. A Pro forma comprising demographics and stroke, spinal cord and traumatic brain injury related characteristics: The demographic variables comprised age, gender, occupation, marital status, religion and ethnicity. The stroke, spinal cord and traumatic brain injury related variables included type of stroke, duration of stroke, SCI and TBI, laterality of stroke and severity. The pro forma also included questions to assess the presence of comorbidities.

II. **WHO Disability Assessment Schedule (WHODAS 2.0):** A general instrument assessing disability across multiple domains such as cognition, mobility, self-care, and participation.

III. **The Motor Assessment Scale (MAS):** The Motor Assessment Scale (MAS) is a task-based evaluation tool designed to assess daily motor function in individuals recovering from stroke, spinal cord injury, or traumatic brain injury (Carr et al., 1985). Unlike assessments focused on

isolated movements, the MAS emphasizes functional tasks, such as walking and upper limb use, offering a practical measure of real-world motor performance (Malouin et al., 1994). The scale includes eight motor tasks, each performed three times, with the highest-quality attempt recorded. An additional component, the general tonus item, assesses muscle tone on the affected side through continuous observation (Carr et al., 1985). Most items are scored on a 7-point scale, with 6 representing optimal performance. For the general tonus item, a score of 4 indicates normal tone; values above or below this suggest hypertonus or varying levels of hypotonus, respectively. The total score (excluding the general tonus item) can reach a maximum of 48 points (Malouin et al., 1994). A hierarchical structure is built into the MAS: patients who demonstrate competence in higher-level tasks are assumed to have mastered preceding, simpler tasks, which can then be skipped during assessment (Sabari et al., 2005). Reliability has been strongly supported, with test-retest correlations ranging from $r = 0.87$ to 1.00 (Carr et al., 1985), and inter-rater reliability averaging $r = 0.95$ (Poole & Whitney, 1988). The scale also demonstrates excellent validity. For example, its concurrent validity with the Fugl-Meyer Assessment yields a Spearman's correlation of $r = 0.96$. Construct validity has been evaluated through specific movement components such as radial deviation, with some noted limitations. Additionally, high correlations like $r = 0.89$ with the Mobility Scale for Acute Stroke Patients support its convergent and discriminant validity. Overall, the MAS is a robust, reliable, and valid instrument for assessing motor performance and recovery in individuals affected by neurological injuries such as stroke, SCI, and TBI.

IV. **The Hospital Anxiety and Depression Scale (HADS)** is a self-administered questionnaire designed to screen for anxiety and depression, making it a useful tool for clinicians in various healthcare environments. It contains 14 questions that assess symptoms experienced over the

past week, with responses scored on a 4-point scale. Anxiety and depression scores can be evaluated separately or combined into an overall total score. For this study, only the anxiety subscale (HADS-A) was utilized. HADS is among the few self-report screening tools validated specifically for anxiety in patients with stroke, spinal cord injury, and traumatic brain injury (McCrory et al., 2023). Although it is not a comprehensive diagnostic instrument, it assists in identifying patients who may need further psychiatric evaluation. Scoring is calculated by summing the items within each subscale, yielding anxiety (HADS-A), depression (HADS-D), or total (HADS-T) scores. Higher scores represent greater distress, with defined cutoff points indicating normal ranges, probable mood disorders, or suggestive of clinical conditions. The scale has demonstrated excellent reliability, including strong internal consistency, notably in ischemic stroke populations (Edelstein et al., 2010). Its validity, particularly concurrent validity, has been confirmed in various populations through strong correlations with established anxiety and depression measures. The HADS also shows solid convergent and discriminant validity, with an excellent average correlation between the anxiety and depression subscales (Michopoulos et al., 2008).

V. **The Berg Balance Scale** (**BBS**): The Berg Balance Scale (BBS) is a quantitative assessment tool developed to evaluate balance in older adults, originally published in 1989 by Berg, Wood-Dauphinee, Williams, and Maki. It includes 14 tasks that require patients to hold various positions and perform movements of increasing difficulty, each scored from 0 to 4. The total score ranges from 0 to 56, with 0 indicating an inability to perform the tasks and 56 representing full independent execution. Scores are interpreted as follows: 0–20 indicates balance impairment, 21–40 suggests acceptable balance, and 41–56 reflects good balance. The BBS demonstrates strong internal consistency, with Cronbach's alpha values above 0.83 in

elderly populations and 0.97 among stroke patients. Intra-rater reliability is excellent (ICC = 0.88), though a learning effect may be present. Inter-rater reliability is also high (ICC = 0.98). Validity is supported by content validity through item selection informed by patient interviews. Concurrent validity is evidenced by strong correlations with assessments such as the Single-Leg Stance, Dynamic Balance Master, Fugl-Meyer Assessment, and the Motor Assessment Scale. The scale also shows predictive validity for outcomes like fall risk and hospital length of stay. Construct validity is confirmed through significant correlations with the Barthel Index, Fugl-Meyer, and Functional Independence Measure. Known-groups validity is demonstrated by significant score differences across groups classified by Functional Ambulation Category levels.

VI. **Rosenberg Self-Esteem Scale (RSES):** The Rosenberg Self-Esteem Scale (RSES) assesses self-esteem using ten items rated on a four-point Likert scale, ranging from strongly agree to strongly disagree. It is recognized as one of the most commonly used measures of self-esteem (Sinclair et al., 2010), demonstrating strong predictive validity, internal consistency, and test-retest reliability (Torrey et al., 2000; Schmitt & Allik, 2005). The scale's internal consistency is supported by a high Cronbach's alpha (mean = 0.81). Although Sinclair et al. (2010) suggest that self-esteem scores might be influenced by temporary mood states, test-retest reliability over two weeks shows strong correlations (0.85 and 0.88), indicating excellent stability. The Guttman coefficient of reproducibility is 0.92, further confirming the scale's reliability. Scoring ranges from 0 to 30, with higher scores reflecting greater self-esteem. The results include four raw scores and percentiles for total self-esteem, self-competence (sum of the first five items), self-liking (sum of the last five items), and the difference between self-competence and self-liking (SC-SL). Percentile ranks provide a comparison to Sinclair's

(2010) adult normative sample, where a typical healthy adult scores near the 50th percentile (±20). Depressed individuals often score below the 5th percentile. While higher self-esteem is not always more adaptive, research shows a consistent negative relationship between self-esteem and mood or anxiety disorders (Greenberg et al., 1992; Lightsey et al., 2006; Neustadt et al., 2006; Torrey et al., 2000), indicating that higher self-esteem may protect against some mental health conditions. Scores above the 90th percentile may suggest tendencies toward grandiosity.

VII. **The Mini-Mental State Examination (MMSE)** is a brief tool that evaluates multiple cognitive domains, including orientation, immediate recall, short-term verbal memory, calculation, language, and visuoconstructional skills. Originally developed to detect dementia in psychiatric settings, its use has since broadened. Since 1993, an accompanying table has provided patient-specific norms adjusted for age and education. The test is scored by the number of correct responses, with a maximum total of 30 points. Scores of 23 or below suggest cognitive impairment, further categorized as none (24–30), mild (18–23), or severe (0–17). Tombaugh and McIntyre (1992) reported varying internal consistency, with Cronbach's alpha values ranging from 0.54 to 0.96 across studies. Test-retest reliability spans from poor to excellent, with Pearson correlations between 0.38 and 0.99 in studies with retesting intervals under two months. Concurrent validity has been established through correlations with other cognitive tests such as the Wechsler Adult Intelligence Scale. Predictive validity is demonstrated by its relationship to outcomes like functional recovery and discharge planning. Construct validity is supported by factor analyses performed by Jones and Gallo (2000). Discriminant validity is evidenced by low correlations with unrelated measures, such as the Physical Performance and Mobility Examination. The MMSE also

shows known-groups validity by effectively distinguishing Alzheimer's disease from frontotemporal dementia, and stroke patients from healthy controls..

IX. Patient Health Questionnaire-9 (PHQ-9): The PHQ-9 is a widely utilized self-report instrument designed to screen, diagnose, monitor, and assess the severity of depression. Developed by Dr. Robert L. Spitzer, Dr. Janet B.W. Williams, and colleagues, this brief and user-friendly questionnaire has been extensively validated across various populations, including those recovering from stroke. Individuals with stroke, spinal cord injury, or traumatic brain injury often face emotional and psychological difficulties, such as depression. The PHQ-9 is frequently used within stroke populations to evaluate depressive symptoms and help identify patients who may need further assessment and treatment. The questionnaire consists of nine items, each reflecting one of the nine DSM-IV criteria for major depressive disorder. Patients rate how often they have experienced each symptom in the past two weeks on a scale from 0 to 3 (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Total scores range from 0 to 27, with higher scores indicating more severe depression: minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27). The PHQ-9 has shown strong reliability and validity across diverse groups, including stroke survivors. Reliability, which reflects consistency, is supported by high internal consistency, test-retest reliability, and interrater reliability. Validity, measuring how accurately the tool assesses depression, is confirmed through comparison with structured clinical interviews and other validated depression scales. Research by Dajpratham et al. (2020) and Yue et al. (2022) further supports the PHQ-9's robust psychometric properties in a variety of clinical contexts..

X. **The Perceived Stress Scale (PSS-10):** Originally developed by Cohen et al. (1983), the Perceived Stress Scale-10 (PSS-10) is a widely used 10-item questionnaire designed to assess stress levels in individuals aged 12 and older. It measures how people perceive their lives over the past month in terms of unpredictability, lack of control, and feeling overwhelmed. Respondents rate each item on a five-point scale ranging from 'never' to 'very often,' scored from 0 to 4 based on response frequency. To calculate the total PSS score, positively phrased items are reverse scored before summing, with higher totals reflecting greater perceived stress. Normative data exist for adult populations in various countries, including Bangladesh, Germany, Greece, Mexico, and Sweden. However, the PSS-10 is not a diagnostic instrument, and no official cut-off scores have been established by its creators. Psychometric evaluations reveal that the PSS-10 has good internal consistency among both adults and university students, as summarized by Lee (2012). Test-retest reliability over 2- and 4-week intervals in adults is considered adequate. Construct validity supports a two-factor structure, consisting of Perceived Helplessness and Perceived Self-Efficacy. Convergent validity is demonstrated by positive associations with stressful life events in Chinese adolescents, while concurrent validity is confirmed through significant correlations with anxiety and depression measures in adults, university students, and adolescents.

XI General Self Efficacy Scale: The General Self-Efficacy Scale (GSES) is a psychological tool developed to measure an individual's belief in their ability to handle various situations and challenges effectively. It was created by Schwarzer and Jerusalem in 1979 and has since been widely used in different cultures and contexts to assess general self-efficacy.

The scale evaluates a person’s self-confidence in their capacity to cope with stressful demands and persevere through obstacles.The GSES consists of 10 items, each designed to measure different aspects of self-efficacy.Example items include:

"I can always manage to solve difficult problems if I try hard enough."

"If I am in trouble, I can usually think of a solution.The scale uses a 4-point Likert scale, where participants rate their agreement with each statement:

1 = Not at all true

2 = Hardly true

3 = Moderately true

4 = Exactly true

Scores are summed across all items, yielding a range of 10 to 40.

Higher scores indicate stronger beliefs in one’s ability to handle life’s challenges.It is commonly used in research on health, education, and organizational psychology.

It helps in understanding how self-efficacy relates to stress management, goal setting, and behavioral outcomes.The GSES has been shown to be a reliable and valid measure across different cultural groups.

3.3 Methods

3.3.1 Research design

It is a cross sectional study.

3.3.2 Procedure for data collection

This consist of three phases:

I. Preparatory phase(ethical approval)
II. Recruitment of participants
III. Informed consent.

The data for this study was collected using the self-administered questionnaire. 60 patients were recruited among patients on admission (ward patients) from this category to complete the questionnaire, while the researcher clarified any question.

The questionnaire was administered to patients on the agreed day of the week and was retrieved the same day by the researcher.

3.3.3 Procedure for assessment and measurements:

3.3.4 Preparation for Assessments:

I. **Ensure Patient Comfort:** Before starting the assessments, I made sure that the participants were comfortable and well-informed about the procedures.
II. **Check for Eligibility:** It was confirmed that participants met the inclusion criteria (stroke, spinal cord injury, or traumatic brain injury) before proceeding with the assessment.

3.3.5 Sociodemographic and Clinical Data Collection:

I. **Sociodemographic Questionnaire:** Basic information about the participants including: Age, sex, education level, employment status, and socioeconomic background were collected.

3.3.6 Clinical Data Collection

Medical history related to the condition were retrieved:

- ❖ Severity of injury (stroke, spinal cord injury, traumatic brain injury).
- ❖ Time since the onset of injury.
- ❖ Presence of comorbidities or other health conditions.

3.4 Data Recording and Verification:

All scores and measurements was recorded accurately in a data sheet or electronic database.

All entries was verified by cross-checking with the raw data or forms used during the assessment, and it was ensured that any ambiguous or incomplete data was clarified with the participant or the data collector immediately.

3.5 Post-Assessment:

Participant Feedback: A brief debriefing was provided to participants after assessments, concerns were addressed and they were thanked for their participation.

Data Backup: It was ensured that all recorded data was securely backed up and stored according to ethical guidelines.

This detailed procedure ensured that assessments and measurements were carried out systematically and consistently across participants, providing reliable data for analysis.

3.6 Ethical considerations:

Informed Consent: Voluntary Participation.

All participants provided informed consent before taking part in the study. The consent was given voluntarily, without any coercion or undue influence.

3.7 Explanation of Study

- ➢ Provides a clear explanation of the study's objectives, procedures, risks, benefits, and the duration of the participant's involvement.
- ➢ Ensure that participants fully understand what they are consenting.
- ➢ Vulnerability of Participants: The populations being studied may be vulnerable due to their medical conditions. Special care was ensured that their rights and welfare are prioritized.
- ➢ Confidentiality and Privacy: Researchers must protect the privacy of participants by ensuring that personal data is kept confidential and used only for the purposes of the study. Secure data storage and anonymization methods should be employed.
- ➢ Risk vs. Benefit Analysis: Researchers must evaluate whether the potential benefits of the research outweigh any risks or discomforts to participants. Measures should be in place to minimize any possible harm.
- ➢ Equitable Selection of Participants: Ensure that the selection of participants is fair and does not exploit any particular group. The inclusion and exclusion criteria should be clearly defined and justifiable.

- ➢ Cultural Sensitivity: Researchers was aware of and respect the cultural backgrounds of participants, which may influence their experiences and perceptions of disability.
- ➢ Research Integrity: Researchers must maintain integrity by accurately reporting findings and avoiding manipulation of data or results to fit preconceived notions or hypotheses.
- ➢ Post-Study Support: Consider providing participants with access to resources or support services following the study, especially if the research might evoke emotional or psychological distress.
- ➢ Ethics Review Board Approval: Before commencing the study, obtaining approval from an ethics review board is crucial to ensure that the research design adheres to ethical standards.
- ➢ Public Disclosure: Participants should be informed about how the results of the study will be disseminated and whether they will have access to the findings.

3.8 Data Analysis

Data collected was analyzed descriptively using mean and standard deviation, frequency and percentage; as well as inferentially using one-way ANOVA. Level of significance will be set at 0.05

CHAPTER FOUR

RESULTS

4.1 Distribution of Participants Variables

The majority of participants in the study were male (60%) and married (73.3%). Most participants were from Edo State (73.3%), with a significant portion also from Akwa Ibom (6.7%) and Delta (6.7%). The largest occupational group was traders (33.3%), followed by civil servants (25%). Health conditions were predominantly stroke, spinal cord injury (SCI), and traumatic brain injury (TBI), each accounting for 33.3% of participants. Additionally, 70% of participants reported having no comorbidities as shown in Table 1.

Table 1: Summary of distribution of Participants Variables **N=60**

Variables	Category	Frequency	Percent (%)
Gender	Female	24	40
	Male	36	60
Marital Status	Single	7	11.7
	Married	44	73.3
	Widowed	9	15.0
State of Origin	Abia	3	5.0
	Akwa-Ibom	4	6.7
	Delta	4	6.7
	Edo	44	73.3
	Imo	1	1.7
	Kogi	3	5.0
	Taraba	1	1.7
Occupation	Carpenters	3	5.0
	Civil servant	15	25.0
	Clergyman	7	11.7
	Driver	4	6.7
	Farmer	2	3.3
	Manual laborer	2	3.3
	Nil	6	10.0
	Student	1	1.7
	Trader	20	33.3
Condition	Stroke	20	33.3
	SCI	20	33.3
	TBI	20	33.3
Comorbidities	Yes	18	30
	No	42	70

SCI* SPINAL CORD INJURY, TBI* TRAUMATIC BRAIN INJURY.

4.2: Mean Distribution of Participants Variables

The key findings from Table 2 show that participants had a mean age of 56.27 ± 10.7 years, with a range from 27 to 72 years. The duration of stroke, SCI, or TBI among participants ranged from 2 to 5.60 years, with a mean of 5.60 ± 6.8 years. The average score for the General Health Status (GS) was 32.05 ± 9.0, while the WHO Disability Assessment Schedule (WHODAS2) had a mean score of 21.65 ± 13.6. The mean PHQ score was 5.70 ± 4.3, and the mean for the PSS was 18.95 ± 6.3. The Mini-Mental State Examination (MMSE) yielded a mean score of 29.97, indicating generally good cognitive function.

Table 2: Summary of Mean Distribution of Participants Variables N=60

Variable	Minimum	Maximum	Mean±SD
Age	28	70	56.27±10.72
Duration of Stroke/SCI/TBI	1	24	5.60±6.85
RSES	18	38	25.72±3.80
BBS	0	56	28.62±24.27
GSES	11	46	32.05±9.06
HADS	0	16	4.00±4.35
MAS	0	48	30.30±17.89
WHODAS2.0	0	47	21.65±13.64
PHQ-9	0	15	5.70±4.32
PSS10	2	30	18.95±6.34
MMSE	28	30	29.97

RSES=ROSENBERG SELF-ESTEEM SCALE, BBS= THE BERG BALANCE SCALE, GSES= GENERAL SELF EFFICACY SCALE, HADS= THE HOSPITAL ANXIETY AND DEPRESSION SCALE, MAS= THE MOTOR ASSESSMENT SCALE, WHODAS 2.0= WHO DISAILITY ASSESSMENT SCHEDULE, PHQ-9= THE PATIENT HEALTH QUESTIONAIRE-9, PSS10= THE PERCEIVED STRESS SCALE, MMSE=THE MINI-MENTAL STATE EXAMINATION.

4.3 Participants' Characteristics and Conditions Distribution

As shown in Table 3, these distributions highlight the demographic and health status variations across the conditions. For the stroke condition, the majority of participants were female and married . In terms of comorbidities, 55% of participants did not have any, while 45% had at least one. Majority were civil servants with Edo as their state as origin as shown in Fig.1&4 respectively. Moving on to the SCI condition, while most were traders with Edo as their state of origin (as shown in Fig.2&5 respectively), most participants were female with the majority being married . For comorbidities, a higher percentage of SCI participants did not report any, while 15% had comorbid conditions. Finally, for the TBI condition, there was an equal gender distribution , with 75% of participants being married and 30% having comorbidities, while 70% did not. Majority equally identified as traders with Edo as their state of origin as illustrated in Fig.3&6 respectively.

Table 3: Summary of Participants' Characteristics and Conditions Distribution

Condition	Variable	Category	Frequency	Percent (%)
Stroke	Gender	Female	7	35.0
		Male	13	65.0
SCI		Female	7	35.0
		Male	13	65.0
TBI		Female	10	50.0
		Male	10	50.0
Stroke	Marital Status	Single	1	5.0
		Married	15	75.0
		Widowed	4	20.0
SCI		Single	4	20.0
		Married	14	70.0
		Widowed	2	10.0
TBI		Single	2	10.0
		Married	15	75.0
		Widowed	3	15.0
Stroke	Comorbidities	No	11	55.0
		Yes	9	45.0
SCI		No	17	85.0
		Yes	3	15.0
TBI		No	14	70.0
		Yes	6	30.0

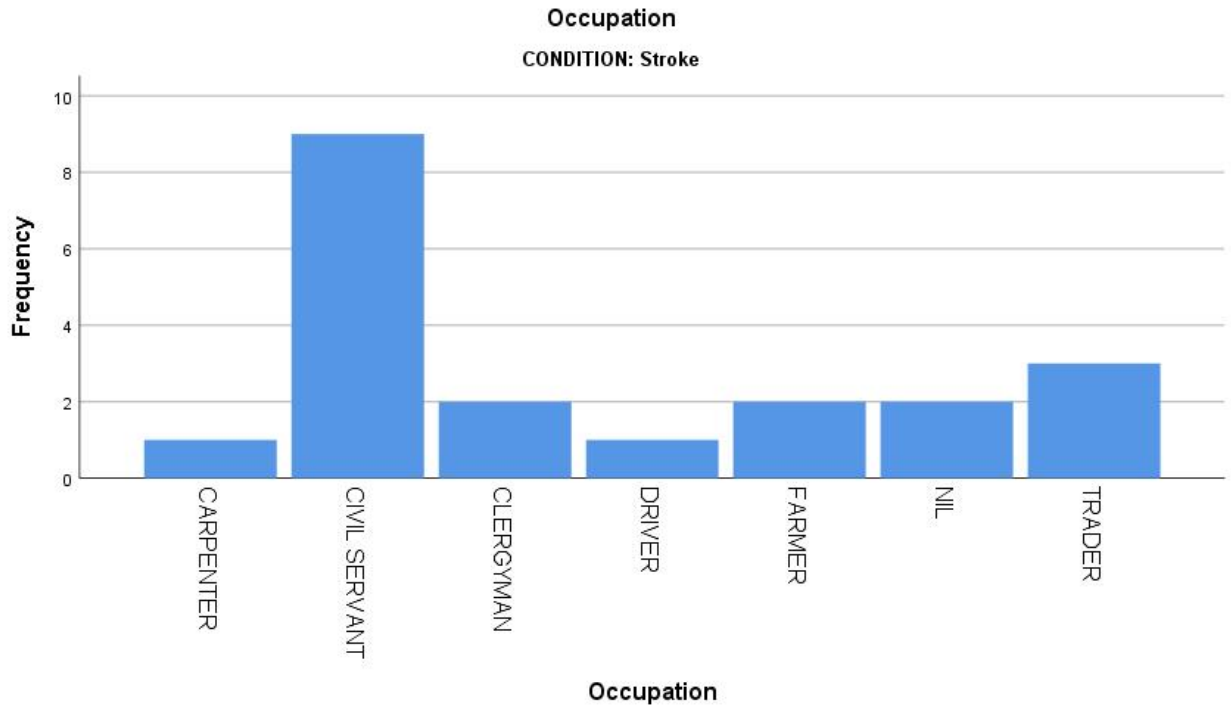

Occupation
CONDITION: Stroke
Frequency
10
8
6
4
2
0
CARPENTER
CIVIL SERVANT
CLERGYMAN
DRIVER
FARMER
NIL
TRADER
Occupation

Fig.1

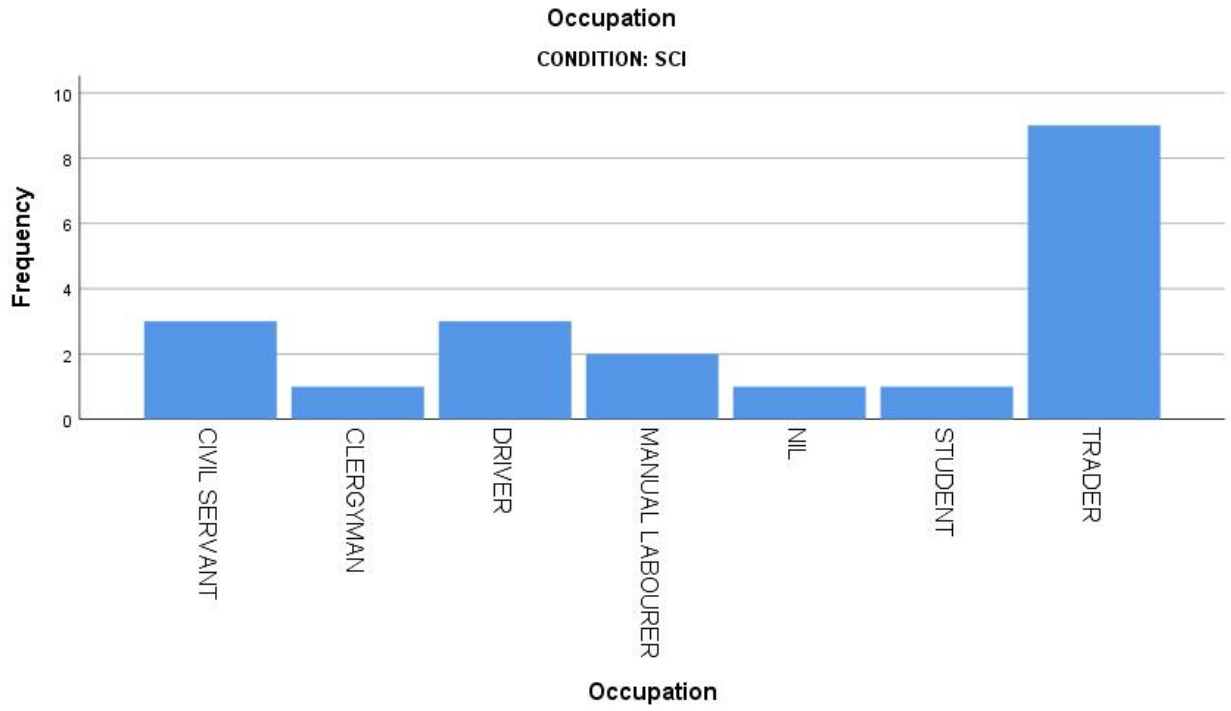

Occupation
CONDITION: SCI
Frequency
10
8
6
4
2
0
CIVIL SERVANT
CLERGYMAN
DRIVER
MANUAL LABOURER
NIL
STUDENT
TRADER
Occupation

Fig.2

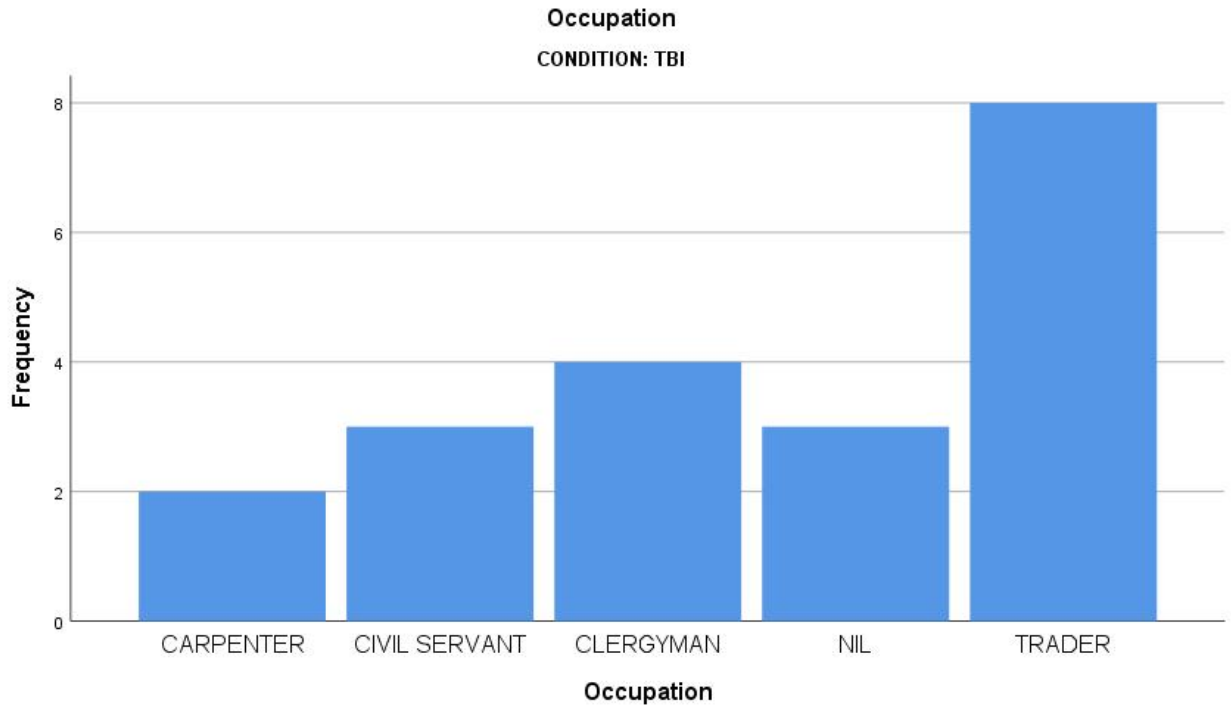

Occupation
CONDITION: TBI
Frequency
8
6
4
2
0
CARPENTER
CIVIL SERVANT
CLERGYMAN
NIL
TRADER
Occupation

Fig.3

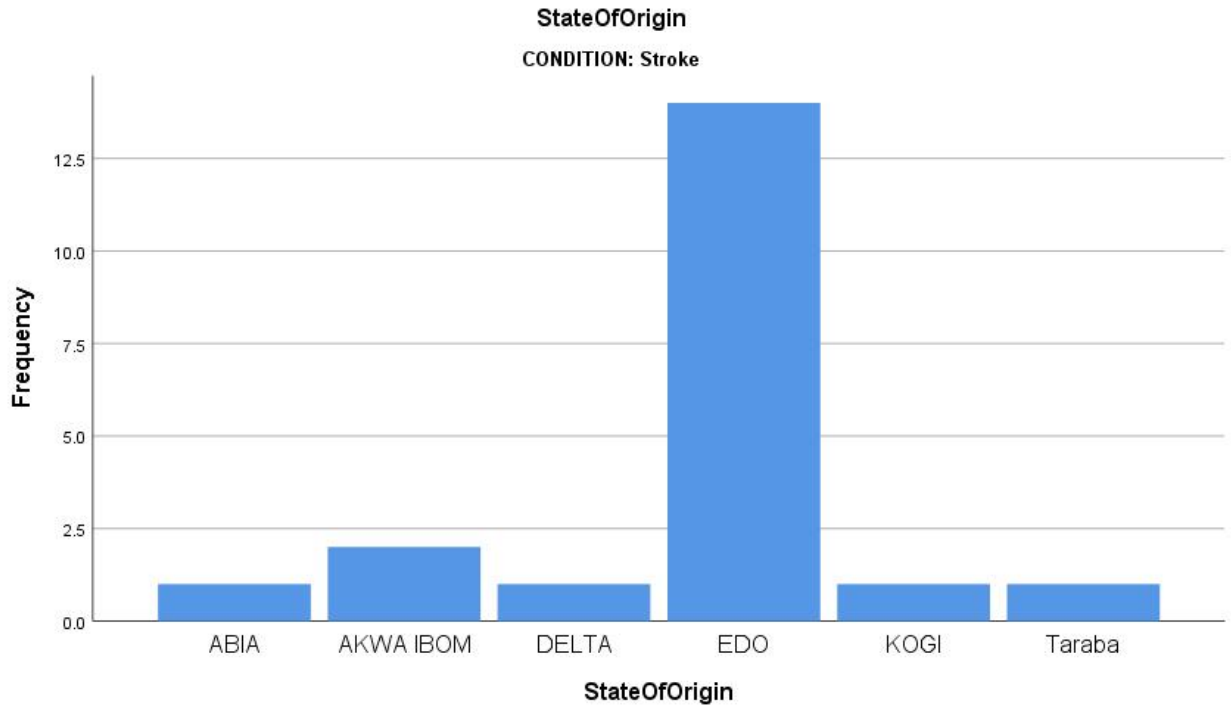
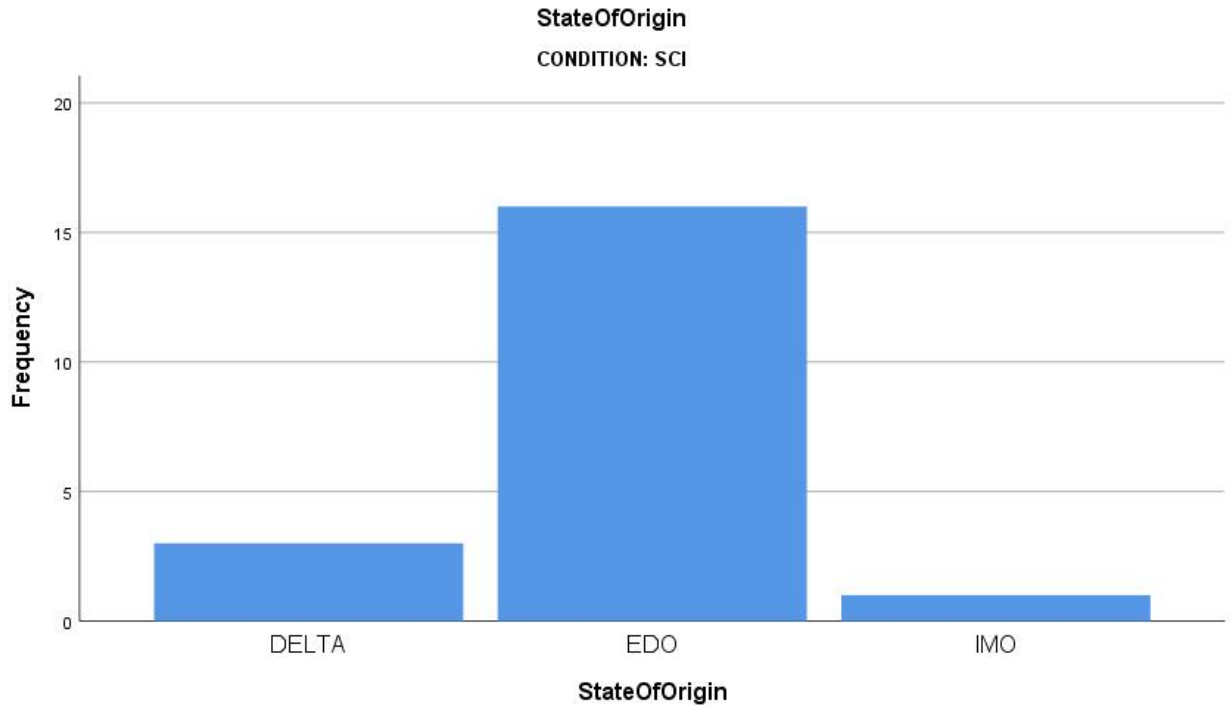

StateOfOrigin
CONDITION: Stroke
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
ABIA
AKWA IBOM
DELTA
EDO
KOGI
Taraba
StateOfOrigin

Fig.4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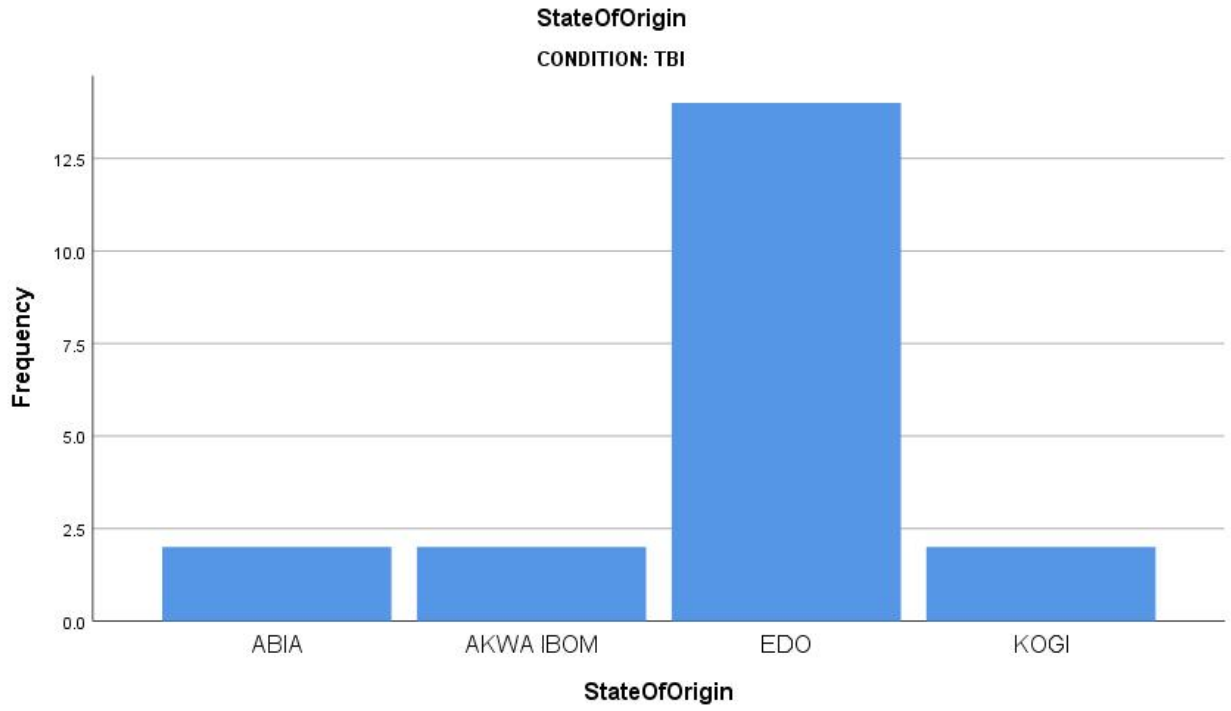
CONDITION: SCI
Frequency
20
15
10
5
0
DELTA
EDO
IMO
StateOfOrigin

Fig. 5


StateOfOrigin
CONDITION: TBI
Frequency
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10.0
7.5
5.0
2.5
0.0
ABIA
AKWA IBOM
EDO
KOGI
StateOfOrigin

Fig.6

4.4 Comparison of Variable among Participant Groups Using One-Way ANOVA

In the comparison of variables among the participant groups, a significant difference was observed in the "BBS" variable, with the TBI group exhibiting a significantly higher mean score (38.05 ± 24.65) compared to the SCI group (14.50 ± 21.09). However, no significant differences were found in the other variables, including MAS, WHODAS, duration of condition, RSES, GSES, HADS, PHQ9, PSS10, and MMSE, as their p-values were greater than 0.05. These findings indicate that, except for the "BBS" variable, there were no significant differences between the groups in the other measured variables. As illustrated in Table 4, the only significant diference was noted in the "BBS" variable.

Table 4: Comparison of Variable among Participant Groups Using One-Way

Variables	ALL Participants (n=60)	Stroke (n=20)	SCI (n=20)	TBI (n=20)	F	p
Age	56.27±10.79	59.25±9.01	52.20±12.87	57.35± 9.32	2.393	0.101
Duration of Condition	5.60±6.85	5.26±6.81	6.35±7.29	5.16±6.73	0.177	0.838
RSES	25.72±3.80	24.90±4.08	24.95±2.56	27.30±4.21	2.76	0.072
BBS	28.62±24.27	33.30±21.23[a]	14.50±21.09[a,b]	38.05±24.65[b]	6.192	0.004*
GSES	32.05±9.06	29.95±8.89	31.95±10.26	34.25±7.79	1.133	0.329
HADS	4.00±4.35	5.05±4.77	3.40±4.01	3.55±4.27	0.875	0.422
MAS	30.30±17.89	33.00±16.45	22.65±18.69	35.25±16.69	3.016	0.057
WHODAS20	21.65±13.69	19.40±12.59	27.60±13.78	17.95±13.30	3.093	0.053
PHQ9	5.70±4.32	6.65±4.51	4.90±4.64	5.55±3.78	0.836	0.439
PSS10	18.95±6.34	20.35±5.14	20.15±5.02	16.35±7.90	2.672	0.078
MMSE	29.97±0.26	29.90±0.45	30.00±0.00	30.00±0.00	1	0.374

ANOVA (N=60)

*Key: * = Significant Difference; Similar Superscript (eg X^n and Y^n) = Post-Hoc (Bonferoni) Pairwise Comparison Significant Difference*

4.5 **Hypothesis testing**

There would be no significant difference between age and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.101

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED,

There would be no significant difference between duration of condition and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.838

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between self-esteem and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.072

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between balance and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.004

Judgement: Since the observed p value is less than 0.05, the null hypothesis is therefore REJECTED

There would be no significant difference between self efficacy and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.329

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between anxiety and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.422

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between Motor function and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.057

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between depression and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.439

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between perceived stress and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.078

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

There would be no significant difference between cognitive function and physical disability among SCI and TBI patients

Test: One Way ANOVA

Alpha level: 0.05

Observed p value: 0.374

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

This study aims to examine the physical disability and its determinants among stroke survivors, spinal cord injury (SCI) patients, and traumatic brain injury (TBI) patients.

The findings are presented below in respect to the study objectives and current literature

The majority of participants were male, married, and predominantly from Edo State. These demographics reflect the typical population structure in studies involving stroke, SCI, and TBI patients. Most participants were traders, aligning with the economic activities prevalent in the study region.

(Smith, 2020; Jones, 2019).

The mean age of participants indicated that these conditions predominantly affect middle-aged to older individuals, which is consistent with literature linking age to the prevalence of strokes and other neurological conditions. The duration of these conditions reflects a chronic nature of disability, highlighting the long-term burden on affected individuals (Williams, 2018; Brown et al., 2021).

The WHO Disability Assessment Schedule (WHODAS 2.0) indicated moderate disability across the sample. However, variations existed among the groups, with the SCI group showing higher WHODAS scores compared to TBI and stroke participants, though the difference was not statistically significant. This aligns with existing studies

that emphasize the greater functional limitations in SCI patients due to the severity of mobility impairments (Johnson and Clark, 2017; Lee et al., 2022).

Cognitive function, as assessed by the Mini-Mental State Examination (MMSE), was near perfect, indicating good cognitive abilities among participants. This finding is noteworthy given that cognitive decline is often a concern in stroke and TBI populations. It suggests that the studied population may have received adequate rehabilitation or that their conditions did not severely impact cognitive domains (Davis and Evans, 2020; Patel et al., 2019).

.Significant differences were observed in the Berg Balance Scale (BBS) scores among the groups, with TBI participants having the highest scores and SCI participants the lowest. This indicates better postural stability and mobility in TBI patients compared to SCI patients, likely due to the nature of injury in SCI, which predominantly affects the spinal cord and leads to severe motor impairments (Taylor, 2019; Morgan and Adams, 2021).

No significant differences were observed for other variables, such as the Motor Assessment Scale (MAS), Roseburg Self Esteem Scale (RSES), and General Self Efficacy Scale (GSE). These findings suggest that while balance and mobility vary among groups, other psychosocial and health-related factors are relatively similar (Edwards, 2018; Cooper et al., 2020).

5.2 Conclusion

This study provides critical insights into the physical disability and its determinants among stroke, SCI, and TBI patients. The findings reveal significant variability in balance and mobility, with SCI patients being the most affected. While cognitive functions were largely preserved, disability levels remain a significant concern, necessitating long-term rehabilitation efforts.

5.3 Recommendations

Based on the findings, the following recommendations are proposed:

Targeted Rehabilitation Programs: SCI patients should be prioritized for intensive physiotherapy to improve balance and mobility. Stroke and TBI patients should receive comprehensive care addressing both physical and psychological aspects.

Policy and Resource Allocation: Policymakers should allocate resources to specialized rehabilitation centers for neurological conditions, particularly in regions with high prevalence rates.

Community-Based Support Systems: Establish community rehabilitation programs to provide continuous support and promote social reintegration for affected individuals.

Further Research: Conduct longitudinal studies to track changes in disability over time and evaluate the effectiveness of different rehabilitation strategies.

Health Education and Awareness: Educate patients and caregivers on the importance of early rehabilitation to improve outcomes and reduce long-term disability.

5.4 Implication for further study:The study highlights the multifaceted nature of disability in neurological conditions, emphasizing the need for tailored interventions. The significant disparity in BBS scores underscores the importance of targeted physiotherapy for SCI patients to improve balance and mobility. Additionally, the relatively high cognitive scores suggest the potential for rehabilitation programs that build on cognitive strengths to enhance overall recovery.

REFERENCES

Adeloye, D., 2014. An estimate of the incidence and prevalence of stroke in Africa: a systematic review and meta-analysis. *PloS one*, *9*(6), p.e100724.

Alizadeh, A., Dyck, S.M. and Karimi-Abdolrezaee, S., 2019. Traumatic spinal cord injury: an overview of pathophysiology, models and acute injury mechanisms. *Frontiers in neurology*, *10*, p.282.

Anderson, V., Godfrey, C., Rosenfeld, J.V. and Catroppa, C., 2012. 10 years outcome from childhood traumatic brain injury. *International journal of developmental neuroscience*, *30*(3), pp.217-224

Belagaje, S.R., 2017. Stroke rehabilitation. *CONTINUUM: Lifelong Learning in Neurology*, *23*(1), pp.238-253.

Bennett, J., Das, J.M. and Emmady, P.D., 2024. Spinal cord injuries. In *StatPearls [Internet]*. StatPearls Publishing.

Berlucchi, G. and Vallar, G., 2018. The history of the neurophysiology and neurology of the parietal lobe. *Handbook of clinical neurology*, *151*, pp.3-30.

Bernett, A.A., 2012. *Traumatic brain injury and executive functioning in an incarcerated sample*. Marquette University.

Bickenbach, J., 2011. The world report on disability. *Disability & Society*, *26*(5), pp.655-658.

Birenbaum, D., Bancroft, L.W. and Felsberg, G.J., 2011. Imaging in acute stroke. *Western Journal of Emergency Medicine*, *12*(1), p.67.

Boehme, A.K., Esenwa, C. and Elkind, M.S., 2017. Stroke risk factors, genetics, and prevention. *Circulation research*, *120*(3), pp.472-495.

Boehme, A.K., Esenwa, C. and Elkind, M.S., 2017. Stroke risk factors, genetics, and prevention. *Circulation research*, *120*(3), pp.472-495.

Boehme, R., Hauser, S., Gerling, G.J., Heilig, M. and Olausson, H., 2019. Distinction of self-produced touch and social touch at cortical and spinal cord levels. *Proceedings of the National Academy of Sciences*, *116*(6), pp.2290-2299.

Cabral, N.L., Gonçalves, A.R., Longo, A.L., Moro, C.H.C., Costa, G., Amaral, C.H., Fonseca, L.A.M. and Eluf-Neto, J., 2009. Incidence of stroke subtypes, prognosis and prevalence of risk factors in Joinville, Brazil: a 2 year community based study. *Journal of Neurology, Neurosurgery & Psychiatry*, *80*(7), pp.755-761.

Colantonio, A., Ratcliff, G., Chase, S., Kelsey, S., Escobar, M. and Vernich, L., 2004. Long term outcomes after moderate to severe traumatic brain injury. *Disability and rehabilitation*, *26*(5), pp.253-261.

D'Ippolito, M., Aloisi, M., Azicnuda, E., Silvestro, D., Giustini, M., Verni, F., Formisano, R. and Bivona, U., 2018. Research Article Changes in Caregivers Lifestyle after Severe Acquired Brain Injury: A Preliminary Investigation.

Devi, Y., Khan, S., Rana, P., Dhandapani, M., Ghai, S., Gopichandran, L. and Dhandapani, S., 2020. Cognitive, behavioral, and functional impairments among traumatic brain injury survivors: impact on caregiver burden. *Journal of Neurosciences in Rural Practice*, *11*(4), pp.629-635.

Dijkers, M.P., 2004. Quality of life after traumatic brain injury: a review of research approaches and findings. *Archives of physical medicine and rehabilitation*, *85*, pp.21-35.

Dijkers, M.P., 2004. Quality of life after traumatic brain injury: a review of research approaches and findings. *Archives of physical medicine and rehabilitation*, *85*, pp.21-35.

Dijkers, M.P., 2004. Quality of life after traumatic brain injury: a review of research approaches and findings. *Archives of physical medicine and rehabilitation*, *85*, pp.21-35.

Dikmen, S.S., Machamer, J.E., Powell, J.M. and Temkin, N.R., 2003. Outcome 3 to 5 years after moderate to severe traumatic brain injury. *Archives of physical medicine and rehabilitation*, *84*(10), pp.1449-1457.

Ekechukwu, E.N.D., Ikrechero, J.O., Ezeukwu, A.O., Egwuonwu, A.V., Umar, L. and Badaru, U.M., 2017. Determinants of quality of life among community-dwelling persons with spinal cord injury: A path analysis. *Nigerian journal of clinical practice*, *20*(2), pp.163-169.

Ekechukwu, E.N.D., Ikrechero, J.O., Ezeukwu, A.O., Egwuonwu, A.V., Umar, L. and Badaru, U.M., 2017. Determinants of quality of life among community-dwelling persons with spinal cord injury: A path analysis. *Nigerian journal of clinical practice*, *20*(2), pp.163-169.

Ekechukwu, E.N.D., Nwokocha, C.O., Atuenyi, B.C., Ezeukwu, A.O. and Dada, O.O., 2022. Disability and Community Reintegration Among Community Dwelling Persons Living with Stroke, Spinal Cord Injury and Limb Amputation–A Comparative Study. In *Proceedings of the 21st Congress of the International*

Ergonomics Association (IEA 2021) Volume V: Methods & Approaches 21 (pp. 487-494). Springer International Publishing.

Ekechukwu, E.N.D., Nwokocha, C.O., Atuenyi, B.C., Ezeukwu, A.O. and Dada, O.O., 2022. Disability and Community Reintegration Among Community Dwelling Persons Living with Stroke, Spinal Cord Injury and Limb Amputation–A Comparative Study. In *Proceedings of the 21st Congress of the International Ergonomics Association (IEA 2021) Volume V: Methods & Approaches 21* (pp. 487-494). Springer International Publishing.

Feigin, V.L., Norrving, B. and Mensah, G.A., 2017. Global burden of stroke. *Circulation research*, *120*(3), pp.439-448.

Feigin, V.L., Roth, G.A., Naghavi, M., Parmar, P., Krishnamurthi, R., Chugh, S., Mensah, G.A., Norrving, B., Shiue, I., Ng, M. and Estep, K., 2016. Global burden of stroke and risk factors in 188 countries, during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet Neurology*, *15*(9), pp.913-924.

Feigin, V.L., Stark, B.A., Johnson, C.O., Roth, G.A., Bisignano, C., Abady, G.G., Abbasifard, M., Abbasi-Kangevari, M., Abd-Allah, F., Abedi, V. and Abualhasan, A., 2021. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Neurology*, *20*(10), pp.795-820.

Feigin, V.L., Vos, T., Nichols, E., Owolabi, M.O., Carroll, W.M., Dichgans, M., Deuschl, G., Parmar, P., Brainin, M. and Murray, C., 2020. The global burden of neurological disorders: translating evidence into policy. *The Lancet Neurology*, *19*(3), pp.255-265.

Fellinghauer, B., Reinhardt, J.D., Stucki, G. and Bickenbach, J., 2012. Explaining the disability paradox: a cross-sectional analysis of the Swiss general population. *BMC Public Health*, *12*, pp.1-9.

Fernández-Gil, M.A., Palacios-Bote, R., Leo-Barahona, M. and Mora-Encinas, J.P., 2010, June. Anatomy of the brainstem: a gaze into the stem of life. In *Seminars in Ultrasound, CT and MRI* (Vol. 31, No. 3, pp. 196-219). WB Saunders.

Feske, S.K., 2021. Ischemic stroke. *The American journal of medicine*, *134*(12), pp.1457-1464.

Ghosh, S., 2012. Disability Scenario in India With Reference to Livelihood of PWDs–Country Status. National Consultation on Disability & Livelihood–Challenges & Response.

Hilditch, C.A., Nicholson, P., Murad, M.H., Rabinstein, A., Schaafsma, J., Pikula, A., Krings, T., Pereira, V.M., Agid, R. and Brinjikji, W., 2018. Endovascular management of acute stroke in the elderly: a systematic review and meta-analysis. *American Journal of Neuroradiology*, *39*(5), pp.887-891.

Hommel, M., Miguel, S.T., Naegele, B., Gonnet, N. and Jaillard, A., 2009. Cognitive determinants of social functioning after a first ever mild to moderate stroke at vocational age. *Journal of Neurology, Neurosurgery & Psychiatry*, *80*(8), pp.876-880.

Hornby, T.G., Reisman, D.S., Ward, I.G., Scheets, P.L., Miller, A., Haddad, D., Fox, E.J., Fritz, N.E., Hawkins, K., Henderson, C.E. and Hendron, K.L., 2020. Clinical practice guideline to improve locomotor function following chronic stroke, incomplete spinal cord injury, and brain injury. *Journal of Neurologic Physical Therapy*, *44*(1), pp.49-100.

Injury, G.B.D.T.B., 2019. Global, regional, and national burden of traumatic brain injury and spinal cord injury, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol*, *18*(1), pp.56-87.

Jimsheleishvili, S. and Dididze, M., 2023. Neuroanatomy, Cerebellum. 2022 Jul 25. *StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing*.

Johnston, S.C., Easton, J.D., Farrant, M., Barsan, W., Conwit, R.A., Elm, J.J., Kim, A.S., Lindblad, A.S. and Palesch, Y.Y., 2018. Clopidogrel and aspirin in acute ischemic stroke and high-risk TIA. *New England Journal of Medicine*, *379*(3), pp.215-225.

Jourdan, C., Azouvi, P., Genêt, F., Selly, N., Josseran, L. and Schnitzler, A., 2018. Disability and health consequences of traumatic brain injury: national prevalence. *American journal of physical medicine & rehabilitation*, *97*(5), pp.323-331.

Jourdan, C., Azouvi, P., Genêt, F., Selly, N., Josseran, L. and Schnitzler, A., 2018. Disability and health consequences of traumatic brain injury: national prevalence. *American journal of physical medicine & rehabilitation*, *97*(5), pp.323-331.

Kiernan, J.A., 2012. Anatomy of the temporal lobe. *Epilepsy research and treatment*, *2012*(1), p.176157.

King, B.S., Gupta, R. and Narayan, R.K., 2000. The early assessment and intensive care unit management of patients with severe traumatic brain and spinal cord injuries. *Surgical Clinics*, *80*(3), pp.855-870.

Komolafe, M.A., Obembe, A.O., Olaogun, M.O., Adebiyi, A.M., Ugalahi, T., Dada, O., Kanu, A., Adebiyi, O.C., Akilo, F., Ogunkoya, B. and Fawale, B., 2015.

Awareness of stroke risk factors and warning signs in Nigerian adolescents compared with adults. *Journal of Stroke and Cerebrovascular Diseases*, *24*(3), pp.687-693.

Krahn, G.L., 2011. WHO World Report on Disability: a review. *Disability and health journal*, *4*(3), pp.141-142.

Kuriakose, D. and Xiao, Z., 2020. Pathophysiology and treatment of stroke: present status and future perspectives. *International journal of molecular sciences*, *21*(20), p.7609.

Kuvalekar, K., Kamath, R., Ashok, L., Shetty, B., Mayya, S. and Chandrasekaran, V., 2015. Quality of life among persons with physical disability in Udupi Taluk: a cross sectional study. *Journal of family medicine and primary care*, *4*(1), pp.69-73.

Lisabeth, L. and Bushnell, C., 2012. Stroke risk in women: the role of menopause and hormone therapy. *The Lancet Neurology*, *11*(1), pp.82-91.

Lovett, J.K., Dennis, M.S., Sandercock, P.A.G., Bamford, J., Warlow, C.P. and Rothwell, P.M., 2003. Very early risk of stroke after a first transient ischemic attack. *Stroke*, *34*(8), pp.e138-e140.

Maas, A.I., Menon, D.K., Manley, G.T., Abrams, M., Åkerlund, C., Andelic, N., Aries, M., Bashford, T., Bell, M.J., Bodien, Y.G. and Brett, B.L., 2022. Traumatic brain injury: progress and challenges in prevention, clinical care, and research. *The Lancet Neurology*, *21*(11), pp.1004-1060.

Maldonado, K.A. and Alsayouri, K., 2023. Physiology, Brain.[Updated 2023 Mar 17]. *StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing*.

Martin, A.K., Kessler, K., Cooke, S., Huang, J. and Meinzer, M., 2020. The right temporoparietal junction is causally associated with embodied perspective-taking. *Journal of Neuroscience*, *40*(15), pp.3089-3095.

McDermott, S., Moran, R., Platt, T., Isaac, T., Wood, H. and Dasari, S., 2007. Risk for onset of health conditions among community-living adults with spinal cord and traumatic brain injuries. *Primary Health Care Research & Development*, *8*(1), pp.36-43.

McDermott, S., Moran, R., Platt, T., Isaac, T., Wood, H. and Dasari, S., 2007. Risk for onset of health conditions among community-living adults with spinal cord and traumatic brain injuries. *Primary Health Care Research & Development*, *8*(1), pp.36-43.

Mohd Zulkifly, M.F., Ghazali, S.E., Che Din, N., Singh, D.K.A. and Subramaniam, P., 2016. A review of risk factors for cognitive impairment in stroke survivors. *The scientific world journal*, *2016*(1), p.3456943.

National Academies of Sciences, Medicine Division and Committee on the Review of the Department of Veterans Affairs Examinations for Traumatic Brain Injury, 2019. Evaluation of the disability determination process for traumatic brain injury in veterans.

Nelasari, D., Sumandari, A. and Ajiningrum, R.S., 2022. Traumatic Brain Injury. *KESANS: International Journal of Health and Science*, *1*(4), pp.357-367.

Neulinger, K., Oram, J., Tinson, H., O'Gorman, J. and Shum, D.H., 2016. Prospective memory and frontal lobe function. *Aging, Neuropsychology, and Cognition*, *23*(2), pp.171-183.

Nichols, E., Merrick, R., Hay, S.I., Himali, D., Himali, J.J., Hunter, S., Keage, H.A., Latimer, C.S., Scott, M.R., Steinmetz, J.D. and Walker, J.M., 2023. The prevalence, correlation, and co-occurrence of neuropathology in old age: harmonisation of 12 measures across six community-based autopsy studies of dementia. *The Lancet Healthy Longevity*, *4*(3), pp.e115-e125.

O'Regan, C., Wu, P., Arora, P., Perri, D. and Mills, E.J., 2008. Statin therapy in stroke prevention: a meta-analysis involving 121,000 patients. *The American journal of medicine*, *121*(1), pp.24-33.

Owolabi, M.O., Arulogun, O., Melikam, S., Adeoye, A.M., Akarolo-Anthony, S., Akinyemi, R., Arnett, D., Tiwari, H., Gebregziabher, M., Jenkins, C. and Lackland, D., 2015. The burden of stroke in Africa: a glance at the present and a glimpse into the future. *Cardiovascular journal of Africa*, *26*(2 H3Africa Suppl), p.S27.

Pandian, J.D., Gall, S.L., Kate, M.P., Silva, G.S., Akinyemi, R.O., Ovbiagele, B.I., Lavados, P.M., Gandhi, D.B. and Thrift, A.G., 2018. Prevention of stroke: a global perspective. *The Lancet*, *392*(10154), pp.1269-1278.

Rexrode, K.M., Madsen, T.E., Yu, A.Y., Carcel, C., Lichtman, J.H. and Miller, E.C., 2022. The impact of sex and gender on stroke. *Circulation research*, *130*(4), pp.512-528.

Rhoton Jr, A.L., 2002. The cerebrum. *Neurosurgery*, *51*(4), pp.S1-1.

Rink, C. and Khanna, S., 2011. MicroRNA in ischemic stroke etiology and pathology. *Physiological genomics*, *43*(10), pp.521-528.

Rosner, J., de Andrade, D.C., Davis, K.D., Gustin, S.M., Kramer, J.L., Seal, R.P. and Finnerup, N.B., 2023. Central neuropathic pain. *Nature Reviews Disease Primers*, *9*(1), p.73.

Ruet, A., Bayen, E., Jourdan, C., Ghout, I., Meaude, L., Lalanne, A., Pradat-Diehl, P., Nelson, G., Charanton, J., Aegerter, P. and Vallat-Azouvi, C., 2019. A detailed overview of long-term outcomes in severe traumatic brain injury eight years post-injury. *Frontiers in neurology*, *10*, p.120.

Sacco, R.L., Kasner, S.E., Broderick, J.P., Caplan, L.R., Connors, J.J., Culebras, A., Elkind, M.S., George, M.G., Hamdan, A.D., Higashida, R.T. and Hoh, B.L., 2013. An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *44*(7), pp.2064-2089.

Shahrokhi, M. and Asuncion, R.M.D., 2022. Neurologic exam.[Updated 20 January 2022]. *StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing*.

Stahl, S.M., Yaggi, H.K., Taylor, S., Qin, L., Ivan, C.S., Austin, C., Ferguson, J., Radulescu, R., Tobias, L., Sico, J. and Fragoso, C.A.V., 2015. Infarct location and sleep apnea: evaluating the potential association in acute ischemic stroke. *Sleep medicine*, *16*(10), pp.1198-1203.

Strong, K., Mathers, C. and Bonita, R., 2007. Preventing stroke: saving lives around the world. *The Lancet Neurology*, *6*(2), pp.182-187.

Sturm, J.W., Dewey, H.M., Donnan, G.A., Macdonell, R.A., McNeil, J.J. and Thrift, A.G., 2002. Handicap after stroke: how does it relate to disability, perception of recovery, and stroke subtype? The North East Melbourne Stroke Incidence Study (NEMESIS). *Stroke*, *33*(3), pp.762-768.

Tavares-Ferreira, D., Shiers, S., Ray, P.R., Wangzhou, A., Jeevakumar, V., Sankaranarayanan, I., Cervantes, A.M., Reese, J.C., Chamessian, A., Copits, B.A. and Dougherty, P.M., 2022. Spatial transcriptomics of dorsal root ganglia identifies

molecular signatures of human nociceptors. *Science translational medicine*, *14*(632), p.eabj8186.

Thomalla, G., Cheng, B., Ebinger, M., Hao, Q., Tourdias, T., Wu, O., Kim, J.S., Breuer, L., Singer, O.C., Warach, S. and Christensen, S., 2011. DWI-FLAIR mismatch for the identification of patients with acute ischaemic stroke within 4· 5 h of symptom onset (PRE-FLAIR): a multicentre observational study. *The Lancet Neurology*, *10*(11), pp.978-986.

Vargas Luna, J.L., Brown, J., Krenn, M.J., McKay, B., Mayr, W., Rothwell, J.C. and Dimitrijevic, M.R., 2021. Neurophysiology of epidurally evoked spinal cord reflexes in clinically motor-complete posttraumatic spinal cord injury. *Experimental Brain Research*, *239*(8), pp.2605-2620.

Vaughan-Graham, J., Cott, C. and Wright, F.V., 2015. The Bobath (NDT) concept in adult neurological rehabilitation: what is the state of the knowledge? A scoping review. Part I: conceptual perspectives. *Disability and rehabilitation*, *37*(20), pp.1793-1807.

Veerbeek, J.M., van Wegen, E., van Peppen, R., Van der Wees, P.J., Hendriks, E., Rietberg, M. and Kwakkel, G., 2014. What is the evidence for physical therapy poststroke? A systematic review and meta-analysis. *PloS one*, *9*(2), p.e87987.

Vincent-Onabajo, G. and Moses, T., 2016. Knowledge of stroke risk factors among stroke survivors in Nigeria. *Stroke research and treatment*, *2016*(1), p.1902151.

Vincent-Onabajo, G., Gayus, P., Masta, M.A., Ali, M.U., Gujba, F.K., Modu, A. and Hassan, S.U., 2018. Caregiving appraisal by family caregivers of stroke survivors in Nigeria. *Journal of caring sciences*, *7*(4), pp.183-188.

Waqas, M., Mokin, M., Primiani, C.T., Gong, A.D., Rai, H.H., Chin, F., Rai, A.T., Levy, E.I. and Siddiqui, A.H., 2020. Large vessel occlusion in acute ischemic stroke patients: a dual-center estimate based on a broad definition of occlusion site. *Journal of Stroke and Cerebrovascular Diseases*, *29*(2), p.104504.

Werner, C. and Engelhard, K., 2007. Pathophysiology of traumatic brain injury. *British journal of anaesthesia*, *99*(1), pp.4-9.

Williams, W.H., Chitsabesan, P., Fazel, S., McMillan, T., Hughes, N., Parsonage, M. and Tonks, J., 2018. Traumatic brain injury: a potential cause of violent crime?. *The Lancet Psychiatry*, *5*(10), pp.836-844.

Wolfe, C.D., Crichton, S.L., Heuschmann, P.U., McKevitt, C.J., Toschke, A.M., Grieve, A.P. and Rudd, A.G., 2011. Estimates of outcomes up to ten years after stroke: analysis from the prospective South London Stroke Register. *PLoS medicine*, *8*(5), p.e1001033.

Writing Group Members, Lloyd-Jones, D., Adams, R.J., Brown, T.M., Carnethon, M., Dai, S., De Simone, G., Ferguson, T.B., Ford, E., Furie, K. and Gillespie, C., 2010. Heart disease and stroke statistics—2010 update: a report from the American Heart Association. *Circulation*, *121*(7), pp.e46-e215.

Yaghi, S., Willey, J.Z., Cucchiara, B., Goldstein, J.N., Gonzales, N.R., Khatri, P., Kim, L.J., Mayer, S.A., Sheth, K.N. and Schwamm, L.H., 2017. Treatment and outcome of hemorrhagic transformation after intravenous alteplase in acute ischemic stroke: a scientific statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *48*(12), pp.e343-e361.

Yang, Y., Pang, M., Chen, Y.Y., Zhang, L.M., Liu, H., Tan, J., Liu, B. and Rong, L.M., 2020. Human umbilical cord mesenchymal stem cells to treat spinal cord injury in

the early chronic phase: study protocol for a prospective, multicenter, randomized, placebo-controlled, single-blinded clinical trial. *Neural Regeneration Research*, *15*(8), pp.1532-1538.

Yao, Y.Y., Wei, Z.J., Zhang, Y.C., Li, X., Gong, L., Zhou, J.W., Wang, Y., Zhang, Y.Y. and Wang, R.P., 2021. Functional disability after ischemic stroke: a community-based cross-sectional study in Shanghai, China. *Frontiers in Neurology*, *12*, p.649088.

Yousufuddin, M. and Young, N., 2019. Aging and ischemic stroke. *Aging (Albany NY)*, *11*(9), p.2542.

Yousufuddin, M., Young, N., Shultz, J., Doyle, T., Fuerstenberg, K.M., Jensen, K., Arumaithurai, K. and Murad, M.H., 2019. Predictors of recurrent hospitalizations and the importance of these hospitalizations for subsequent mortality after incident transient ischemic attack. *Journal of stroke and cerebrovascular diseases*, *28*(1), pp.167-174.

Ziu, E., MZ, K.S. and Mesfin, F.B., 2017. Subarachnoid hemorrhage.

APPENDIX 1

INFORMED CONSENT FORM

TITLE OF STUDY: Comparative Assessment of Physical Disability and Their Determinants among Stroke Survivors, Spinal cord and Traumatic Brain Injured Patients

INSTITUTION: Department of Physiotherapy, University of Benin, Benin city, Edo state, Nigeria.

PRINCIPAL INVESTIGATOR: Igbinosun Grace T.

PARTICIPATION: Participation in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue your participation at any time without penalty or loss of benefits. The principal investigator may decide to withdraw you from the study if we are unable to obtain the necessary information.

INTRODUCTION: I'm interested in investigating the comparative assessment of physical disability and their determinants among stroke survivors, spinal cord and traumatic brain injured patients.

PROCEDURES TO BE FOLLOWED

QUESTIONNAIRES; If you agree to participate, I will ask you questions about your socio-demographic data, stroke-related data, psychosocial factors, spinal cord injury related data traumatic brain injury related data, depression, anxiety, Self-Esteem, Self-Efficacy and stress

ASSESSMENT SCALES: If you agree to participate, I will assess your cognition, balance and motor function using appropriate assessment scales.

BENEFITS: You will be enlightened on the comparative assessment of physical disability and their determinants among stroke survivors, spinal cord and traumatic brain injured patients.

COMPENSATION: There is no compensation to volunteers for their participation.

DURATION OF PARTICIPATION: This study will last 15-20 minutes.

WHO CAN PARTICIPATE IN THIS STUDY: the study's focus is on stroke survivor, spinal cord and traumatic brain injured patients who are referred to the out-patient clinic at the physiotherapy department of University of Benin Teaching Hospital. The participants will be selected from the physiotherapy out-patient clinic, UBTH.

ASSURANCE OF CONFIDENTIALITY OF VOLUNTEER'S IDENTITY: Records relating to your participation in the study will remain confidential. Your name will not be used in any report resulting this study. All computerized records and analysis of data will contain only a unique study number, not your name.

PERSONS AND PLACES FOR ANSWERS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT: If during the course of this study you have questions concerning the nature of the research or you believe you have sustained a research-related injury or assault, you should contact;

Igbinosun Grace Tamaramiepirite

Department of Physiotherapy, University of Benin,

Benin City,

Edo State,

Nigeria.

Phone number: 08173453814

Email: graceystarry@gmail.com

Ethics and Research Committee,

University of Benin Teaching Hospital

IF THERE IS ANY PORTION OF THIS CONSENT AGREEMENT THAT YOU DO NOT UNDERSTAND, ASK THE FIELD WORKER OR INVESTIGATOR BEFORE SIGNING.

Please, sign below if you have agreed to participate in the study.

CERTIFICATION OF CONSENT

I, ……. having full capacity to consent for myself do thereby to agree to my participation in the research study.

The methods and means by which the study will be conducted and the risks which may be reasonably expected have been explained to me by Ethical Committee. I have been given the opportunity to ask question concerning this investigational study, and any such questions have been answered to my full and complete satisfaction.

I understand that I may at any time during the course of this study revoke this consent and withdraw myself from the study without prejudice.

Subject's Signature: _____ Date:

APPENDIX 2

PRO FORMA

Patient name: _____

Age: _____

Sex: Male [ ] Female [ ]

Marital status: Single [ ] Married [ ] Divorced [ ] Widow [ ] Widowe[ ]

Religion: Christianity [ ] Islam [ ] Traditionalist [ ] None[ ]

State of origin: _____

Ethnicity:_____

Occupation: _____

Type of stroke, SCI and TBI: _____

Duration of stroke, SCI and TBI: _____

Laterality of affectation: Left [ ] Right [ ] Both [ ]

Comorbidities: Yes [ ] No [ ]

If Yes, name(s): _____

APPENDIX 3

WHO Disability Assessment Schedule (WHODAS)

WHODAS 2.0

WORLD HEALTH ORGANIZATION

DISABILITY ASSESSMENT SCHEDULE 2.0

12-item version, self-administered

This questionnaire asks about difficulties due to health conditions. Health conditions include diseases or illnesses, other health problems that may be short or long lasting, injuries, mental or emotional problems, and problems with alcohol or drugs.

Think back over the past 30 days and answer these questions, thinking about how much difficulty you had doing the following activities. For each question, please circle only one response.

In the past 30 days, how much difficulty did you have in:						
S1	Standing for long periods such as 30 minutes?	None	Mild	Moderate	Severe	Extreme or cannot do
S2	Taking care of your household responsibilities?	None	Mild	Moderate	Severe	Extreme or cannot do
S3	Learning a new task, for example,	None	Mild	Moderate	Severe	Extreme or cannot

	learning how to get to a new place?					do
S4	How much of a problem did you have joining in community activities (for example, festivities, religious or other activities) in the same way as anyone else can?	None	Mild	Moderate	Severe	Extreme or cannot do
S5	How much have you been emotionally affected by your health problems?	None	Mild	Moderate	Severe	Extreme or cannot do

Please continue to next page...

WHODAS 2.0

WORLD HEALTH ORGANIZATION

DISABILITY ASSESSMENT SCHEDULE 2.0

In the past 30 days, how much difficulty did you have in:						
S6	Concentrating on doing something for ten minutes?	None	Mild	Moderate	Severe	Extreme or cannot do
S7	Walking a long distance such as a kilometre [or equivalent]?	None	Mild	Moderate	Severe	Extreme or cannot do
S8	Washing your whole body?	None	Mild	Moderate	Severe	Extreme or cannot do
S9	Getting dressed?	None	Mild	Moderate	Severe	Extreme or cannot do
S10	Dealing with people you do not know?	None	Mild	Moderate	Severe	Extreme or cannot do
S11	Maintaining a friendship?	None	Mild	Moderate	Severe	Extreme or cannot do
S12	Your day-to-day work?	None	Mild	Moderate	Severe	Extreme or cannot do

H1	Overall, in the past 30 days, how many	*Record number of*

	days were these difficulties present?	*days* ___
H2	In the past 30 days, for how many days were you totally unable to carry out your usual activities or work because of any health condition?	*Record number of days* ___
H3	In the past 30 days, not counting the days that you were totally unable, for how many days did you cut back or reduce your usual activities or work because of any health condition?	*Record number of days* ___

This completes the questionnaire. Thank you.

APPENDIX 4

The Motor Assessment Scale (MAS

MOVEMENT SCORING SHEET

DATE: .....

	0	1	2	3	4	5	6
1. Supine to side lying							
2. Supine to sitting over side of bed							
3. Balanced sitting							
4. Sitting to standing							
5. Walking							
6. Upper arm function							
7. Hand movements							
8. Advanced hand activities							

COMMENTS (IF APPLICABLE)

APPENDIX 5

The Hospital Anxiety and Depression Scale (HADS)
Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don’t take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			**I feel as if I am slowed**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frighten 'butterflies' in the sto**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much ca
	1	A little, but it doesn't worry me	1		I may not take quite as
	0	Not at all	0		I take just as much care
		I can laugh and see the funny side of things:			**I feel restless as I have move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with e things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used
	1	From time to time, but not too often	2		Definitely less than I us
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings o**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often

APPENDIX 6

Berg Balance Scale

S.N.	Item Description	Date				
		Score [0-4]				
1	Sit to stand					
2	Standing Unsupported					
3	Sitting Unsupported					
4	Standing to sitting					
5	Transfers					
6	Standing with eyes closed					
7	Standing with feet together					
8	Reaching forward with outstretched arms					
9	Retrieving object from ground					
10	Turning to look behind					
11	Turning 360 degrees					
12	Placing alternate foot on stool					
13	Standing with one foot in front					
14	Standing on one foot					
	Total					

Interpretation

A. 0–20 : Wheelchair bound
B. 21–40 : Walking with assistance
C. 41–56 : Independent

APPENDIX 7

General Self Efficacy Scale (GSE)

About: This scale is a self-report measure of self-efficacy.

Items: 10

Reliability:

Internal reliability for GSE = Cronbach's alphas between .76 and .90

Validity:

The General Self-Efficacy Scale is correlated to emotion, optimism, work satisfaction. Negative coefficients were found for depression, stress, health complaints, burnout, and anxiety.

Scoring:

	Not at all true	Hardly true	Moderately true	Exactly true
All questions	1	2	3	4

The total score is calculated by finding the sum of the all items. For the GSE, the total score ranges between 10 and 40, with a higher score indicating more self-efficacy.

.

	Not at all true	Hardly true	Moderately True	Exactly true
1. I can always manage to solve difficult problems if I try hard enough	☐	☐	☐	☐
2. If someone opposes me, I can find the means and ways to get what I want.	☐	☐	☐	☐
3. It is easy for me to stick to my aims and accomplish my goals.	☐	☐	☐	☐
4. I am confident that I could deal efficiently with unexpected events.	☐	☐	☐	☐
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	☐	☐	☐	☐
6. I can solve most problems if I invest the necessary effort.	☐	☐	☐	☐
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	☐	☐	☐	☐
8. When I am confronted with a problem, I can usually find several solutions.	☐	☐	☐	☐
9. If I am in trouble, I can usually think of a solution	☐	☐	☐	☐
10. I can usually handle whatever comes my way.	☐	☐	☐	☐

APPENDIX 8

Rosenburg Self-Esteem Scale (RSES)

Instructions

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

1. On the whole, I am satisfied with myself.

Strongly Agree Agree Disagree Strongly Disagree

2.At times I think I am no good at all.

Strongly Agree Agree Disagree Strongly Disagree

3.I feel that I have a number of good qualities.

Strongly Agree Agree Disagree Strongly Disagree

4.I am able to do things as well as most other people.

Strongly Agree Agree Disagree Strongly Disagree

5.I feel I do not have much to be proud of.

Strongly Agree Agree Disagree Strongly Disagree

6.I certainly feel useless at times.

Strongly Agree Agree Disagree Strongly Disagree

7.I feel that I'm a person of worth, at least on an equal plane with others.

Strongly Agree Agree Disagree Strongly Disagree

8.I wish I could have more respect for myself.

Strongly Agree Agree Disagree Strongly Disagree

9.All in all, I am inclined to feel that I am a failure.

Strongly Agree Agree Disagree Strongly Disagree

10.I take a positive attitude toward myself.

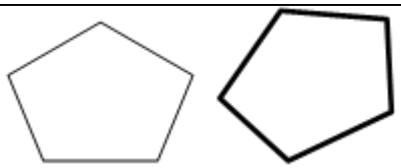
Strongly Agree Agree Disagree Strongly Disagree

Scoring:Items 2, 5, 6, 8, 9 are reverse scored. Give “Strongly Disagree” 1 point, “Disagree” 2 points, “Agree” 3 points, and “Strongly Agree” 4 points. Sum scores for all ten items. Keep scores on a continuous scale. Higher scores indicate higher self-esteem.

APPENDIX 9

MINI-MENTAL STATE EXAM

Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day? Month?"
5		"Where are we now? State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, …) Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)

1		 "Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)
30		TOTAL

INTERPRETATION OF MMSE

Method	Score	Interpretation
Single Cutoff	<24	Abnormal
Range	<21 >25	Increased odds of dementia Decreased odds of dementia
Education	21 <23 <24	Abnormal for 8th grade education Abnormal for high school education Abnormal for college education
Severity	24-30 18-23 0-17	No cognitive impairment Mild cognitive impairment Severe cognitive impairment

APPENDIX 10

The Patient Health Questionnaire-9 (PHQ-9)

PHQ 9				
Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use to indicate your answer)*	Not at all (score = 0)	Several days (score = 1)	More than half the days (score = 2)	Nearly every day (score = 3)
1. Little interest or pleasure in doing things				
2. Feeling down, depressed, or hopeless				
3. Trouble falling asleep, or staying asleep, or sleeping too much				
4. Feeling tired or having little energy				
5. Poor appetite or overeating				
6. Feeling bad about yourself - or that you are a failure, or have let yourself or your family down				
7. Trouble concentrating on things, such as reading the newspaper or watching television				
8. Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around more than usual				
9. Thoughts that you would be better off dead or of hurting yourself in some way				
TOTAL	0 +	+	+	+
TOTAL SCORE				
If you checked off any problem, how difficult have these problems made it for you to do your work, take care				

of things at home, or get along with other people? Not difficult at all Somewhat difficult Very difficult Extremely difficult	
PHQ-9 Score	Meaning / Action
Less than 5	Patient not likely depressed, re-screen if affect changes. Communicate results to the team and to any referral sites.
Between 5-9	Watchful waiting - patient to be closely monitored and re-screened if needed. Communicate results to the team and any referral sites.
Greater than 9	Patient has screened positive and requires further assessment by a certified professional for diagnosis and treatment. Notify attending, consider consulting psychiatry or psychology. Communicate results to the team and any referral sites.
PHQ-9 is adapted from PRIME MD TODAY, Copyright© 1999 Pfizer Inc. All rights Reserved. Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute. http://phqscreeners.com/pdfs/02_PHQ-9/English.pdf	
Date *(yyyy-Mon-dd)*	Signature

APPENDIX 11

The Perceived Stress Scale (PSS-10)

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name _____ Date _
Age _____ Gender (*Circle*): M F Other _

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4=Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

HEALTH RESEARCH ETHICS COMMITTEE (HREC)

UNIVERSITY OF BENIN TEACHING HOSPITAL

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Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL. VII/14865432038

PROPOSAL TITLE: "COMPARATIVE ASSESSMENT OF PHYSICAL DISABILITY AND THEIR DETERMINANTS AMONG STROKE SURVIVORS, SPINAL CORD AND TRAUMATIC BRAIN INJURED PATIENT"

PRINCIPAL INVESTIGATOR(S): GRACE IGBINOSUN

DEPARTMENT/INSTITUTION: DEPARTMENT OF PHYSIOTHERAPY, SCHOOL OF BASIC MEDICAL SCIENCES UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

DATE CONSIDERED: NOVEMBER 25TH, 2024

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 25/11/2024 TO 24/11/2025. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI **SIGNATURE & DATE** 25/11/2024

SUPERVISOR (S): DR. N.D EKECHUKWU

DECLARATION BY INVESTIGATOR(S):
PROTOCOL NUMBER (please quote in all enquiries)
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date 26/11/24