

Physiotherapists' Use of Outcome Measure Tools in the Assessment of Neuro-Musculoskeletal Injuries for Short-Term Functional Rehabilitation Domains to Minimize Impairments and Disability following Commercial Motorcycle Road-Related Accident, Eldoret, Kenya

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ABSTRACT

Bed immobilization remains a core intervention to stabilize neuro-musculoskeletal injuries following commercial motorcycle-related road traffic accidents. Despite timely operative and conservative management, most patients remain handicapped, requiring short- and long-term physical therapy. That calls for physiotherapists to assess and make use of outcome measure tools to determine the level of impairments and disability and make informed decisions when developing management goals. The objective of the study was to determine short-term functional rehabilitation domains, the use of outcome measure tools, and physiotherapy interventions used to minimize impairments and disability following a commercial motorcycle road-related accident in Eldoret, Kenya. Biopsychosocial theory guided the study. A prospective cohort study was adopted. Purposive sampling was used for the selection of 79 participants for 6 months between March 2021 and July 2021 in level 5 hospitals in Eldoret, Kenya. The target population included post-operative patients in both male and female orthopedics wards, physiotherapists, and social workers in the orthopedic department of Moi Teaching and Referral Hospital. The study population was 150 patients. A self-administered, structured questionnaire was used. The data collected was entered and analyzed with SPSS 20. The findings of this study revealed that forty-four percent (44%) of total participants were bedridden for fracture immobilization and spinal cord injuries for more than 3 days before and after orthopedic and neurological surgery. The majority (100%) of the participants had been referred for physiotherapy rehabilitation. All 100 participants were assessed with different outcome measure tools for neuro-musculoskeletal injuries to determine the level of physical function. Forty-three percent (43%) had lost functional abilities of the upper extremity (19 males, 15 females). Fifty-one-point nine percent (51.9%) had lost physical function due to lower extremity fractures (39% (26 males, 15 females) and 24% (15 males, 4 females) with spinal cord injuries. Four participants (5%) reported lost days to school, and 94.9% reported lost days to income-generating activities (27 females, 48 males). The majority (100%) of the participants pre- and post-operatively were assessed with standardized outcome measure tools that remain significant for prompt best evidence-based physiotherapy practices. Pain (100%) and impaired physical functions (100%) were the main rehabilitation domains that posed the biggest challenge to patients' post-trauma. Multicomponent physiotherapy interventions ranging from stretching, strengthening, breathing exercises, bed positioning, mobility and transfers, balance and coordination, and gait training tailored to patients' physical function levels, prevention of muscle atrophy and strength, and joint stiffness were core. This study recommended short-term physiotherapy rehabilitation on early bed mobilization and ambulation for patients, which remains core for the restoration of physical functional levels and a return formula to socioeconomic status.

Keywords: Assessment, Commercial Motorcycle Road-Related Accident, Disability, Domains, Fractures, Impairments, Interventions, Outcome Measure Tools, Prolonged Bed Immobilization, Short-Term Functional Rehabilitation, Spinal Cord Injury

I. INTRODUCTION

Globally, commercial motorcycle road-related injuries are higher in low- and middle-income countries than in developed countries (Cholo et al., 2023). In African countries, especially South Africa and Malawi, the use of commercial motorcycles as a means of transport is linked to traumatic fractures of the long bones that negatively impact one's several aspects of life (Abbas et al., 2023; Singaram & Naidoo, 2019). Fractures to most patients have been reported to impair physical mobility and functional abilities, pain, reduced level of independence in activities of daily living, self-care, grooming, absenteeism from employment or school, inability to meet financial obligations, limited social interactions, and psychological disruptions following sick role identity and financial obligations to meet medical health costs (Abbas et al., 2024; Singaram & Naidoo, 2019). Globally, 90% of traumatic spinal cord injuries are linked to road accidents, with a male-to-female ratio of 2:1 among young people. A number presents with life-threatening neurological changes that alter one's physical and sensory functions and social, psychological, and economic aspects limiting daily activity participation (Rodríguez-Mendoza et al., 2020). Injuries that incur huge financial burdens for immediate and long-term management cost approximately United States dollars (USD) 334,170

to 1,023,924 annually (Rodríguez-Mendoza et al., 2020). Physiotherapy use of outcome measure tools for the assessment of impairments and disability remains core for the determination of rehabilitation functional domains; prescription of approaches and strategies with goals to restore and improve the patient's level of independence has been emphasized elsewhere (Rodríguez-Mendoza et al., 2020).

Rehabilitation is a set of interventions prescribed or designed to optimize body structure function and minimize impairments and disability for patients or clients with diseases, disorders, injuries, or trauma (World Health Organization [WHO], 2023). Rehabilitation remains one of the core aspects of WHO (2015) for the promotion of health for all in the prevention of diseases, treatment of structural and functional impairments, disability, and palliative care to ensure a healthy nation. However, in Kenya, little is known about how traumatic limb fractures and spinal cord injuries impact one's bio-psychosocial life, their assessment of rehabilitation functional domains, and physiotherapy interventions to lower socioeconomic impacts and improve quality of life.

Physiotherapists remain focused on a patient-centered rehabilitation services approach among other healthcare professionals despite barriers faced in primary healthcare (Forslund et al., 2023; Maharaj et al., 2018). Physiotherapy interventions are pointed to be core for limb fractures and spinal cord injuries following traumatic commercial motorcycle road accidents among adult patients. That, in turn, optimizes the restoration of physical functional rehabilitation, health, and independence and increases activity participation for a meaningful social life, education, and economic status. The Global Burden of Disease Study 2019 indicates the need to prioritize rehabilitation services as a key strategy for achieving universal health coverage (Cieza et al., 2020).

Despite limb fractures and spinal cord injuries, bed immobilization is an immediate intervention for uncomplicated impairments and lost body function. There is evidence that, with or without traumatic injuries, prolonged bed immobilization negatively impacts the connective tissues, especially tendons, ligaments, and cartilage, altering the structure and function of collagen fibers after 4-6 days of bed immobility (Parry & Puthuchery, 2015). Three to twenty days of bed immobility have been linked to a loss of tendon natural stiffness and increased viscosity, which impair energy transmission from muscle tissue to bone (Knight et al., 2019). That results in increased muscle weakness due to the reduced generation of dynamic forces by a group of muscles to produce motion in a given joint for physical function without fatigue (Knight et al., 2019). Ligaments with prolonged bed immobility do shorten and lose their elasticity following disuse atrophy and weakness (Marusic et al., 2021). Articular surfaces also lose their elasticity and ability to glide over each other, increasing joint friction between the opposing synovial membranes (Knight et al., 2019). Eventually, the formation of joint adhesions leads to a reduced joint range of motion and joint contracture (Trudel et al., 2003). However, little is known about how assessment of the functional rehabilitation domains of the affected and non-affected body structures calls for physiotherapists to make comprehensive use of outcome measure tools for patients' assessment, prescribe interventions to rehabilitate lost physical and functional impairments, and slow down the effects of bed immobility following commercial motorcycle road-related accidents.

1.2 Problem Statement

Despite the role of physiotherapists in rehabilitation services for disease and injury (Mathye & Narrain, 2019), there are only 2.41 billion people worldwide with health diseases and injuries who do not have access to physiotherapy rehabilitation services to cater to their functioning needs (Cieza et al., 2020) at the primary healthcare level. While in low- and middle-income countries (LMICs), 50% or more of people who need rehabilitation services do not access physiotherapy rehabilitation services (Cieza et al., 2020). A gap seems to drawback the achievement of Universal Healthcare Coverage (UHC) 2015 for the actualization of the 3rd Sustainable Development Goals (SDGs).

There are continued reports of a lack of knowledge and inconsistency in the use of evidence-based outcome measures tools for physical examination, monitoring treatment progress, patient-clinician communication, and making informed prognoses of patients globally (Käll et al., 2016). There is also a lack of knowledge about physiotherapy's scope of rehabilitation approaches and interventions for the affected and non-affected body systems among patients and other healthcare professionals. This study aims to reveal the use of outcome measure tools for the most common rehabilitation functional domains of the non-affected body systems as they undergo disuse atrophy despite major physiotherapy treatment interventions geared towards rehabilitation of the injured body systems. More so, little is documented on how injuries and prolonged bed immobilization negatively influence the anatomical and physiological structures of the human body. This is a barrier that continues to narrow the knowledge scope of physiotherapists' role in the assessment and prescription of interventions to manage negative health and socioeconomic consequences following commercial motorcycle road-related accidents.

1.3 Research Objectives

- i. To assess the short-term rehabilitation domains in victims of motorcycle-related road traffic accidents admitted at Moi Teaching and Referral Hospital, Eldoret, Kenya

- ii. To investigate the outcome measure tools used by physiotherapists in the assessment, review, and evaluation of victims of motorcycle-related road traffic accidents at Moi Teaching and Referral Hospital, Eldoret, Kenya
- iii. To determine physiotherapeutic interventions used to manage functional rehabilitation domains of patients recovering from fractures and spinal cord injuries following commercial motorcycle road traffic accidents at Moi Teaching and Referral Hospital, Eldoret, Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 International Classification of Functioning, Disability and Health (ICF) Bio-Psychosocial Models of Functioning

The bio-psycho-social model suggests spinal cord injuries consist of impaired neuro-musculoskeletal systems of the biological structure of the bone and nerves with impaired loco-motor systems, with resultant restrictions to functional activities and participation (Mathew et al., 2001). The model addresses the consequences of fractures and spinal cord injuries during conservative management and after surgical repair and considers the short- and long-term functional impairments requiring physiotherapy rehabilitation programs (Tabarestani et al., 2022). While emphasizing the role of biological, psychological, and social aspects in determining the use of outcome measure tools in acute and long-term functional rehabilitation domains. These are core to the assessment of functional limitations and clinical evaluation associated with lower limb fractures (Belete et al., 2021) and upper limb fractures (Roh, 2013). A model that informs physiotherapy interventions and social-economic aspects of the health outcomes of upper and lower limb fractures and spinal cord injuries following commercial motorcycle road-related accidents.

2.1.2 Biological Model

Studies have shown that fractures following commercial motorcycle road accidents occur when an external force and momentum lead to dysfunction of the bone structure as a connective tissue made of biological materials such as protein, collagen, and calcium. Fractures are reported to destroy the underlying microstructure frameworks that make bone hard and strong to support locomotor activity participation (Sheen et al., 2023). Fractures and spinal cord injuries have significant functional impairments, long-term disability, and morbidity for victims following commercial motorcycle road accidents (Cholo et al., 2023). Stretch, compression, and breaking through the nervous system may lead to a complete or incomplete nerve spinal cord injury with partial or complete loss of motor and sensory function below the level of injury according to the America Spinal Injury Association (ASIA) scale of assessment (Bennet & Emmady, 2020; Kirshblum et al., 2014). Their impacts that require progressive rehabilitation need to change spared abilities after traumatic spinal and orthopedic injuries. While bone discontinuity may result in loss of bone strength, tightness, and toughness, high medical health costs and high social and economic dependence may lower one's quality of life.

2.1.3 Psychological Models

Fractures of the limbs and injuries to the spinal cord are reported to have a negative psychological impact on individuals, families, communities, schools, employment, and health institutions, among others (Budd et al., 2022). These patients with extremity fractures and spinal cord injuries (SCI) tend to assume a sick role and are viewed by others as people with limited functional capacity and high socioeconomic dependence, greatly influencing their interpersonal relationships and interactions with their impairments and others, thereby interfering with their quality of life. These patients must cope with their trauma, pain, loss of function, and social and economic isolation from themselves, their partners, family, and community members (World Health Organization [WHO], 2007). A situation that can be alleviated through early physiotherapy rehabilitation of functional domains of various body systems, health education of interventions compliance, psychological counseling, and re-integration programs near normal to their way of life.

2.1.4 Social Function

Short- and long-term impairments and disabilities that present following fractures and spinal cord injuries and conservative and surgical repair usually negatively affect a person's health and the physical function capabilities and condition of the affected body part. Patients are usually viewed as individuals with high levels of dependence due to impaired or restricted ability levels to execute or participate in an activity compared to a healthy person (WHO, 2023). Restrictions and impairments that negatively interfere with an individual's social identity as a patient are confined to a hospital bed with restricted personal, family, and community interactions. These patients continue to have high levels of socioeconomic dependence on others, with fewer societal expectations of them.

However, with physiotherapy rehabilitation for patients with fractures and spinal cord injuries, restoration and prevention of further loss of physical functional ability remain core if best practice guidelines for the use of outcome measure tools to assess, treat, and rehabilitate were determined to document the evidence-based interventions to restore the structural and physiological ability of body function. This enables physiotherapists to prescribe ward and home exercise programs on progression and health education on the significance of patients' compliance with rehabilitation regimes to decondition and rehabilitate both affected and non-affected body parts, respectively, to optimize the quality of health and life following these injuries. The theoretical constructs are shown in Figure 1 below:

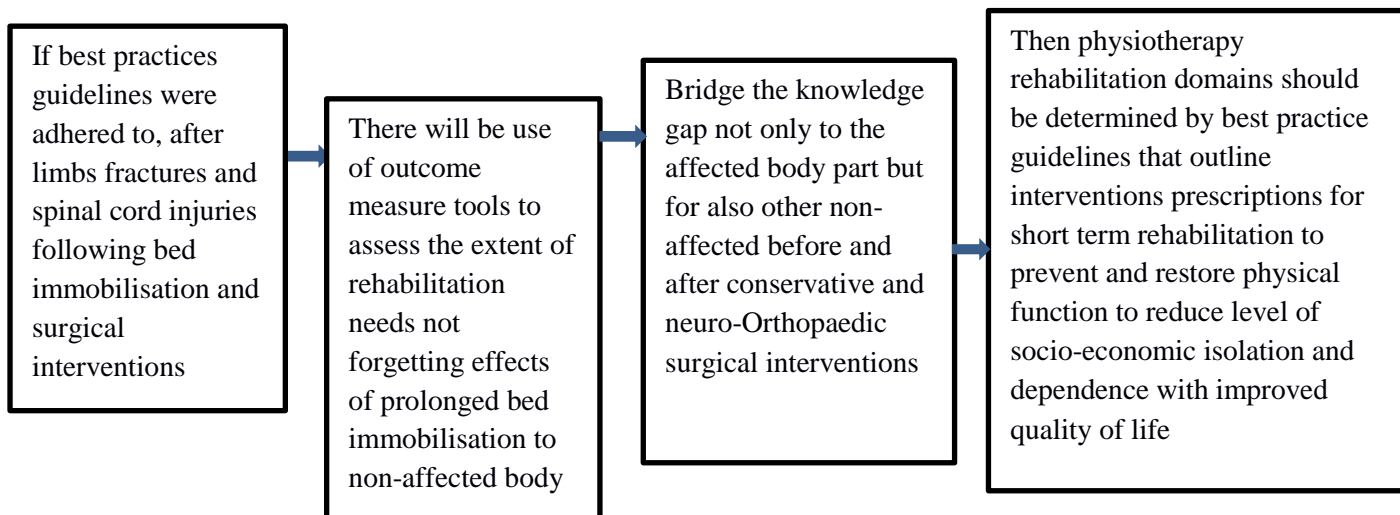


Figure 1

Theoretical Constructs of Fractures and Spinal Cord Injuries and Delivery of Physiotherapy Rehabilitation Interventions to the Affected and Non-Affected Body Systems

2.2 Theoretical Review

Globally, in 83% of the 4.6 million deaths that occur in the LMICs following commercial motorcycle road-related accidents, musculoskeletal injuries were reported to be one of the major causes of loss of function in most survivors (Cordero et al., 2020). In the LMICs, for every road-related death that occurs, 10 to 50 patients admitted suffer temporary or permanent impairments or disabilities or both (Mock & Cherian, 2008). Of the 1.19 million people who die, 91% of these road accidents occur in LMICS, with 130 million people sustaining fractures every year despite numerous National Transport and Road Safety strategies in place (Moshi, 2018). In LMICs, motorcycle road-related neuro-musculoskeletal injuries account for high lost disability-adjusted life years (DALYs) compared to the annual summation of cancer, myocardial infarction, malaria, and human immunodeficiency virus (HIV) (Unit, 2018).

Kenya reports over 3,000 deaths and 30,000 traumatic causes of morbidity and disability related to road-related accidents annually (Macharia et al., 2009; Odero et al., 2003). A prevalence rate that is 30 times higher than that of motorized developed countries, involving 75% of youth and middle-aged adults in their maximum work productivity necessary for the country's economic growth and the resultant strain on health systems of motorcycle accidents (Karau et al., 2015). Understanding the physiotherapy rehabilitation domains, the use of assessment outcome measure tools (OMs), and physiotherapy interventions would be significant in minimizing potential impairments and disability following patients' hemodynamic stabilization and post-operative interventions.

Studies reveal that trauma and limb immobilization do result in short- and long-term structural and physiological changes of the affected and non-affected other body systems, especially cardiorespiratory, musculoskeletal, endocrine, and neurological systems, among other systems that have remained a hallmark domain for physiotherapists' assessment, treatment, and rehabilitation following prolonged bed immobilization exceeding 72 hours (Crossland et al., 2019). Monti et al. (2021) report that patients' immobilization has reduced neural control of the neuromuscular junction with reduced motor unit recruitment to initiate muscular contractions and carry out physical function. Consequently, this leads to reduced muscle strength and endurance, with complaints of fatigue reported by most bedridden patients (Xu et al., 2023).

Other changes reported were muscle fiber atrophies, loss of their sarcopenia, insulin hormone intolerance, mitochondria dysfunction that leads to muscle fatigue in immobile patients, reduced muscle strength, power, and endurance with a more rapid reduction in size in fast-twitch fibers, and reduced muscle mass due to protein synthesis by 50% (Chen et al., 2023; Parry & Puthuchery, 2015). At the same time, others present with increased plasma cortisol hormones and increased production of inflammatory mediators and destructive superoxide anions (Knight et al., 2019). Puthuchery et al. (2010) point out the increased catabolic breakdown of muscle tissue that exceeded

protein synthesis due to the patient's bed immobility. Studies report a 12% rate of skeletal muscle strength decline per week following bed immobilization of the affected and non-affected global movers and stabilizers muscles, requiring physiotherapy assessments and interventions (Sharlo et al., 2021; VanPutte et al., 2017; Nigam et al., 2009).

Evidence-based guidelines for physiotherapists enhance the use of outcome measure tools to objectively assess physical functional rehabilitation domains to guide interventions in treating and rehabilitating patients' impairments and disability-related injuries and prevent the structural effects of prolonged bed immobility. Evidence-based practice was reported for maintaining near-normal health and restoring lost structural and functional levels to optimize the level of independence in the participation of ADLs for a better quality of life following traumatic lower limb fractures and spinal cord injuries (Jiandani & Mhatre, 2018). Despite this, some of the patients do present with secondary impairments following 72 hours to 4-6 days of extremity fracture immobilization to stabilize injuries (Halanski & Noonan, 2008).

Despite timely orthopedic surgery, some of the patients were referred for short- and long-term physiotherapy rehabilitation following commercial road-related orthopedic and neurological injuries. Little is documented in the study area of physiotherapists' use of OMs to assess types of impairments to inform rehabilitation domains and prescribe interventions to maintain, restore, and improve body structure and function. This study determines functional rehabilitation domains, the use of assessment OMs, and physiotherapy interventions to minimize impairments and improve levels of independence following extremity fractures and spinal cord injuries in Eldoret, Kenya.

2.2 Empirical Review

Empirically, victims involved in commercial motorcycle road-related injuries are assessed with lost and impaired physical functions of the affected body structure, pain, depression, muscle weakness, lost motor or sensory function, or both (Tumwesigye et al., 2016). Often, victims of trauma have been perceived to have lost means of physical levels, incapacity to work or school, and increased levels of dependence (International Classification for Health, Disability, and Functioning, ICF, 2001). A health situation that may be short-lived or permanently unchanging is associated with residual impairments and disability if prompt early rehabilitation is delayed. Injuries, impairments, incapacity, and disability have been viewed as interrelated issues following commercial motorcycle road-related accidents (WHO, 2007; De Kleijn-De Vrankrijker, 2003).

Globally, the use of the International Classification of Functioning, Disability, and Health, also known as ICF, remains one of the standardized assessments and OMs for health and health-related domains. That restricts activity participation and performance for the individual's well-being and quality of life. ICF WHO (2001) remains a guide to the assessment of physiotherapy rehabilitation needs and the description of treatment interventions for impairments and disabilities of the body structure, function, and environment to lower the negative impact on one's socioeconomic and psychological aspects of life (Belete et al., 2021).

Thus, this study hoped to determine short-term rehabilitation domains from the acquired upper and lower extremities and spinal cord injuries as guided by WHO (2007). The pain of the body structures specifically the back (b28013); upper (b28014); lower limb (28015), sensory functions and pain(b298); spinal cord and related structures (s120); structures of the lower extremities (s750, s770) related to impaired walking and moving(d450 to d 469), structures of the upper extremities (s730) related to carrying, moving and handling objects (d430to d449; dependence on others for self-care (d510-599); restrictions to household tasks(d630-d649); have been pointed as one of the qualifiers for activity participation restriction and limitations involvement in a life situation that requires physiotherapy rehabilitation service following commercial motorcycle road accident injuries.

Physiotherapists consider the use of functional and impairment OMs as a standardized, valid measure for patients' activity limitations and participation restrictions (Jette et al., 2009). That remains a key role in the professional communication between physiotherapists and clinicians on patients' assessments, prognosis, and evaluation of the effective treatment, review of the need for interventions, progression, or termination, as guided by evidence-based practice worldwide (Renteria & Berg, 2019). Despite reported physiotherapists' opinions, reluctance, barriers, and facilitators for its practice in clinical settings (Gleadhill et al., 2022; Duncan & Murray, 2012), OMs are reported to form a base of knowledge focused on patients' 'rehabilitation domains, needs, and that of the insurance companies if compensation is reached out for (Renteria & Berg, 2019). The most commonly used OMs are numerical pain rating and visual analog scales for pain, goniometers for joint range of motion, manual muscle testing for muscle strength, muscle tone, and mass, shortened soft tissues, fatigue for perceived rate of exertion, motor and sensory function (ASIA), lower extremity functional scales for function, cardiopulmonary endurance with 2 or 6 or 10 Minute Walk Test (MWT), balance and coordination gait, and levels of independence within the body structures and domains of tasks, according to the World Health Organization of ICF (WHO, 2001: 2007).

The most commonly used orthopedic OMs have been reported as the patient-reported specific functional scale (PFFS), activity measures post-acute care (AM-PAC), upper limb functional index (ULFI), functional index measure (FIM), Barthel index of physical activity dependence in personal activities of daily living (BI/PADL), and lower

extremities functional scale (LEFS) (Renteria & Berg, 2019). Despite this, OMS faced time constraints in administering them, negative patient perception, lack of knowledge, relevance, and value among physiotherapists, as reported in some studies (Lim et al., 2023; Hassani et al., 2022; Mehta & Grafton, 2014; Duncan & Murray, 2012), but they remain significant for determining patient reports (PROMs) and performance-based OMs (PBOMs) following injuries to the musculoskeletal and neurological systems (Lim et al., 2023). However, Kenya's physiotherapists' use of these OMs in orthopaedics and neurological wards remains less documented.

Globally and regionally, physiotherapists devise effective rehabilitation interventions and programs guided by findings on impairments, activity limitations, and participation restrictions (Gomara-Tolra et al., 2014). Studies have pointed out that physiotherapists have a significant role in the management of patients with SCI and lower extremity fractures through early bed mobilization, chest physiotherapy for maintenance of lung functions, bed transfers, range of movements, stretches, and strengthening exercises to prevent soft tissue shortening and muscle atrophies of the affected and non-affected muscles, respectively, static and dynamic balance training, gait training with or without assistive devices, and social integration back to family, job, school, and a normal way of life, thus improving one's quality of life (Nas et al., 2015; Postma et al., 2009). However, physiotherapist interventions guided by standardized assessment remain a concern for documentation in this study.

III. METHODOLOGY

3.1 Study Design

A prospective descriptive cohort study design was conducted for 6 months at Moi Teaching and Referral Hospital in orthopedics wards; Longonot and Kilimanjaro (male), Sergoit (female), and Neurological wards from March 2021-July 2022.

3.2 Study Area

The study was conducted at Moi Teaching and Referral Hospital (MTRH). The hospital serves Kenya, Eastern Uganda, Northern Tanzania, Southern Sudan, and the Democratic Republic of Kenya, with a catchment population of over 25 million. The hospital is located in Eldoret town, Uasin Gishu County, in the North Rift region of Kenya. It is situated along Nandi Road and is about 310 kilometers northwest of Nairobi, the capital city of Kenya. It is a level six (6) hospital accredited by the National Insurance Hospital Fund (NHIF) that provides medical services for inpatient and outpatient services for approximately 1,500 inpatients and 1,500 outpatients daily visiting from different parts of other counties. It has a bed capacity of 1020 for inpatients. It has four coordinated departments for victims of motorcycle accidents and emergencies: diagnostics, prosthetics, theater, inpatients, and outpatient services.

2.3 Study Population

The study population consisted of 150 patients admitted with upper and lower extremity fractures and spinal cord injuries to the orthopaedics and neurological wards, respectively, in MTRH. Patients aged 18 years and older had undergone surgical interventions and were referred for physiotherapy rehabilitation interventions for the management of their impairments. Medical records were reviewed to obtain patients' case presentations of their socio-demographic characteristics, injuries sustained, functional rehabilitation domains, use of assessment tools, and physiotherapy interventions prescribed.

3.4 Inclusion and Exclusion Criteria

Those patients with motorcycle-related injuries who had undergone surgery and were receiving in-patient physiotherapy services in the Orthopaedics and Neurological wards were included. Patients with incomplete bio data files, traumatic head injuries, and those with a Glasgow Coma Scale (GCS) of less than 12/15 without caregivers were excluded.

3.5 Sampling Procedure and Sample Size Determination

Non-probability purposive sampling was used to select patients post-operatively following motorcycle-related road traffic accidents with upper and lower extremity fractures and spinal cord injuries in orthopaedics and neurological wards in MTRH. The Yamane formula (1973) was used to determine sample size from a study population of 150 patients who were admitted during the study period with a 95% confidence level, as illustrated: $\pi = N / (1 + N(e)^2)$, where π = sample size, N = population size, and e = accepted 5% margin of error/degree of precision: $150 / (1 + 150(0.05)^2) = 85.714$, which was rounded off to 86. A sample size of 86 was selected, but only 79 participants qualified for the inclusion criteria.

3.6 Data Collection Instruments and Techniques

Data was collected by using self-developed structured questionnaires that were guided by literature reviews of similar studies. These were face-to-face self-administered questionnaires. The collected data was coded, entered, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive data was presented using percentages, frequencies, histograms, and bar graphs. Permission to conduct the research study was sought from the Institute of Research and Ethics Committees at MTRH, Eldoret. Participants were informed of their voluntary participation and withdrawal from the study, the aim and objectives of the study, and their confidentiality. All personal information and data gathered during the study were protected according to guidelines set out by the Protection of Personal Information Act and the Kenya Data Protection Act No. 24 of 2019.

3.7 Data Analysis

A prospective cohort study was conducted. A total of 150 patients were admitted with upper and lower extremity fractures and spinal cord injuries to orthopedics (Longonot and Kilimanjaro (male), Sergoit (female), and neurological wards in MTRH during the 6 months of March 2021–July 2021. Only 79 patients qualified for the inclusion criteria. All patients were referred for post-operative physiotherapy after surgery. Out of 150 bio-data sets of patients’ medical records that were prospectively reviewed, only 79 participants qualified for inclusion in the study. Descriptive statistics were used to analyze the data. Findings were presented as frequencies in tables, charts, and figures.

IV. FINDINGS & DISCUSSIONS

4.1 Socio-Demographic Characteristics

The prevalence of commercial motorcycle road-related traumatic fractures of the upper extremities was 43% (19 males, 15 females), lower extremities (51.9%) (26 males, 15 females), and spinal cord injuries (15 males, 4 females). Men made up 62% and women made up 38%, with a male-to-female ratio of 4.9:3. The majority (85.7%), consisting of 44 males (55.7%) and 30 females (30%), were between the ages of 18 and 44. Three percent (3%) were minors, and 4% were above 55 years old, as shown in Figure 2.

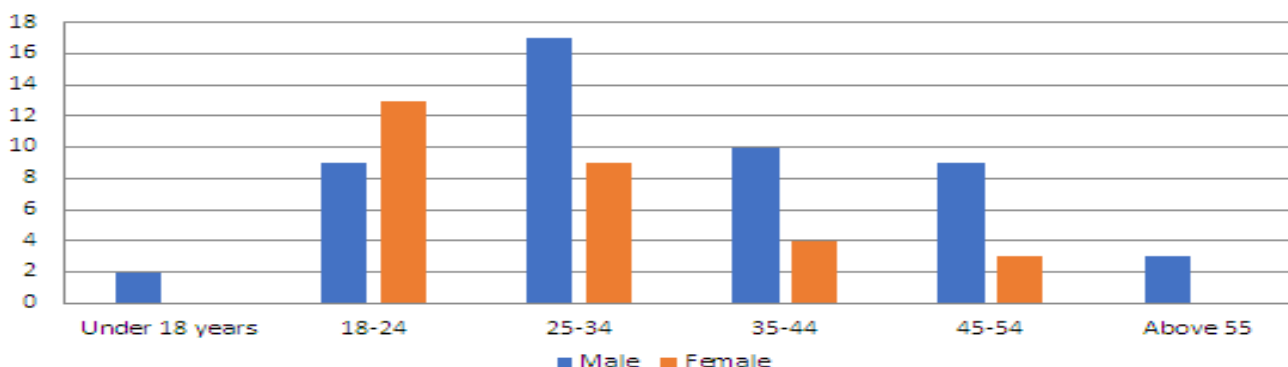


Figure 2

Showing Age Brackets of the Participants

On hospital admission, all 100 participants were bedridden due to upper and lower fractures and spinal cord injuries during hemodynamic stabilization. Sixty-six percent of the participants were admitted for upper and lower extremity fractures, while 34% had spinal cord injuries.

All (100%) participants underwent some form of emergency orthopedics and neurological surgical interventions to stabilize their injuries, wound stitching, and debridement (10%), while others were for open reduction with internal fixation (18%), open reduction with intermediary nails (5%) and K-wire (3%), and external fixation (21%). Others were bedridden (24%), on skin traction (6%), on skeletal traction (11%), and on long plaster of Paris (2%). Only 0.001% of the participants had undergone orthopaedics and neurosurgical interventions within 1 to 5 hours and 29% within 24 hours after hospital admission following commercial road-related upper and lower limb fractures and spinal cord injuries, as shown in Figure 3 below.

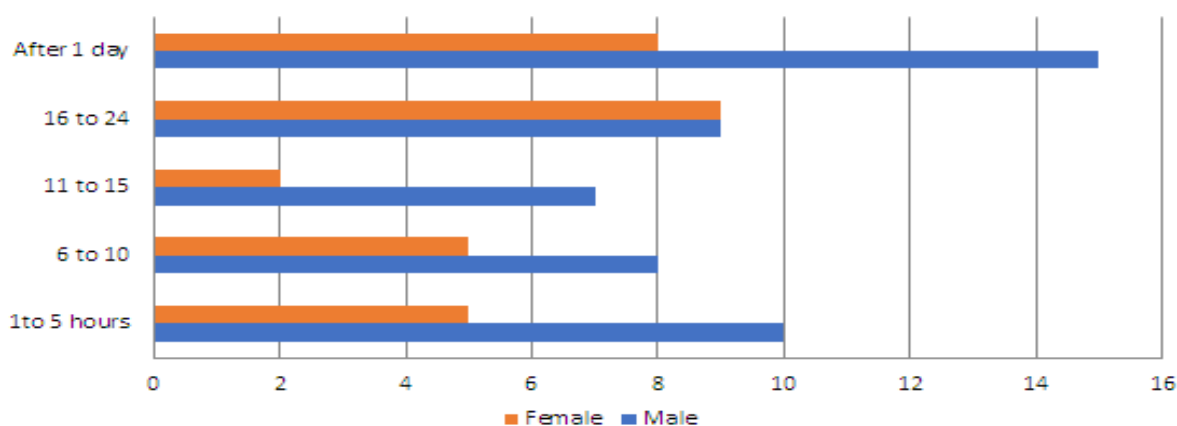


Figure 3
Showing Length of Hospital Stay before Surgical Interventions

The majority (100%) of participants indicated pain (100%), prolonged bed immobility (43%), with surgical interventions, 51.8% of impaired functional levels of the upper and 75.9% of the lower extremities, and 22.8% of lost nervous function. On socio-economic status, 94.9% revealed they had lost days to work to earn an income, 5% to school, 100% to family and friends, and 68.3% had lost money to buy assistive devices. Some participants revealed that they had been trained on how to walk again by using assistive devices (walking frames (21.5%), axillary crutches (21.5%), and wheelchairs (25.3%), as shown in Table 1 below.

Table 1
Showing Participants' Perception of the Health Impact of Extremity Fractures and Spinal Cord Injuries

Impact	Patients' status	Number	Percentage (%)
Health status	Pain	79 (30 females,49 males) 25 (7 females, 17 males)	100
	Bedridden due to impaired upper extremities functional levels	34 (15 Females, 19 Males)	43
	Bedridden due to impaired lower extremities physical levels	43 (15 Females,26 Males)	51.8
	Bedridden due to lost nervous function	19 (4 Females,15 Males)	24
Socio-economic	Lost days to work and activities of daily living	79 (27 Females, 48 males)	94.9
	Lost days to school	4 (3 females, 1 male)	5
	Lost days with family and friends	79 (30 females, 49 males)	100
	Unexpected expenditure on orthopedics instrumentation and assistive devices	54 (19 females, 35 Males)	68.3
Assistive devices for Gait training	Walking frames	17 (6 Females 11 Males)	21.5
	Axillary crutches	17 (6 Females 11 Males)	21.5
	Wheelchair	20 (7 Females 13 Males)	25.3

The majority (100%) of the participants on the assessment of hospital admissions presented with neurological and muscular pain of 10/10 to 9/10 on a visual analog scale, which worsened with limb movements. Various physiotherapy assessment outcome measures tools were used to manage the pain, as shown in Table 2 below. The use of goniometry, tape measure, Oxford scale, and palpation were used for the assessment of joint range, muscle length, strength, and tone, respectively, as shown in Table 2 below. Multicomponent therapeutic exercise and positioning were the main physiotherapy interventions, as shown in Table 2 below. Positioning of fractured limbs as well as vertebral regional, bed mobility, transfers, and stretches exercises were the main interventions for functional rehabilitation, as shown in Table 2.



Table 2
Physiotherapy Functional Rehabilitation Domains, Assessment, and Interventions

Functional Rehabilitation domains	Outcome measures tools	Assessment	Parameters	Physiotherapy Interventions	Percentage (%)
Pain	Visual Analogue Scale (VAS), Numeric visual scale	Observation	Increased input and output processing nociceptive (Muscular, neurological, Referred pain)	Isotonic muscle contraction, Muscle settings, and relaxation techniques Bed mobility and bed transfer guidelines	100
		Palpation			
	Physical functional or Joint movement that aggravates pain	Level, Nature, and mechanism of pain	Reduced joint range of motion (ROM) Poor movement pattern	Passive range of motion (PROM) stretches, Active assisted ROM. Active resisted ROM, low-load facilitated ROM stretches Positioning, Static muscle contraction	100
Joint stiffness	Goniometry Tape measure	Joint ROM Palpation Limb girth and length discrepancy	Reduced joint ROM	PROM, AROM, AAROM, AROM stretching exercises, joint mobilization techniques Muscle settings, stretching, Isometrics	100
			Reduced Muscle tone, Reduced limb length		
			Reduced Muscle mass		
			Reduced muscle strength	Gradual strengthening exercises (isometrics, eccentric, isotonic, isokinetic) Use of Manual and mechanical equipment	52
Muscle weakness	Oxford scale	Manual muscle testing			100

Pain and joint stiffness were reported by the majority of the participants (100%) with 52% indicating reduced muscle strength. All (100%) participants revealed they were assessed and managed their cardiorespiratory systems using various tools after which physiotherapy interventions were commenced to maintain, restore, and improve the skeletal muscle strength, increased venous return and lung functions as shown in Table 3 below.



Table 3
Physiotherapist Assessment of Cardiorespiratory Systems and Interventions

Functional rehabilitation domains	Assessments	Outcome measures	Parameters	Physiotherapy interventions
Cardio-vascular systems	Cyanosis Anemia	Observation Capillary refill Rate of perceived exertion (RPE)	Central or peripheral Pulse oximeter	Cardiopulmonary- endurance training. Low aerobics exercise
	Oedema	Observation Grading 1-4 The figure of 8 measurements Goniometry	Pitting or non-pitting Range of motion	Effleurage, friction, skin rolling technique Elevation of the limb to aid venous return
Respiratory systems	Chest expansion	Observation Tape measure chest symmetry	Use of accessory muscles for breathing Patterns, rhythm, and rate of breathing Fatigue Posture	Head, neck, and shoulder relaxation exercises, Range of motion
	Breath and heart sounds	stethoscopes for auscultation		Muscles stretches of head, neck, shoulder, thoracic and abdominal region(chest mobility)
	Lung function tests	Incentive spirometer	Normal and abnormal breath sounds	Active cycle of breathing (ACBT), Pursed-lip, forced expiratory training, diagrammatic breathing exercises and coughing techniques
	Deep venous thrombus	Homan’s sign	Raised local temperature, swelling, shiny skin, pain	Positioning at least 3 days following warfarin and heparin medications Ankle and foot stretching’s Ambulation
	Posture analysis	Observation	static and dynamic body symmetry	Posture and gait training Stretching of shortened muscles and strengthening weakened to achieve chest mobility and compliance
	Gait analysis		Stance and swing phase	Locomotor training for Stride length & time, step length, time & velocity, cadence, single & double leg support, trunk and arm swing.

All 100 participants reported that their neuro-musculoskeletal assessments were done using various outcome measurement tools by physiotherapists, as indicated in Table 4. That determined structural and physiological impairments linked to limb fractures and spinal cord injuries, which guided physiotherapy interventions, as shown in Table 4.



Table 4

Musculoskeletal and Nervous Physiotherapy Rehabilitation Domains, Assessment, Outcome Measure Tools, Structural Changes, and Physiotherapy Interventions

Rehabilitation domains	Assessments	Outcome measures tools	Structural changes	Physiotherapy interventions	Percentage (100%)
Musculoskeletal	Muscle tone Muscle mass	Palpation	Loss of muscle tone, mass, length	Static muscles contraction, Monkey chains, Push-ups	100
		Limb girth measurements			
		Tape measures			
	Muscle strength Muscle power and endurance	Oxford scale Functional Index Measures Scale (FIMS)	Muscle strength	Isometric (eccentric, concentric & Isotonic) Bridging Exercises & aerobic training	77
		6MWT (Minute walk test)	Fatigue		
		10MWT	Reduced muscle endurance		
	Joint range of motion	Goniometry	Joint stiffness	Range of motion (ROM)- Passive ROM, Active ROM, AROM-resisted exercises, Maitland & Mulligan Joint mobilization techniques	52
	Posture Balance and coordination	Static and Dynamics Gait training	Lost/impaired/reduced physical function	Positioning and splinting	52
				Open & closed kinetic exercises	
Parallel bars for; Proprioception, co-ordination & Sensorimotor training					
Weight-bearing exercises					
Nervous system	ASIA (American Spinal Injury Association)	Motor and sensory function	Loss of nervous and motor function	PROM. bed positioning, bed mobility, bed-to-wheelchair transfers, assisted bridging, resistive exercises	24
			Impaired sensory and motor function	Assistive devices, weight-bearing exercises, Pelvic tilt, Stair climbing, obstacles navigating	
		Modified Berthal Index Score (100-point scale) Independence-activities of daily living (IADL)	Level of independence	Progression adherence to guidelines on levels of assistance	
	ICF ICIDH 10	Limited activity participation and restrictions		100	

Sixty-two percent of participants (30 males and 19 females) had a good perception of post-operative physiotherapy management, while 37% (20 males and 10 females) had a negative perception. One percent had yet to undergo surgical interventions. Fifty-one percent of participants (27 males, 14 females) and 46.8% (22 males, 15 females) had positive experiences with improved physical function and negative experiences with physiotherapy interventions, respectively. Seventy-nine percent point seven (32 males and 31 females) had a best to good perception of physiotherapy interventions, while 20% had a fair perception of their fractured limbs and spinal cord injuries. The majority (100%) of the participants reported limited activity participation and restrictions.

4.2 Discussions

The majority (100%) of the participants were admitted with extremity fractures (76%) and spinal cord injuries (24%) following commercial motorcycle road accidents, with men accounting for 62% and 92% of an age group in their active socio-economic reproductive age with a peak age of 18–44 years. These findings were similar to the Ezema et al. (2023) study but with a lower male prevalence of 74.4% to 62% in the current study. Findings were similar to Mowafi et al. (2021); and Moshi (2018) study, which points out that 74% of the population affected were at

their maximum working force between 20 and 55 years of age, with a significant loss of daily earnings and substantial low living standards in households and societies. These study findings were supported by Cordero et al. (2020), who indicated motorcycle road-related musculoskeletal injuries remained high, over 80%, as one of the neglected epidemics at community, national and global health levels despite the implementation of Kenya National Transportation Road and safety measures.

Forty-three percent (43%) had lost functional abilities of the upper extremity (19 males, 15 females). Fifty-one-point nine percent (51.9%) had lost physical function due to lower extremity fractures (39% (26 males, 15 females) and 24% (15 males, 4 females) with spinal cord injuries. Four participants (5%) reported lost days to school, and 94.9% reported lost days to income-generating activities (27 females, 48 males). Commercial motorcycle road-related traumatic fractures of the extremities and spinal cord injuries remained a major cause of prolonged bed immobilization in 74.8% of the participants, similar to the Gathecha et al. (2018) study. A few (29%) of participants were hospitalized for one day before emergency orthopedic and neurological surgical interventions were done. These findings were similar to those of Ezema et al. (2023), whose participants (67.4%) were admitted for more than 1 day to more than 14 days.

Upper and lower extremity fractures and spinal cord injuries lower the functional level of independence and eventually lower one's social and economic status due to impairments and disabilities (Cordero et al., 2020). This is contrary to the 2030 agenda on Sustainable Development Goals to reduce road traffic fatalities and injuries to 50% by 2023. However, the majority of hospital admissions continue to increase, resulting in prolonged bed immobility. Prolonged bed immobility remains a major cause of structural and physiological changes due to prolonged bed immobility, traumatic fractures, and spinal cord injuries. Physiotherapists use the Modified American Spinal Injury Association (ASIA) impairment scale to assess and determine the level of complete and incomplete spinal cord injuries for prompt prescription and progression of interventions (Kirshblum et al., 2020).

Participants, who sustained fractures of extremities (74.9%) and spinal cord injuries (24%), were referred for short- and long-term post-operative physiotherapy rehabilitation. Forty-four percent (44%) of participants were bedridden for their extremity fractures, immobilization, and spinal cord injuries for more than 3 days before and after orthopedic and neurological surgery. All 100 participants reported their injuries had interfered with their physical limitations and function, which called for physiotherapy treatment and rehabilitation. This was in line with the Ezema et al. (2023) study, which found that 78.8% of the participants involved in motorcycle road-related accidents had a temporary disability, but with physiotherapy, long-term functional rehabilitation was hoped to return to pre-trauma function.

Functional rehabilitation domains were pain, joint stiffness, reduced cardio-respiratory endurance, and lost motor and sensory function of the musculoskeletal and nervous body systems. The majority (100%) of the participants pre- and post-operatively were assessed with the following outcome measure tools: visual analog scale, goniometer, observation, tape measures, manual muscle testing, and ASIA, which informed prompt interventions as guided by best evidence-based physiotherapy practices. Functional rehabilitation domains were pain, joint stiffness, and cardio-respiratory, musculoskeletal, and nervous body systems. The majority (100%) of the participants pre- and post-operatively were assessed with the following outcome measure tools: visual analog scale, goniometer, observation, tape measures, manual muscle testing, ICF, IADL, Barthel index, and ASIA, which informed prompt physiotherapy rehabilitation interventions as guided by best evidence-based physiotherapy practices. Physiotherapy assessment of individuals with musculoskeletal impairments of lower limbs, fractures, and spinal cord injuries was done in line with Scott et al. (2020) to determine lost function and impairments and interventions to restore and improve level of independence and Waddell and Burton (2004) in the determination of rehabilitation strategies. Although there were no policies enforced for the use of OMs, they developed comprehensive rehabilitation for an interdisciplinary approach, as pointed out by Rashid et al. (2022).

Pain (100%) and impaired physical functions (100%) were the main rehabilitation domains that posed the biggest challenge to patients' post-trauma. In the current study, all (100%) participants were assessed with outcome measure tools, and their rehabilitation domains were identified that informed the course of physiotherapy interventions. These findings concurred with Kramer et al. (2017) and Belavý et al. (2017) studies, which indicate the significant role of physiotherapists in the prescription of physical activity and exercise for the restoration and maintenance of soft tissue length and strength, bone density, tendons and ligament structures, and function of the affected and non-affected limbs following bed immobilization.

Multifaceted tailored physiotherapy interventions ranging from stretching, strengthening, breathing exercises, bed positioning, mobility and transfers, balance and coordination, and gait training towards patients' physical function levels and prevention of muscle atrophy, strength, and joint stiffness were prescribed for both conservative and post-operative physiotherapy programs. Short-term physiotherapy rehabilitation on early bed mobilization and ambulation for patients remains core for the restoration of physical functional levels and a return formula to socioeconomic status while preventing the acquisition of structural and physiological changes linked to impairments and bed

immobilization. These findings were supported by Kramer et al. (2017) and Belavý et al. (2017) studies that indicate patients who participate in static muscle contraction have a lower rate of deep venous thrombosis incidences. Those who take part in light aerobics and strengthening exercises have less muscle atrophy and weakness. Thus, well-maintained muscle strength in cardiorespiratory and musculoskeletal functional rehabilitation domains is associated with increased neuromuscular junction activity for synchronization of nervous systems and increased insulin sensitivity for energy utilization for muscle tissue growth. This is also supported by Scott et al. (2020), who maintain prescribed range of motion exercises, flexibility, strengthening exercises, and gait training on non-weight and weight-bearing exercises to reverse muscle atrophy at 6% per week. This concurs with Graham et al. (2021), who maintain the prescription of therapeutic exercises as a preventive measure against muscle wasting.

This is in line with another study that has shown that after one day of patient bed immobility, the fibroblast-derived protein collagen in tendons and ligaments responsible for its stretching during activities of daily living (ADLs) is shortened, straighter, and densely packed with lost function (Paxton et al., 2012). Participants were reported to develop joint stiffness, a shortened length of soft tissues, and reduced metabolic function with the loss of lean muscle mass, strength, and dynamic forces of groups of muscles causing fatigue and reduced endurance with evidence-based rehabilitation strategies (Parry & Puthuchear, 2015; Giangregorio & McCartney, 2006). Patients with spinal cord injuries were reported to develop foot and ankle contractures (Amis, 2014). The negative effects of increased lengths of bed immobilization should be reduced or prevented early bed mobilization by physiotherapists. However, physiotherapists knew the implementation of OMs in assessments and interventions to prevent disuse atrophy as a core rehabilitation aspect, contrary to Swinkels et al. (2011), who report gaps in the implementation of standardized outcome measures tools in physical therapy practice. The findings in this study are contrary to Claydon et al. (2014) emphasis on physical mobility and functional assessment, pain, and levels of patients' independence with ADLs as some of their core rehabilitation needs without consideration of bed immobility's effects on other body systems.

The majority (100%) of the participants reported hospital admission had separated them from friends and their families. All (100%) incurred unexpected medical healthcare costs, with 68.3% incurring extra costs for buying assistive devices for gait training due to motorcycle road-related neuro-musculoskeletal injuries. This concurs with the Ingabire et al. (2015) study, which reported motorcycle road-related injuries that socially affect the individual patient, family, and economic growth of one's country. This is also supported by the United Kingdom, National Guidelines Alliance (NGA, 2018) study, which indicates that in the LMICs, approximately 180 million US dollars are lost annually to healthcare costs due to commercial motorcycle-related fractures of the limbs and spinal cord injuries. Globally, 4.8 billion people access timely, safe, and affordable surgery (Cordero et al., 2020), which indicates a lack of cost-effective access to facility-based trauma care and physiotherapy rehabilitation services. However, little intervention was geared toward psychological and psychosocial aspects, as pointed out elsewhere (Economist Intelligent Unit [EIU], 2022).

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

Most of the participants had succumbed to limb fractures and spinal cord injuries following commercial motorcycle road accidents. Most of them were in their workforce age brackets. Most of these injuries are linked to hospital bed immobilization for some time. Most participants were concerned about losing time with their friends and family, who were their source of emotional support. These injuries also resulted in a significant negative impact on individuals' impaired physical mobility and functional abilities, disruption of socio-economic and psychological aspects, limited social interactions, and financial burden. The study was guided by a biopsychosocial model. This guided the use of outcome measure tools for the assessment of short-term functional rehabilitation domains, especially pain, physical impairments, mobility, and functional abilities, Physiotherapy interventions prescribed ranged from early bed mobilization for affected and non-affected body systems to prevent disuse atrophies and further deterioration of impairments and disabilities acquired. The progression of therapeutic exercise interventions, bed positioning, mobility, and transfers; range of motion, strengthening, bridging exercises, proprioception, kinetic, sensorimotor, gait training, and ambulation remain core for the restoration of physical functional levels and a return formula for the socio-economic pre-injury status of participants. Previous studies have highlighted the importance of the significant role of physiotherapy rehabilitation despite negative patients' perceptions of non-affected limbs and other body systems, hence the need for health education on their importance.

5.2 Recommendations

Participants admitted with traumatic extremity fractures and spinal cord injuries following a commercial motorcycle road accident should be assessed with outcome measure tools to determine the severity, interventions, and prognosis of impairments and disabilities. Physiotherapists should enhance patients' health knowledge in their

rehabilitation functional domains to comply with short-term physiotherapy interventions of the affected and non-affected body structures. Despite patients' negative perceptions due to pain, impairments, and lost physical functions of the extremities due to fractures and SCI, This will be hoped to maintain body functions, reduce pain, joint stiffness, and muscle weakness, and restore lost, impaired, and acquired physical functions of the cardiorespiratory and neuromusculoskeletal systems. There is a need for more research on the documentation of the ICF coding system and OMs in patient care and healthcare professional communication. Physiotherapy rehabilitation interventions, approaches, and strategies for neuro-musculoskeletal injuries following commercial motorcycle road accidents need to be documented on their aims towards rehabilitation needs and services to all while achieving the United Nations 2030 agenda for the 3rd Sustainable Development Goals.

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