CLINICAL CLASSIFICATION AND RISK OF CHRONIFICATION AMONG PATIENTS PRESENTING WITH LOW BACK PAIN AT TERTIARY CARE LEVEL IN TANZANIA

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Clinical Classification and Risk of Chronification among Patients Presenting with Low Back Pain at Tertiary Care Level in Tanzania.

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DECLARATION

This thesis is my original work and has never been presented for a degree in any other university.

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This thesis has been submitted for examination with our approval as University Supervisors

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DEDICATION

In memory of the late Cate Nelson. Your existence in this world is my lifetime lesson.

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ABBREVIATIONS AND ACRONYMS

CI	Confidence Interval
CLBP	Chronic Low Back Pain
JKUAT	Jomo Kenyatta University of Agriculture and Technology
LANSS	Leeds Assessment of Neuropathic Symptoms and Signs
LBP	Low Back Pain
MNH	Muhimbili National Hospital
MOI	Muhimbili Orthopaedic Institute
NSLBP	Nonspecific Low Back Pain
OPD	Outpatients' Department
SBST	STarT Back Screening Tool
SI	Sacroiliac
SPSS	Statistical Package for Social Sciences
ZJ	Zygapophyseal Joint

OPERATIONAL DEFINITION OF TERMS

Central pain Amplified response to painful/non painful stimuli in the central nervous system. Constant firing of nociceptive impulses in the brain leads to central sensitization

Centralization Phenomenon in which distally located symptoms migrate towards the central/proximal after repetitive movements or positioning.

Compressive radiculopathy Alteration of motor or sensory function as a result of inflammation or compression of the nerve root.

Chronification Process through which the disease or condition becomes persistent.

Clinical Classification Identification of diagnostic, prognostic and treatment subgroups of patients presenting with LBP

Clinical Diagnosis Process through which a particular illness is identified by physical examination.

Disability Complex interraction between individual's impairment, activity limitation and particiption restriction. Thus, a problem in body function or structure which hinders execution of task or activity in life situations.

Discogenic pain Pain arising from nociceptive receptors within intervertebral discs.

Low back pain Pain on the posterior aspect of the body between the gluteal folds and low boarder of the twelfth rib with or without being referred to leg.

Low back pain sub-group Potentially painful structures within the lower back part of the body .Theyinclude;intervertebral-discs/joints,sacroiliac joints,muscles, fascia and nerve roots.

Lumbar segmental instability Abnormal movement in response to normal physiological loading due to loss of neuromuscular control of intervertebral joints.

Maladaptive behaviour Inability to adjust healthily to a particular situation or environment.

Myofascial pain arising from activation of nociceptors within muscles or fascia.

Neurogenic claudication Pain in response to ischemia or compression of nerve roots within the intervertebral foramen or central canal.

Neuropathic pain response to damage to the somatosensory system. Lesion/disease of the somatosensory nervous system alters an individual's perception of pain, vibration, touch, pressure, temperature and proprioception.

Nociceptive pain response to actual tissue damage. The pain resulting from activation of nociceptors in the muscles, ligaments, joints and tendons in response to chemical, mechanical or thermal stimulus.

Non compressive radiculopathy Pain arising when free nerve endings are stretched. Mechanical sensitivity of these nerves is often a result of inflammation. Clinically, peripheral nerves of lower extremities can be stretched through Straight leg raise, Slump test and Femoral nerve stretch tests.

Orthopedic movement tests	Series of stressful movements perfomed with the aim of analysing movements , detecting faults or yielding response.
Prognosis	Prediction of the expected development of the disease or condition.
Psychosocial factors	Combination of the psychological and social factors. The interaction between the environment and individual thoughts or behaviour.
Radiculopathy	Impaired or loss of reflexes, motor and/or sensory function as a result of nerve compression or inflammation. Radiculopathy is assessed objectively by clinician.
Risk factors	Variables that are associated with likelihood of disease development or injury.
Treatment outcomes	Evaluation undertaken to assess the effectiveness of an intervention.
Zygapophyseal joint pain	Pain resulting from activation of nociceptors within or around facet joints.
Sacroiliac joint pain	Pain resulting from activation of nociceptors within or around sacroiliac joint.

ABSTRACT

Low Back Pain, is the leading cause of years lived with disability globally, work absenteeism, early retirement and inability to participate in the expected social roles in rural and urban Africa. The impact of low back pain to individuals and healthcare system, can not be ignored, considering its prevalence and socioeconomic consequences. It is imperative that the correct diagnosis be made in early stages to avoid improper treatment, chronification and misuse of resources. In turn, this practice will enable practitioners to come up with working diagnoses which inform management decisions. Thus, matching the right treatment to the right diagnosis at the right time. This study was aimed at classifying people presenting with LBP at the Physiotherapy outpatients' departments of MNH and MOI, into different clinical sub-groups. Secondly, determining the levels of risk of chronification among patients within the two institutions. Finally, establishing the relationship between the LBP clinical subgroups and the levels of risk of chronification. Cluster sampling followed by simple random sampling methods were used to determine the sample size from the two clusters. Based on departmental records from the two hospitals, a ratio of 2:1 was employed to proportionately distribute the sample size within the two clusters. A cross-sectional sample size of 310 patients presenting with LBP, were randomly selected from the Physiotherapy outpatient registers of the two tertiary hospitals in Tanzania. Both written and verbal consent were sought from study participants before their enrolment. Participants were classified into clinical subgroups using the diagnostic checklist and levels of risk of chronification was established using the STarT Back Screening Tool. The descriptive and inferential statistics were analysed using SPSS version 25. Chi-square statistical test was performed to test association between clinical subgroups and levels of risk of chronification. The results on the bivariate analysis were interpreted within the 95 % Confidence Interval and the level of significance (p-value$\leq$ 0.005) which indicate the statistical significance of the two variables. Low Back Pain was classified into mainly four groups namely Nociceptive pain (n=227, 73.2%), Neuropathic pain (n=45, 14.5%), Functional instability (n=21, 6.8%) and Other diagnoses (n= 17, 5.5%). Regarding the levels of risk of chronification, 49.03% were at low risk, 24.2% medium risk and 26.8% were at high risk of developing persistent pain and disability. Furthermore, results indicated that there was significantly strong and positive relationship between Neuropathic LBP, Functional instability and high risk of chronification. In conclusion, this study has established that majority of the patients had Nociceptive followed by Neuropathic LBP. Overall, the study has established that over a quarter (¼) of people presenting with LBP, were at high risk of chronification. More specifically, patients with Neuropathic and Functional instability LBP were at higher risk of chronification.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Definition and prevalence of low back pain

Low back pain is a symptom or rather a complaint expressed in terms of location (Hartvigsen *et al.*, 2018; Maher *et al*., 2017). It is defined as pain on the posterior aspect of the body between the gluteal folds and margins of the twelfth rib with or without referred leg pain (Hartvigsen *et al*., 2018;Maher *et al*., 2017). Most people experience low back pain at least once in their lifetime (Balagué *et al*., 2012; Foster, 2011). The life time prevalence of low back pain is estimated to be 84% (Maher *et al*., 2017), while one year prevalence of LBP ranges between 60% and 80% in the developed countries and 57% in Africa (Hoy *et al*., 2014; Morris *et al*., 2018). It is the most prevalent musculoskeletal disorder in all age groups reported in the primary care setting in rural and urban Africa (Igwesi-Chidobe *et al*., 2017).

Causes and risk factors

Generally, low back pain exist in three forms, which are, specific spinal pathology, nerve root pain /radiculopathy and biomechanical causes which are nonspecific (Almeida & Kraychete 2017). However, the first two sources are less prevalent in primary care setting. Furthermore, LBP is multifactorial, multidimensional and population specific (Delitto *et al*., 2012). Additionally, risk factors linked to LBP are said to be either individual or activity related (Hoy *et al*., 2014). Individual risk factors include, demographic, anthropometric, physical and psychosocial factors (Vlaeyen *et al*.,2018). While, the activity related factors which are linked to LBP include operating heavy equipment and higher physical demand jobs such as lifting and bending or twisting the back (Shambrook *et al*., 2011).

Clinical presentations and complications

It is reported that, about 80% to 90% of the low back pain cases seen in the primary care setting are non-specific (Maher *et al*., 2017). Meaning that, non-specific LBP is clinically diagnosed when there is no recognizable pathology (Hartvigsen *et al*., 2018). Often, patients with nonspecific LBP demonstrate no spinal abnormalities in radiological findings but many diverse symptoms (Maher *et al*., 2017; Shambrook *et al*., 2011). While those with radiculopathy often present with leg pain and numbness or weakness below the knee (Shambrook *et al*., 2011). Specific spinal disorders may include, vertebral fracture, malignancy, infection or cauda equina syndrome (Bardin *et al*., 2013). Which may present with unexplained weight loss, constant pain which do not change with movement or time, structural deformity or persistent lumbar flexion among others (Bardin *et al*., 2017; Hartvigsen *et al*., 2018). However, patients in the last two categories represent the minority (less than 10%) in the primary care hospitals (Maher *et al*., 2017).Thus, thorough clinical assessment and classification is necessary to identify other causes of low back pain (Bardin *et al*., 2017).

It is estimated that acute LBP lasts for six weeks, sub-acute stage 6 to 12 weeks and chronic stage is beyond 12 weeks (Karran, Mcauley, *et al*., 2017). Chronic low back pain is common but not easily manageable (Kamper, 2015; Traeger *et al*., 2015). The unpredictable nature and symptom patterns predispose low back pain patients to altered brain activity response to pain even within the same person (Hashmi *et al*., 2013). It is reported that, 60% to 80% of people with low back pain still experience pain symptoms and disability a year after previous episode even when they do not seek medical care (Foster, 2011; Geurts *et al*., 2018). Global estimates are that in every 100,000 people, 9442.5 (9%) have chronic LBP (Geurts *et al*., 2018). Thus, a call for efforts to develop preventive strategies particularly in the developing countries where resources are constrained.

Assessment and Diagnostic classification

Proper stratification of nonspecific LBP is fundamental to prevention of recurrence and chronification of the condition (Wippert *et al*., 2017). According to Foster, (2011), most of clinicians treat the symptoms present amongst LBP patients,with regards to subjective and objective information gathered or rather imaging findings. Further, they fail to identify the individual, psychosocial and work-related barriers to recovery (Foster *et al*., 2018). Chronic LBP has gained global health concerns recently due to its debilitating consequences (Fourney *et al*., 2011; Geurts *et al*., 2018; Sato, 2017).

Health and socio-economic impact

Low back pain is among the main contributors of health care costs worldwide (Maher *et al*., 2017). The condition affects all life domains both directly and indirectly. The indirect costs are mainly due to lost productivity, while the direct costs include the cost for hospitalization, medications, medical equipment/supplies and clinicians' time (Sato, 2017). However, the indirect costs represent the largest proportion (75%-93%) of the total cost of care for LBP patients *(*Husky *et al*., 2018). For instance, in the Netherlands, it is reported that, cost of care for chronic LBP patients account for 0.6% of the gross national product and 1% to 2% in other countries (Amescua-garcia *et al*., 2017; Dutmer *et al*., 2019; Geurts *et al*., 2018). While, in 2005, the direct cost of care for LBP patients was estimated to be 85 million dollars in the United States, with 65% increase since 1995 (Katzan *et al*., 2020).

People with LBP symptoms are affected physically, emotionally, socially and economically. It is estimated that, the number of years lived with disability due to LBP has escalated from 58.2 million to 83 million in 10 years (Sato, 2017). Furthermore, people with LBP lose their social identity due to inability to fulfil traditional and expected social roles in a society (Hartvigsen *et al*., 2018).

On the other hand, the economic impact of LBP includes work absenteeism and presenteeism (being at work but not able to work to the full capacity due to illness). Reports show that, LBP is the reason for work absenteeism and disability claims in people under 45 years of age (Fourney *et al*., 2011). It is also amongst the reasons for early retirement and reduced wealth creation opportunities in people below 65 years with LBP compared to their age mates without LBP (Hartvigsen *et a*l., 2018; Maher *et al*., 2017).

Consequences of low back pain are more extreme in the low- and middle-income countries due to inadequate resources and poor structural adjustments at work places. Hence placing the low back pain sufferers in more disadvantaged situations (Buchbinder *et al*., 2018; Hartvigsen *et al*., 2018; Igwesi-Chidobe *et al*., 2017). Therefore, investigators across the globe, lay emphasis on secondary prevention strategies to reduce the socio-economic impact of LBP. This study was aimed at identifying the clinical categories of LBP and levels of risk of chronification as well as establishing the relationship between the clinical subgroups and levels of risk of chronification.

1.2 Statement of the problem

Up to 80% of people continue to experience pain and disability a year after LBP onset even when they do not seek medical care (Foster et al., 2011). Majority of LBP patients (80-90%) have nonspecific pain, meaning that no underlying pathology can been identified (Maher et al., 2017). However, there is no proper stratification of the condition by the clinicians (Miller-spoto & Gombatto, 2014). Failure to recognise the different clinical subgroups of low back pain by Physiotherapists, has resulted into poor treatment outcomes, misuse of resources and longer duration of treatment and hence LBP chronification. Poor treatment outcome is costly to individuals and society. Studies indicating that LBP exist in different classifications are scanty particularly in Tanzania. This study findings are therefore aimed at filling this information gap particularly in the Tanzanian context.

1.3 Significance of the study

The lifetime prevalence of LBP is as high as 84% in rural and urban Africa and is among the contributing causes of years lived with disability in Sub-Saharan Africa. Its prognosis remains poor in most cases. Informing that LBP may exist in different subgroups is timely and important since there is need to alleviate LBP related disabilities, reduce treatment invariability, improve efficiency and patients' satisfaction.

1.4 Justification of the study

Information obtained from this study may guide healthcare providers to adopt LBP classification systems as part of their standard procedure. Hence, come up with specific interventions to match patients' underlying pathology at the right time. Additionally, the proposed LBP classification strategy if adopted by any clinical setting may reduce the use of invasive and expensive methods of diagnosis and treatment, hence facilitate proper use of resources. In the long term and if fully adopted, proper classification of LBP and targeted treatment may lead to improved treatment outcomes, reduce individuals' work lost days due to sickness absence and increase productivity to the nation.

1.5 Objectives

1.5.1 General objective

To classify LBP into clinical sub-groups and establish the levels of risk of chronification amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania.

1.5.2 Specific objectives

1. To classify Low Back Pain into clinical subgroups according to Patho-anatomical based classification scheme, amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania.
2. To establish the levels of risk chronification amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania.
3. To determine the association between the clinical subgroups and the levels of risk of chronification amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania.

1.6 Research questions

This study aimed at providing answers to the following questions.

i. What are the LBP clinical subgroups according to Patho-anatomical based classification scheme, amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania?
ii. What are the levels of risk of chronification amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania?
iii. What is the association between the clinical subgroups and the levels of risk of chronification amongst patients attending the Physiotherapy outpatient clinics at Muhimbili Orthopaedics Institute (MOI) and Muhimbili National Hospital (MNH) in Tanzania?

1.7 Study Conceptual Framework

This study was conceptually framed around nociceptive pain, neuropathic pain, functional instability and other LBP diagnosis as the independent variables while the dependent variables were the levels of risk chronification. The possible intervening variables were the different therapeutic approaches as utilised during conventional physiotherapy management as shown in the figure1.1.

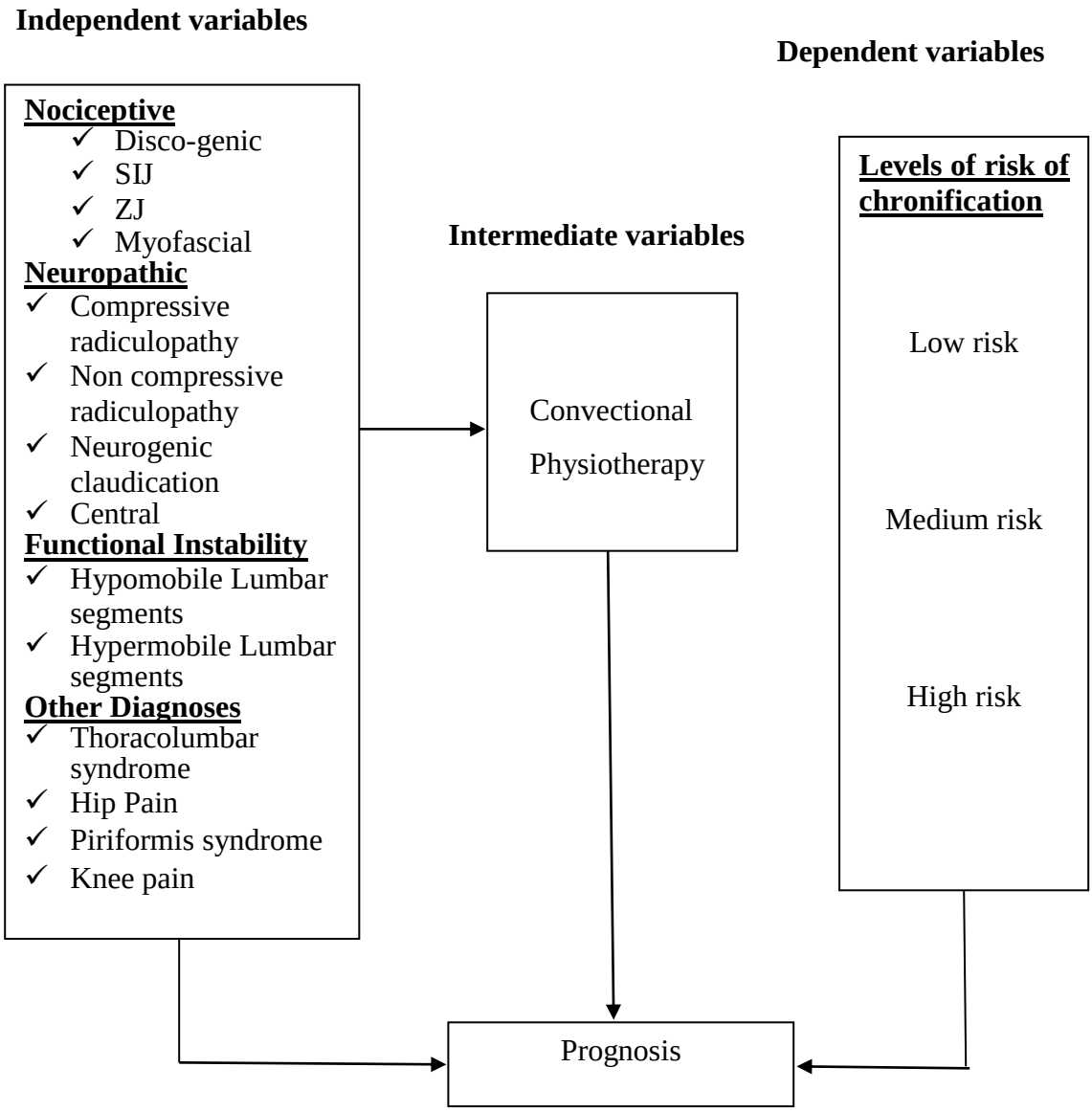

Figure 1.1: Study Conceptual Framework

1.8 Summary of the chapter

Diagnosis of low back pain is very challenging because the area contains many structures which are very sensitive to pain its symptoms are nonspecific. Consideration of all possible somatic, neurophysiological and psychosocial aspects ensures successful management of low back pain symptoms. Often, these features of low back pain are not

easily recognizable clinically. This study aimed at determining the clinical subgroups of low back pain and establishing the levels of risk of chronification in the different clinical subgroups. Information obtained from this study is expected to improve clinical practice and reduce invasive treatment/diagnostic methods thus facilitate proper use of resources.

CHAPTER TWO

LITERATURE REVIEW

2.1 Classification of LBP

In most studies LBP is classified as either specific or nonspecific LBP, however this classification is merely based on absence of pathology on radiological findings (Hartvigsen *et al*., 2018). LBP in absence of tissue pathology is termed as NSLBP, which represent 85% of all cases (Bardin *et al*., 2017). However, this classification ideology has failed to improve treatment outcome and patient's expectations simply because most of the symptomatic individuals have normal radiological findings (Sullivan, 2011). Additionally, the LBP condition is known to be multidimensional with multiple varying patterns, thus proper classification of NSLBP is warranted (Stynes *et al*., 2016).

Classification of LBP refers to identification of the multiple subgroups within LBP population through specific trunk movement tests which are then utilised to make clinical decision and treatment (Hartvigsen *et al*., 2015). While, classification scheme is a clinical assessment method developed to identify homogenous subgroups within LBP population through specific trunk movement tests and use those movement tests to make clinical decision and treatment (Karayannis *et al*., 2012). A good classification scheme considers all possible sources of LBP, that is path anatomical, neurophysiological, psychosocial and biomechanical factors. Furthermore, a useful classification of NSLBP should be able to identify homogenous subgroups which respond to a specific treatment intervention (Hodges, 2019). In orthopaedic physiotherapy practice, there are commonly five classification systems which utilize the patients' response to clinical movements during physical examination (Stynes *et al*., 2016).

These are Treatment Based Classification (TBC), Movement System Impairment (MSI), Mechanical Diagnosis and Treatment (MDT), O'Sullivan Classification Scheme (OSC) and Patho-anatomical Based Classification (PBC) (Karayannis *et al*., 2015). These classification schemes share some clinical features. For instance, MSI and MDT assess spinal alignment/movement directions which elicit symptoms then modify the identified motion at fault in order to reduce symptoms. While OSC and TBC assess the psychosocial factors in people presenting with LBP, which are then used to guide choosing appropriate intervention (Hodges, 2019).

2.1.1 O'Sullivan Classification Scheme (OSC)

This classification scheme seeks to identify pain driving mechanisms behind LBP (Karayannis *et al*., 2012). OSC is principally generated from Motor Control Impairment (MCI) theory (Seraj *et al.*, 2019). According to this scheme, LBP is a result of maladaptive spinal postures or movement patterns, and motor control behaviour (Karayannis *et al*., 2015). Following, alterations in movement or control, one develops persistent impairment and awkwardness during task performance hence vicious cycle of pain is formed (Meier *et al*., 2019). People with movement or control impairment exhibits either pain avoidance or pain provocation behaviour and their response is categorised as adaptive or maladaptive (Karayannis *et al*., 2012). Adaptive motor response to pain is a result of underlying pathological process (Van Dieën *et al*., 2017). While maladaptive motor response to pain is the result of combination of psychosocial (non-organic) factors and movement impairment (Seraj *et al*., 2019). From the two responses, five distinct movement patterns are generated. They include, Flexion which is defined as pain disorder due to loss of motor control in the lumbar segment (usually presenting with loss of lumbar lordosis) (Hodges, 2019). Active extension referred to as pain disorder resulting from lumbar segment being held actively into extension (presenting with increased segmental lordosis) (Seraj *et al*., 2019). Lateral shift (Flexion or extension) that is pain disorder resulting from loss of motor control of the lumbar segment in the frontal plane (lateral shift pattern) (Van Dieën *et al*., 2017).

Passive extension, that is pain disorder resulting from loss of motor control of the lumbar segment into extension, this is associated with the tendency to passively over extend (hinging) the symptomatic segment of the lumbar spine (Karayannis *et al*., 2012). The assessment of the MCI is coupled with subjective information, physical examination, pain behaviour assessment, radiology, screen for serious pathology (red flags) and psychosocial factors (yellow flags) (Hodges, 2019).

In the first stage, radiological evidence is matched with clinical presentation of the patient to distinguish between specific LBP and NSLBP (Karayannis *et al*., 2015). In the second stage, pain driving mechanism is identified as either central or peripheral nervous system disorder (Seraj *et al*., 2019). Pain is said to be centrally mediated when it is constant, non-remitting in nature with no clear mechanical loading influence (Karayannis *et al*., 2012). Whereas pain is said to be peripherally mediated when it is localized, logically defined (anatomical), and clear mechanical loading influence (Hodges, 2019).

When the identified pain is peripherally mediated, its location/origin is further classified, as LBP arising from the spinal structures or the pelvic girdle (Karayannis et al., 2012). LBP arising from the spinal structures is assessed whether it result from control or motor impairment (Van Dieën *et al*., 2019).

Control impairment LBP is lack of movement control of the symptomatic spinal segment in the direction of provocation (pain provocation behaviour) (Seraj *et al*., 2019). In this category, pain onset is usually gradual characterised by muscle guarding tendency due to loss of specific motor control of the spinal stabilizing muscles (Hodges, 2019). It is also associated with loss of withdrawal reflex, proprioception and loss of functional control (of the specific spinal segment) in neutral zone (Van Dieën *et al*., 2019). Thus, these patients unconsciously adopt spinal movements and postures that maximally increase pain (Van Dieën *et al*., 2017).

On the other hand, movement impairment LBP is loss of normal physiological movement in one or more directions and exhibition of fear avoidance behaviour (characterized by pain avoidance behaviour) (Reeves *et al*., 2019). Patients in this category, exhibit excessive lumbo-pelvic muscle co-contraction and excessive stability (Meier *et al*., 2019). Thus, these patients are actively aware of their pain provocation movements and therefore tend to avoid them (Van Dieën *et al*., 2017).

During the fourth stage, the direction and position (flexion, extension, lateral flexion or multidirectional patterns) of MCI are determined (Meier *et al*., 2019). The last stage involves assessing for contribution of the psychosocial and life style factors to LBP such as depressed symptoms, negative attitude, poor self-perception, smoking and sedentary (Hodges, 2019). Identification of the driving mechanism (MCI) behind LBP, guide the appropriate intervention (Seraj *et al*., 2019). For control impairment disorders, the aim of treatment is to enhance control of movement patterns through gradual training hence functionally unloading the painful sensitive structures (Meier *et al.*, 2019).While, in movement impairment disorders the aim of treatment is to facilitate movement gradually and to reduce the fear avoidance behaviours (Van Dieën *et al*., 2017). Concurrently, Cognitive Functional Therapy is applied, to tackle the physical and cognitive maladapted behaviours of people with movement impairment disorders (Hodges, 2019).

2.1.2 Treatment-Based Classification (TBC)

Treatment Based Classification is commonly known as Delitto's classification based treatment approach (Knol *et al*., 2012). Based on signs, symptoms and observation during clinical examination, classification algorithm is integrated (Karayannis *et al*., 2012). The algorithm enable the clinician to identify treatment most likely to benefit the patient (Alrwaily *et al*., 2016).

Signs from key movement tests such as centralization/peripheralization of pain, straight leg raising, prone instability test, and posterior-anterior lumbar mobility testing are essential in predicting the treatment strategy to be used (Karayannis *et al*., 2015). Nerve root compression signs are isolated through neurological examination (Hartvigsen *et al*., 2018).While, symptoms are assessed based on pain location, frequency, duration and fear avoidance beliefs of the patient (Alrwaily *et al*., 2016). The examiner observes for the presence of peculiar motion or lateral shift deformity during clinical observation (Henry, 2012). Four treatment strategies exist in TBC classification scheme, that is; Stabilization, Manipulation, specific exercises and Traction (Oliveira *et al*., 2018).

High velocity thrust is applied to the lumbo-pelvic region (manipulation) if the patient meets any of the four criteria, that is no symptoms distal to the knee, Low FABQW score (below 19), more than one hypomobile segment on lumbar segmental mobility testing, and hip internal rotation ROM (more than 35 degrees for at least one hip) (Karayannis *et al*., 2015). While, in stabilization subgroup exercises are prescribed to enhance stability and co-contraction of the stabilizing muscles such as transverse abdominis (Alrwaily *et al*., 2016). Stabilization exercises are indicated when the patient meets any of the three criteria, that is greater general flexibility (Average SLR ROM > 91, or postpartum or high BLLS more or equal to 4 out of 9), Positive prone instability test, positive deviant movements and age less than 40 years (Fritz *et al*., 2010).

Traction is indicated when there are signs and symptoms of nerve root compression and absence of movement causing centralization of symptoms (Alrwaily *et al*., 2016). Patient in traction subgroup receives mechanical traction in prone position coupled with exercises which facilitates centralization of symptoms (Oliveira *et al*., 2018). While end range spinal movements are applied in the specific exercise subgroup to centralize and improve the symptoms (Henry, 2012). Lumbar extension exercises are indicated when there are symptoms distal to the buttock, centralization of symptoms with lumbar extension and peripheralization with lumbar flexion (Fritz et al., 2010)

Flexion exercises are indicated when the patient is older than 50 years and evidence of spinal stenosis on imaging findings (Oliveira *et al*., 2018). While lateral shift exercises are indicated when there is lateral shift of the shoulders in relation to the pelvis (on observation) (Tousignant-Laflamme *et al*., 2017).

2.1.3 Movement System Impairment (MSI)

Theory behind MSI is that, there are direction-specific alignment and movements which increase or decrease patient's symptoms (Sahrmann *et al*., 2017).This classification scheme, seeks for specific directions of spinal alignment and movement which elicits symptoms in a patient presenting with LBP (Riley et al., 2019).

These fault movements are result of degenerative changes, repetitive movements and sustained/habitual postures which are assumed in daily life activities. Hence, alterations of joint movement and development of stiffness (Mesekaa *et al*., 2018).The tissue adaptation changes affect alignment/movement in all joints (intervertebral joints, hip and shoulder) ,this explains the absence or presence of flexibility of the lumbar region when lower limb range of motion is tested or trunk lateral flexion (Sahrmann *et al*., 2017). After detecting the lumbar motion which exacerbates symptoms, direction-specific movement strategies are used to modify patient's symptoms (Mesekaa *et al*., 2018).

During clinical assessment, the LBP subgroups are identified after testing for muscular stability, alignment, asymmetry, flexibility of the lumbar spine, hip and pelvis (Riley *et al*., 2019). The LBP subgroups according to MSI scheme are, lumbar flexion, lumbar extension, lumbar flexion with rotation and lumbar extension with rotation (Sahrmann *et al*., 2017). However, the system lacks pathoanatomical and psychosocial orientation and the five categories lacks classification reliability (Hodges, 2019).

2.1.4 Mechanical Diagnosis and Treatment (MDT)

This scheme is based on a combination of history taken from the patient and response elicited on lumbar spine loading (Garcia *et al*., 2016). The lumbar spine is subjected to direction specific movements or sustained postures which are in turn used to make diagnosis and guide treatment (Shipton, 2018). The main LBP subgroups include, derangement, postural and dysfunction syndromes(Garcia *et al*., 2017).

Derangement syndrome is proposed to result from intervertebral disc displacement, while dysfunction syndrome is thought to result from adaptive shortening or imperfect tissue repair (Lam *et al*.,2018). On the other hand, prolonged spinal end range positioning and sustained postures causes joint capsule and ligament ischemia hence postural syndrome subgroup (Garcia *et al*., 2017).

The loading strategies (Flexion, extension or side gliding) are applied repeatedly to the end of range to relocate or stretch the shortened tissue (Shipton, 2018). The patients' response to loading strategies are used to guide appropriate treatment.

Patient's response is either referred to as centralization or peripheralization that is movement of peripherally located pain/symptoms to the central location and vice versa *(Garcia et al*., 2017). However, the system has patho-anatomical orientation but lacks clear guidelines for management when outcomes are compared with other classification schemes (Henry, 2012).

2.1.5 Patho-anatomical Based Classification (PBC*)*

The PBC classification system is currently considered an ideal scheme for identifying the biopsychosocial traces amongst LBP sufferers (Abdelnaeem *et a*l., 2019).The system identifies the most common pathologic structures known to cause LBP, using evidence or hypothesis to support the diagnosis and direct treatment (Vining, 2013).

Evidence suggests that, identifying the patho-anatomical aetiology behind LBP development is essential during physical assessment process, as it leads to accurate diagnosis and administration of appropriate treatment intervention (Petersen *et al*., 2017).Thus, enabling the clinician to address individual needs of the LBP patients when planning treatment strategies (Ford & Hahne, 2013). This scheme classifies patients with NSLBP into different syndromes based on history and response to orthopaedic movement (Vining *et al*., 2019).These are intervertebral disc, facet joint, sacroiliac joint, nerve root, spinal stenosis, spondylolisthesis, fracture, myofascial structures, peripheral nerve and central sensitization (Petersen *et al*., 2017).

Subgrouping process, is based on the response to orthopaedic movement tests, symptom location and duration, response to mechanical loading (walking, sitting or lying positions), age and aggravating/easing factors (Spahr *et al*., 2017). For instance, intervertebral disc pathology is ruled out based on the centralization of patient's symptoms during repeated range of movements such as flexion, extension, left lateral shift and right lateral shift (Riley *et al*., 2020). PBC provides room for clinician to use the signs and symptoms presented by LBP patient to make diagnosis and directing individualised treatment hence avoidance of the expensive and invasive diagnostic methods (Petersen *et al*., 2017; Vining, 2013).

2.2 Factors associated with chronification of LBP

Low back pain is a condition with varying patterns and unpredictability than absolute recovery (Foster *et al*., 2018). Furthermore, the recovery process is uncertain when the condition has progressed for more than 12 weeks (Fourney *et al*., 2011). Generally, factors associated with chronic low back pain are categorised into four groups, that is modifiable, non-modifiable, assessment and treatment strategies (Wong *et al*., 2017).

The non-modifiable factors such as gender, age, genetic makeup, low education levels, low income and marital status are related to higher risk of chronification of LBP (Hartvigsen *et al*., 2015). It is suggested that, old aged females are more prone to

experience chronic LBP due to co-existence of other conditions such as osteoporosis, osteopenia and osteoarthritis (Hartvigsen *et al*., 2018). Also the genetic makeup of some individuals may affect their central pain processing mechanisms as well as their response towards analgesics hence making them vulnerable to chronic pain (Wong *et al*., 2017).

Other modifiable factors (yellow flags) such as smoking, poor living environments, poor access to health services, abnormal illness behaviours, presence of co-morbidity, inactivity, poor working conditions and psychological distress are highly associated with LBP chronification (Fujii & Matsudaira, 2013; Wippert *et al*., 2017). On the other hand, those with higher education levels and good income status are thought to be more willing and compliant to treatment and healthier lifestyle behaviours compared to those with low education levels and poor income status (Hodges, 2019). Furthermore, incomprehensive subjective and objective assessment of LBP patients by clinicians, under reporting of pain by patients and limited use of post treatment outcome measures are said to increase the odds for chronification of LBP (Wippert *et al*., 2017). Evidence suggest that individuals reporting neuro-compressive symptoms such as radicular pain, numbness and altered sensation are more likely to develop chronic LBP (Foster *et al*., 2013; Karran, Mcauley, *et al*., 2017).

It is postulated that, early treatment and categorisation of patients in their acute stage is more helpful in determining eventual improvement (Traeger *et al*., 2016). Recovery from pain and activity limitation occurs within the first three months since onset, beyond that time, recovery is poor (Traeger *et al.*, 2015). For instance in an observational prospective cohort study done in UK, Newell, Field, & Pollard, (2015), reported that, shorter duration, absence of pain above the knee and absence of pain 30 days in the previous year predicted remarkable improvement at 14 days follow up compared to 30 days follow up.

2.3 Pathophysiological process of chronification

Chronicity is defined as back pain persisting for more than three months (Karran *et al*., 2017; Traeger *et al*., 2016; Traeger *et al*., 2015). Functional organization of human brain is often influenced by stimulation, training or injury (Roussel & Nijs, 2013). Prolonged painful stimuli in the dorsal horn neuron result into abnormal pain processing in the central nervous system (Roussel & Nijs, 2013). Constant stimulation of nociceptors in the peripheral tissues causes heightened response in the brain commonly referred to as central sensitization (Petersen *et al*., 2017). This explains heightened emotional response and abnormal illness behaviour overtime in people with low back pain (Hashmi *et al*., 2013). It also explains, the mechanical hyperalgesia, referred pain and allodynia often experienced by people with chronic low back pain (Roussel & Nijs, 2013). Stabilization of changes in the brain activity marks the chronification of back pain, which usually takes 6 to 12 months (Hashmi *et al*., 2013). Evidence suggest that, mechanisms of central sensitization are precipitated by cognitive and emotional factors in patients with chronic LBP (Roussel & Nijs, 2013). Therefore, chronicity of symptoms is worsened by cognitive and emotional sensitization.

2.4 Risk of Chronicity

Risk of developing chronicity in back patients is anticipated so as to avoid over treating the low risk and undertreating the high risk patients (Traeger *et al*., 2015). Evidence suggest that high risk patients receive more Physical therapy treatment than the low and medium risk patients. For example in an observational prospective cohort study done in UK to stratify patients into risk groups, the clinicians despite being unaware of the risk groups allocation, they prescribed more treatment to the high risk group than the low and medium risk (Newell *et al*., 2015).

Early stratification of patients into risk groups has proven to be more effective in terms of treatment outcome (Foster *et al*., 2011). Moreover, evidence suggest that, stratification of LBP into risk groups (specifically high risk group), has resulted into

reduction of patient's symptoms in the subsequent treatment sessions (Karran, Traeger, *et al*., 2017). This is simply a result of tailored specific interventions towards the modifiable factors (Newell *et al*., 2015). According Hodges, (2019), patients at higher risk of developing chronic pain and persistent disability should be screened for psychosocial factors such as emotions and social conditions.

Psychosocial factors play a great role in transition of acute LBP to chronicity (Pincus, Burton, Vogel, & Field, 2002). It is suggested that, psychosocial disorders delay healing process in patients experiencing back pain (Beneciuk *et al*., 2017). For example, Newell *et al*., (2015), reported that patients in the medium risk group who were diagnosed to have more physical barriers to treatment showed remarkable improvement compared to high risk group who displayed more psychosocial barriers to treatment. Among the signs that an individual is prone to develop chronic low back include; inappropriate attitudes and beliefs about back pain ,inappropriate pain beliefs, work related problems and emotional problems (Nonclercq & Berquin, 2012).

2.5 Screening and Assessment of LBP

In Physiotherapy, clinical assessment is a vital process as it paves way for appropriate diagnosis identification and treatment intervention (Miller-spoto & Gombatto, 2014). Diagnostic labels serve as universal language amongst health care professionals as well as indicators for treatment intervention one is receiving (Foster, 2011; Foster *et al*., 2013, 2018). Classification of LBP patients into homogenous subgroups has proven to be effective in terms of outcome and treatment response. However, there is lack of uniformity in the diagnosis of LBP subgroups among clinicians attending to LBP patients (Hartvigsen *et al*., 2015). In the same article, Hartvigsen *et al*., (2015) referred to a postal survey done in Australia to determine the labels clinicians give to LBP subgroups, in which LBP subgroups were diagnosed differently. Also, they described differently the signs and symptoms of the diagnosed LBP subgroups. Similar situation is reported by Miller-spoto & Gombatto, (2014), who reported that, orthopaedic physiotherapists gave different labels to exactly one LBP clinical case.

The inconsistency in labelling LBP subgroups has implications in communication with other health care providers as well as management of the condition (Miller-spoto & Gombatto, 2014).

Most clinicians diagnose LBP on Patho-anatomical bases (Riley *et al*., 2020). On the other hand, some clinicians assess LBP in terms of physical impairment and pain response (Hartvigsen *et al*., 2015). However, there is limited use of validated tools and techniques in measuring pain, range of movement ,activity limitation and psychosocial factors in patients with LBP (Oliveira *et al*., 2018).

Assessment techniques of LBP differ across health disciplines due to beliefs, personal preferences and training received (Foster *et al*., 2018). Hartvigsen *et al*., (2015) reported a study done in Australia, to determine the methods used by clinicians to assess NSLBP, it was found that, some disciplines used techniques such as MRI, pain drawings, X-ray visual analysis and line drawing, more than others. Also ,infrequent use of low back pain outcome measures was reported across all disciplines (Hartvigsen *et al*., 2015). Proper assessment of LBP in its acute stages ensures treatment effectiveness and reduces chances of chronification. To counteract LBP chronification, guidelines suggest a shift from biomedical management of LBP to biopsychosocial approach (Foster *et al*., 2018). The reason being, biomedical diagnosis creates fear, abnormal body self-imaging, and induce avoidance behaviours towards painful movements thus, creating a vicious cycle of pain and persistent disability (Sullivan, 2011). Similarly, most of the treatments addressed in conjunction to biomedical diagnosis have proven to be ineffective (Oliveira *et al*., 2018). Possibly due to lack of specific individual's tailored treatment and failure to address other dimensions of LBP (Foster *et al*., 2011, 2018). Biopsychosocial framework considers all possible dimensions of LBP namely physical, neurophysiological, psychological and social factors (Buchbinder *et al*., 2018).

Thus, assessment and management of these factors in individuals with LBP is likely to prevent LBP chronification.

2.6 Summary of the chapter

Evidently, chronification of LBP is associated with gender, age, genetic influence, poor working conditions, low education levels and poor economic status. It is also influenced by negative emotions, abnormal illness behaviours of patients and inadequate compliance to the recommended treatment guidelines. Early identification of individuals prone to develop chronic LBP is highly recommended.

Physiotherapy comprehensive assessment of these patients and categorisation of LBP through various classification schemes ensures that individualised treatment will be offered to these patients thus reducing the chances of LBP chronification.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study site

This study was conducted at Muhimbili Orthopaedic Institute (MOI) and Muhimbili National hospital (MNH) located in Dar es Salaam, Tanzania for eleven weeks (July, August, and September 2019). The two study sites were preferred because, they receive patients from across the country particularly those seeking specialised orthopaedic treatment. Both (MOI and MNH) are national referral hospitals with a bed capacity of 340 and 1500 respectively (Human Resource Manager MOI, 2019; Human Resource Manager MNH, 2019). MOI is the only tertiary care facility offering specialised healthcare services in orthopaedics and neurosurgery in Tanzania. While, MNH is the national referral hospital offering specialised medical and surgical care services namely; Internal medicine, Paediatric and child health, Emergence medicine, Rehabilitative medicine, Psychiatric, Obstetrics and Gynaecology, Thoracic and general surgery, Urology among others. The exact setting for this study was, Physiotherapy outpatient clinics of both MOI and MNH. The two clinics were preferred because according to the departmental records, low back pain is among the common cases reported.

3.2 Study design

In undertaking this study, the researcher followed the reporting guidelines of the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) framework (Vandenbroucke *et al*., 2014). Further to STROBE framework, the researcher followed the observational study design. Where, a once-off observation of pre-specified study outcomes was conducted.

This cross-sectional approach was preferred because both dependent and independent variables were measured at a single point in time and research subjects were enrolled based on the inclusion and exclusion criteria set for the study (Spector, 2019).

Besides, this approach is relatively cheap to conduct, takes less time to complete and allow comparison of multiple population characteristics at the same time (Kesmodel, 2018). Hence due to limited time allocated for the research project and the specific objectives set to answer the research questions cross-sectional surveying approach was preferred.

3.3 Study population

In this study, the researcher targeted all patients presenting with LBP attending Physiotherapy outpatient clinics at MOI and MNH during the months of July, August and September. These were estimated to be approximately 1350 at MOI and 675 at MNH (MOI Physiotherapy head of department 2019; MNH Physiotherapy head of department 2019). However, due to human resource constrains, the researcher did not approach all patients presenting with low back pain. Therefore, not all patients presenting with low back pain formed part of the study population.

3.3.1 Inclusion criteria

For the purposes of this study, the researcher included all patients presenting with LBP at the two participating study sites who met the following criteria;

1. 18 years and above
2. Acute episode of LBP ($\leq$ 3 months since onset).

3.3.2 Exclusion criteria

In this study, the researcher did not include LBP patients who had;

1. History of spine surgery and pregnancy.
2. Any condition which might get worse during physical examination such as severe discogenic pain unrelieved by positions or physical agents such as moist heat and ice.

3. Confirmed/ suspected red flags such as cancer and progressive neurological deficit.

3.4 Sampling and sample size

The researcher utilized simple random methods to recruit participants from the two instructions. Participants were first arranged in alphabetical order and then randomly picked from Physiotherapists' appointment diary.

Sample size determination

Sample size is the sufficient number of research participants required to obtain ethically and scientifically valid results (Kadam & Bhalerao, 2010). In this study, sample size was determined using the Yamane formula (Adam, 2020);

$$n = N / (1 + Ne^2)$$

Where, n= sample size, N = population size, and e = Margin of error (MoE), e = 0.05 based on the research condition. In this study, population N=2025, Margin of error is 0.05

$$n=2025/ (1 +2025(0.05) ^2)$$

$$n=332$$

Therefore, the predetermined sample size was 332.

Sampling procedure

To ensure equitable representation of the two different participating sites, the researcher employed a selection criterion of participants using the ratio of 2:1 for MOI and MNH respectively.

This ratio was based on the number of patients presenting with LBP seen at Physiotherapy outpatient clinics of MOI and MNH in a month, that is 1350:675=2:1 for (MOI: MNH) according the departmental records in both hospitals.

The sample size was therefore distributed in the two hospitals in the same ratio. Thus, the researcher assessed 215 participants presenting with LBP from MOI and 107 participants at MNH Physiotherapy outpatient clinic.

3.5 Data collection tools

This study utilized three tools during data collection process namely; diagnostic checklist, STarT Back Screening Tool and the Body chart. A diagnostic checklist was used to identify the clinical subgroups of LBP and the Body chart was used to map patients' symptoms. While the STarT Back Screening Tool (SBST), was used in this study to establish the levels of risk of chronification (high, medium or low) amongst LBP patients.

3.6 Validity and Reliability of data collection tools

Previously, the diagnostic checklist was created based on the available evidence in literature and the likelihood ratios (Vining, 2013). Likelihood ratios (LR's) describe the probability of a test to detect a disease/condition precisely (Vining, 2013). Positive LRs of 2-5 are small but important while positive LRs of 5-10 indicate moderate ability and LRs of more than 10 indicate the highest ability of confirming the condition (Vining, 2013). The Keel Start Back Tool (SBST), has been tested for reliability and ability to classify patients into risk groups (Robinson, 2017). The ICC (95% CI) for SBST total score and for psychosocial subscore was 0.89 (0.82,0.94) and 0.82 (0.70,0.90) respectively showing that the relative test retest reliability was excellent (Robinson, 2017). Piloting was done on a randomly selected sample of 10 people with LBP symptoms.

LBP was classified into clinical subgroups using the diagnostic checklist developed by Vining, (2013) and levels of risk of chronification were established (low, medium and high) using STarT Back Screening questionnaire (SBST). These participants were not included in the main study.

3.7 Data collection procedure

The researcher identified LBP patients at the physiotherapy clinics in the two participating hospitals using the simple random sampling method. With the help of one research assistant, eligibility was checked before enrolment.

After a thorough explanation of the research aims to the participants using the participants' information sheet, those who agreed to participate were requested to sign a consent form. Then, a demographic questionnaire was administered. Thereafter a participant entered the examination room in which history of the presenting condition was taken, and symptoms mapped by the investigator using a body chart attached to the diagnostic checklist. Some of the questions asked during the interview, included area, onset and duration of the symptoms, the aggravating and relieving positions/movements. Based on the gathered information from the interview, the principal investigator/ research assistant classified LBP into clinical subgroups using the diagnostic checklist developed by (Vining, 2013). During classification, the researcher performed orthopaedic movement tests to rule out Sacroiliac and Zygapophyseal joint pain subgroups. Other LBP subgroups, were diagnosed by matching the information gathered from the interview and the checklist (by marking Yes/No). Later, the levels of risk of LBP chronification were assessed using the SBST. The researcher administered SBST questionnaire in English and Swahili languages. Each completed questionnaire was scored according to the scoring system previously established by SBST developers. In order to avoid consequences such as patients losing their place in queue or treatment cut short, the researcher undertook the following measures;

i. Chose participants randomly from Physiotherapist's diary.

ii. The researcher did not keep patients waiting in a queue, once a participant met the inclusion criteria, he/she proceeded to filling in the questionnaires and physical examination was done.
iii. The researcher dealt with one participant at a time.
iv. Participants were treated by Physiotherapist (preferably the one whose diary was used to pick the participant), once the researcher was certain that a questionnaire was filled in and all data collection procedures were completed.

3.8 Data handling and management

At the end of each day during the data collection process, the researcher collected all completed questionnaires and written consent forms for secure storage in a safety cabinet. The total participation time was 30 minutes. After achieving the targetted sample size, the reseacher collected all completed questionnaires for further processing. The data management process began by assigning serial numbers to all questionnaires, followed by identification of the key study variables under the following categories; sociodemographics, clinical characteristics, low back pain subgroups and the levels of risk of chronification.

Thereafter, the researcher coded the various specific variables into numerics example under the variable sex, male was assigned 1 while female was assigned 2. Then, information was extracted from all questionnaires sequentially into an excell spread sheet. This was followed by data cleaning process where by the researcher manually cross checked each entry with the participants' responses as captured in the questionnaire. The cleaned data in the excel spread sheet was then transported to the SPSS for statistical analysis.

3.9 Data handling and management

The imported data from Microsoft excel spread sheet was analysed using SPSS version 25.

Analysis was conducted using both descriptive and inferential statistical techniques. Descriptive analysis is important because it provides comprehensive description of the study participants' social demographics, unique clinical characteristics, clinical subgroups and the levels of risk of chronification.

The SBST scoring system was used to identify the levels of risk of chronification (high, medium or low) of study participants (Beneciuk *et al*., 2017). The overall score of SBST is obtained by summing up all the positive responses. Total score of three or less indicate low risk of chronification. While, the psychosocial subscale score is obtained by summing up items 5-9, where a score of three or less indicates medium risk of chronification (Beneciuk *et al*., 2017). While a score of four or more indicates high risk of chronification. The results on descriptive analysis were interpreted in form of frequencies, percentages and means while its presentation is in form of tables. Furthermore, the association between the different LBP clinical subgroups and the levels of risk of chronification was determined through bivariate analysis using the Chi-square statistical test. The results on the bivariate analysis were interpreted within the 95 % CI and the level of significance (p-value) which indicate the statistical significance of the two variables.

3.10 Ethical clearance

Authority to conduct the study was sought from Jomo Kenyatta University of Agriculture and Technology ethical review committee and the National Health Research Ethics Review Committee (NatHREC) in Tanzania. Furthermore, permission to conduct the study was sought from the administrators of MNH and MOI hospitals. Before enrolment, the informed consent was sought from the participants and were allowed to decline at any point during the study without suffering any repercussions and without forfeiting any benefits which they would have been otherwise entitled to. Furthermore, all questionnaires were coded to ascertain anonymity of the research participants.

Also, the information gathered from the participants was kept confidential and was only used for research purposes. Additionally, all completely filled questionnaires were stored in a safe and locked cabinet and were only accessed by the principal investigator.

CHAPTER FOUR

RESULTS

4.1 Preliminary analysis

Results from the normality test, and visual inspection of the histograms, normal Q-Q plots showed that data were approximately normally distributed therefore parametric tests will be used to conduct inferential statistics. Also, the researcher conducted preliminary analysis on the internal consistency of the diagnostic checklist and the STarT Back Screening tools using Cronbach's Alpha coefficient. For the diagnostic checklist the Cronbach's alpha coefficient ranged from 0.749 to 0.796 while for the SBST it was 0.712. Thus, the results indicate that measurement scales used were sufficiently reliable and adequately measured variables of the study. Further, sampling adequacy tests were done using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. The KMO test for the LBP main categories and the subcategories in the diagnostic checklist were 0.843 and 0.811 respectively while the risk of chronicity in the SBST was 0.709. The results from the Bartlett's test of sphericity on the LBP-main category, LBP sub-category and risk of chronification were 178.312 (p= 0.014), (319.161, p =0.019) and (147.339, p = 0.021) respectively. Since the KMO test results were above 0.5 and the Bartlett's test significances were less than 0.05 it indicates an acceptable degree of sampling adequacy.

A sample of 310 participants were enrolled, equivalent to 93.4% response rate. While, 12 participants were excluded/declined to participate. The enrolment process is elaborated in figure 4.1.

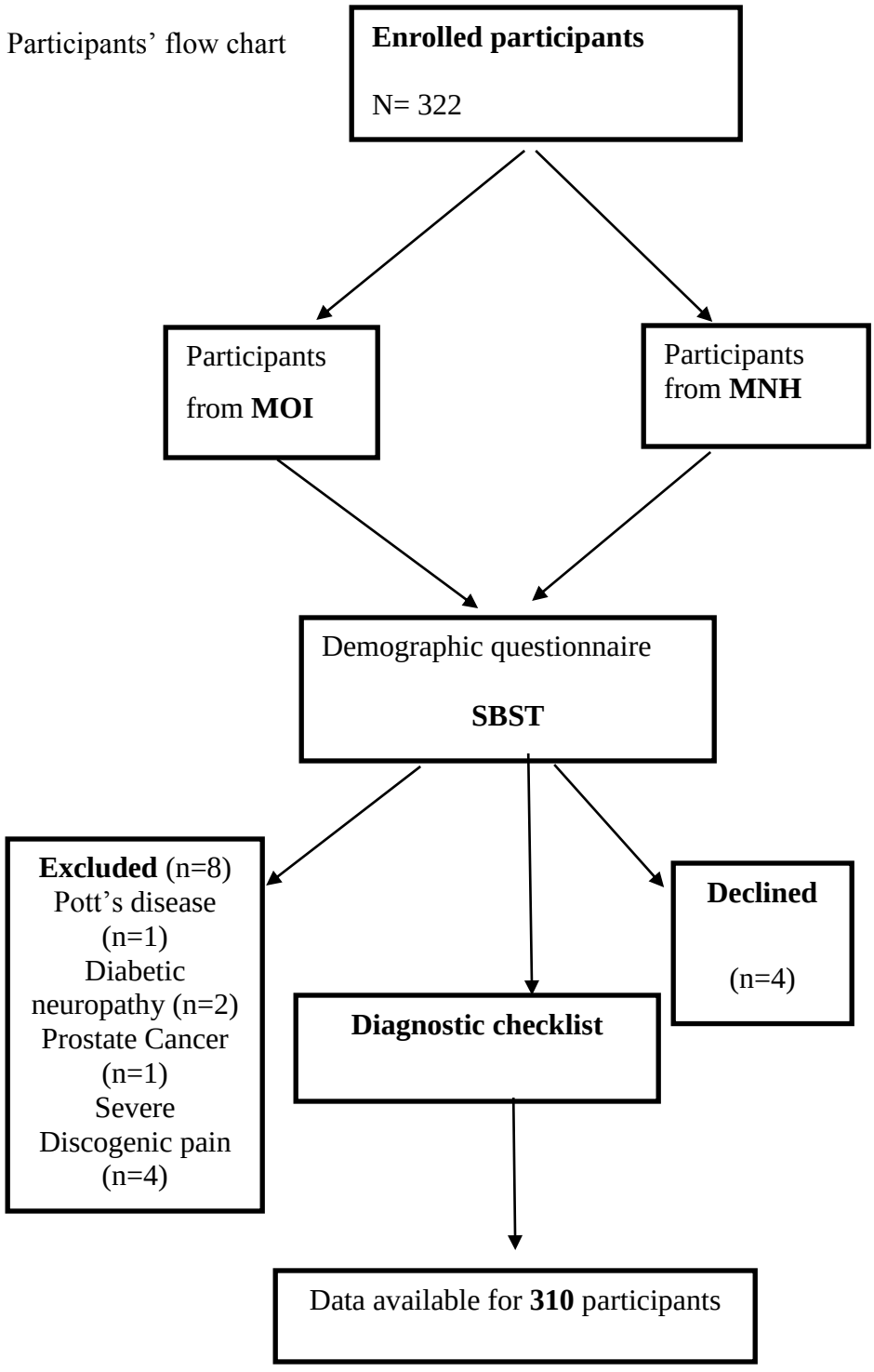

Figure 4.1: The Consort diagram

4.2 Socio-demographic characteristics

Descriptive analysis shows gender distribution of 204 females (65.81%) and 106 males (34.19%). Majority of the participants were above 40 years old, married (n=216; 69.68%) with secondary education (n=171; 55.16%). Additionally, most participants belonged to professional group (n=130; 41.94%). Also, majority of the participants had no history of smoking (n= 246; 79.4%). Table 4.1 presents results on the participants' socio demographic characteristics.

Table 4.1: Distribution of selected socio-demographic characteristics

Demographic characteristics	n	%
Gender		
Males	106	34.19
Females	204	65.81
Age		
< 30 years	26	8.39
30-40 Years	54	17.42
41-50Years	79	25.48
51-60Years	78	25.16
> 60 Years	73	23.56
Marital Status		
Single	72	23.23
Married	216	69.68
Divorced/separated	8	2.58
Widowed	14	4.52
Education Level		
Primary	58	18.71
Secondary	171	55.16
College/Diploma	31	10.00
University/Degree	41	13.23
Postgraduate	9	2.90
Occupation Group		
Professional	130	41.94
Managerial/Technical	64	20.64
Skilled Non-Manual	30	9.68
Skilled Manual	33	10.65
Unskilled	10	3.23
Not Applicable	43	13.87
Smoking Status		
Never	246	79.4
Previously	35	11.3
Current	29	9.4

4.3 Classification of Low Back Pain into categories

Participants were classified into mainly four categories, each with several subcategories. Most of the participants were in the Nociceptive Pain category, 73.2% (n=227; Mean=2.24; S. E=0.010).

Others in Neuropathic Pain category 18.39% (n=45; Mean=1.69; S. E=0.019) and the rest of the participants had evidence for other diagnoses not included in the checklist 5.5% (n=17; Mean=0.98; S. E=0.087). The results on classification of LBP into categories are summarised in table 4.2.

Table 4.2: The main categories of LBP

Main category of LBP	n	%	Mean	S.E of Mean	STD
Nociceptive Pain	227	73.2	2.24	0.010	0.265
Neuropathic Pain	45	14.5	1.69	0.019	0.398
Functional Instability	21	6.8	1.03	0.015	0.312
Other Diagnoses	17	5.5	0.98	0.087	0.417

Note: **n**: number of patients; **%**: percentage proportion; **S.E**: standard error; **STD**: Standard deviation

On further classification of LBP, within the Nociceptive pain category, participants were sub-classified having Discogenic pain (n=24; 7.74%), SI joint pain (n= 103; 33.23%), ZJ (facet) pain (n=55; 17.74%) and Myofascial pain (n=45; 14.51%). While in Neuropathic pain category, most participants had Compressive radiculopathy signs (n=29; 9.35%), Neurogenic claudication (n= 7; 2.3%), Central pain subgroup (n= 10; 3.23%) and only 3 participants (0.97%) belonged to Non compressive radiculopathy subclass. Furthermore, participants in the Functional instability category, were sub-classified having lumbar segmental instability signs (n= 17; 5.48%). Additionally, participants who had signs and symptoms of conditions other than LBP (which did not fit to either of the above categories/subcategories) were sub-classified as having other diagnoses/other (n= 21; 6.77%). These results are summarised in table 4.3.

Table 4.3: The subcategories of LBP

Main Category of LBP	Sub-category of LBP	N	%	Mean	S.E of Mean	STD
Nociceptive Pain	Disco-genic	24	7.74	1.82	0.015	0.268
	SI Joint pain	103	**33.23**	1.99	0.006	0.098
	Zygapophyseal Joint Pain	55	**17.74**	1.97	0.021	0.377
	Myofascial Pain	45	14.51	1.95	0.020	0.350
Neuropathic Pain	Compressive Radiculopathy	29	**9.35**	1.92	0.017	0.292
	Non-Compressive Radiculopathy	3	0.97	1.68	0.015	0.268
	Neurogenic Claudication	3	0.97	1.68	0.015	0.268
	Central Pain	10	**3.23**	1.97	0.010	0.177
Functional Instability	Lumbar Segmental	17	5.48	1.91	0.012	0.208
	Other diagnosis	21	6.77	1.93	0.011	0.377

Note: **n**: number of patients; **%**: percentage proportion; **S.E**: standard error; **STD**: Standard deviation

4.4 Risk of LBP chronicity among participants presenting with LBP

Both genders had low risk of developing chronic LBP. Those with more than 60 years had high risk of developing chronic LBP (9.03%, n= 28). Likewise married participants (18.39%, n=57), had high risk of developing chronic LBP. Also, participants with primary education (5.16%, n= 16) and secondary education (11.29%, n=35) had high risk of developing chronic LBP. Furthermore, those who worked as professionals (13.23%, n= 41) were at high risk of developing chronic LBP compared to the unskilled (1.61%, n=5) and skilled manual (7.1%, n=22) who had low risk of chronification. The table 4.4 summarises these results.

Table 4.4: Risk of chronification within selected socio-demographic characteristics

Demographic characteristic	Risk of Chronification						Total	
	Low		Medium		High			
	n	%	n	%	n	%	n	%
Gender								
Males	51	16.45	24	7.74	31	10.00	106	34.19
Females	101	32.58	51	16.45	52	16.77	204	65.81
Age								
< 30 years	17	5.48	4	1.29	5	1.61	26	8.39
30-40 Years	28	9.03	11	3.55	15	4.84	54	17.42
41-50Years	**39**	12.58	22	7.10	**18**	**5.80**	79	25.48
51-60Years	37	11.94	24	7.74	17	5.48	78	25.16
> 60 Years	31	10.00	14	4.52	**28**	**9.03**	73	23.56
Marital Status								
Single	46	14.84	12	3.87	14	4.52	72	23.23
Married	103	33.23	56	18.07	**57**	**18.39**	216	69.68
Divorced/separated	0	0.00	2	0.65	6	1.94	8	2.58
Widowed	3	0.97	5	1.61	6	1.94	14	4.52
Education Level								
Primary	26	8.39	16	5.16	**16**	**5.16**	58	18.71
Secondary	99	31.94	37	11.93	**35**	**11.29**	171	55.16
College/Diploma	9	2.90	8	2.58	14	4.52	31	10.00
University/Degree	18	5.81	13	4.19	10	3.23	41	13.23
Postgraduate	0	0	1	0.32	8	2.58	9	2.90
Occupation Group								
Professional	55	17.74	34	10.97	**41**	**13.23**	130	41.94
Managerial/Technical	43	13.87	13	4.19	8	2.58	64	20.64
Skilled Non-Manual	16	5.16	10	3.23	4	1.29	30	9.68
Skilled Manual	22	7.10	6	1.93	5	1.61	33	10.65
Unskilled	5	1.61	2	0.65	3	0.97	10	3.23
Not Applicable	11	3.54	10	3.23	22	7.10	43	13.87

4.5 Levels of risk of chronification within LBP categories

The results show that, most participants had low risk of developing chronicity (n=152; 49.03%). Others, had medium risk of chronification (n=75; 24.20%) and the rest had high risk of developing chronic pain and disability (n=83; 26.77%). Also, 39% (n=122) of participants with Nociceptive symptoms were at high risk of developing LBP chronification.

Approximately 6% of participants with signs of Neuropathic LBP were at high risk of developing chronic pain. The table 4.5, illustrates the number of participants in each risk subgroup within LBP categories.

Table 4.5: Risk of chronification within LBP categories

Low Back Pain (LBP)	Risk of Chronification						Total	
	Low		Medium		High			
	n	%	n	%	n	%	n	%
Nociceptive Pain	39	12.58	66	21.29	122	39.35	227	73.22
Neuropathic Pain	12	3.87	15	4.84	18	5.81	45	14.52
Functional Instability	3	0.96	8	2.58	10	3.22	21	6.77
Other Diagnoses	2	0.65	5	1.61	10	3.22	17	5.48
Total	56	18.06	94	30.32	160	51.61	310	100

4.6 Levels of risk of chronification within LBP subcategories

Results shows that within Discogenic pain subclass, 3.87% (n=12) of participants had high risk of chronification. Additionally, a significant number of participants with Zygapophyseal Joint Pain had low risk of chronification (11.29%, n=35). These results are elaborated in table 4.6.

Table 4.6: Risk of chronification within LBP sub-categories

Low Back Pain (LBP)	Risk of Chronification						Total	
	Low		Medium		High			
	n	%	n	%	n	%	n	%
Discogenic	4	1.29	8	2.58	12	3.87	24	7.74
SI Joint	50	16.13	26	8.39	27	8.71	103	33.23
Zygapophyseal Joint Pain	35	11.29	14	4.52	6	1.94	55	17.74
Myofascial Pain	36	11.61	7	2.26	2	0.65	45	14.51
Compressive Radiculopathy	18	5.81	5	1.61	6	1.94	29	9.35
Non-Compressive Radiculopathy	0	0	0	0	3	0.97	3	0.97
Neurogenic Claudication	0	0	2	0.65	1	0.32	3	097
Central Pain	1	0.32	2	0.65	7	2.26	10	3.23
Lumbar Segmental	4	1.29	6	1.94	7	2.26	17	5.48
Other diagnosis	4	1.29	5	1.61	12	3.87	21	6.77
Total	152	**49.03**	75	**24.19**	83	**26.77**	310	100

4.7 Relationship between study variables

The results indicate that there was statistically significant relationship between main categories of LBP (Nociceptive Pain; Neuropathic Pain; Functional Instability and other diagnoses) and the level of chronification risk of LBP (F=8.252; P=0.0021). These results are demonstrated in table 4.7

Table 4.7: ANOVA test between LBP main categories and risk of chronification

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.450	4	5.362	8.252	0.0021[b]
	Residual	198.192	305	0.650		
	Total	219.642	309			

a. Dependent Variable: LBP Main category
b. Predictors: (Constant) Level of risk of chronification

In addition, the ANOVA statistical test was performed to determine the association between risk of chronification and the LBP subcategory. The results indicated that there was significant relationship between LBP subcategories and the level of risk of chronification (F=10.123; P=0.0017). These results are presented in table 4.8.

Table 4.8: ANOVA test between subcategories of LBP and risk of chronification

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.165	9	5.685	10.123	0.0017[b]
	Residual	168.477	300	0.562		
	Total	219.642	309			

a. Dependent Variable: LBP Sub-Category
b. Predictors: (Constant) Level of risk of chronification

4.8 Association between socio demographic characteristics and LBP subcategories

Results indicated that there was strong and positive relationship between Discogenic pain (r=0.785, p-value=0.004), S.I Joint pain (r=0.838, p-value=0.002), Neurogenic Claudication (r=0.813, p-value=0.003), and age of participant with LBP.

Also, occupation group had significantly strong and positive relationship with Zygapophyseal Joint Pain (r=0.818, p-value=0.005) and Neurogenic Claudication (r=0.810, p-value=0.005). These results on the relationship between LBP subcategories and demographic characteristics are summarised in table 4.9.

Table 4.9: Relationship between LBP subcategories and selected demographic characteristics

		Age	Gender	Marital Status	Occupation Status	Occupation Group
Discogenic	Pearson Correlation	0.785*	0.735*	0.520	0.632	0.721*
	Sig. (2-tailed)	0.004	0.017	0.045	0.030	0.014
SI Joint	Pearson Correlation	0.793*	0.709	0.722*	0.712*	0.762*
	Sig. (2-tailed)	0.008	0.011	0.019	0.030	0.010
Zygapophyseal Joint Pain	Pearson Correlation	0.838**	0.775**	0.754*	0.728*	0.818*
	Sig. (2-tailed)	0.002	0.014	0.011	0.018	0.005
Myofascial Pain	Pearson Correlation	0.634	0.666	0.483	0.549	0.595
	Sig. (2-tailed)	0.033	0.026	0.054	0.048	0.044
Compressive Radiculopathy	Pearson Correlation	0.715*	0.635	0.720	0.612	0.741*
	Sig. (2-tailed)	0.039	0.013	0.015	0.030	0.014
Non-Compressive Radiculopathy	Pearson Correlation	0.691	0.689	0.732*	0.717*	0.772*
	Sig. (2-tailed)	0.012	0.050	0.012	0.031	0.010
Neurogenic Claudication	Pearson Correlation	0.818**	0.716**	0.751*	0.718*	0.810*
	Sig. (2-tailed)	0.003	0.031	0.011	0.023	0.005
Central Pain	Pearson Correlation	0.614	0.633	0.683	0.649	0.605
	Sig. (2-tailed)	0.035	0.026	0.054	0.048	0.044
Lumbar Segmental	Pearson Correlation	0.675	0.747*	0.720*	0.743*	0.711*
	Sig. (2-tailed)	0.009	0.017	0.045	0.021	0.014

Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed). Statistical interpretation r<0.5 Weak; r≤0.5-0.6 Moderated; r≥0.7-0.9 strong

4.9 Association between LBP main categories and the levels of risk of chronification

The results indicated that there was significantly strong and positive relationship between Neuropathic Pain (r=0.899, p-value= 0.001), Functional Instability (r=0.873, p-value=0.002) and high risk of LBP chronification. While, Nociceptive Pain (r=0.680, p-value=0.031) and other diagnoses (r=0.705, p-value=0.013) had significantly strong and positive relationship with low risk of chronification. These results are illustrated in table 4.10.

Table 4.10: Relationship between LBP main categories and risk of chronification

		Level of LBP Chronification Risk		
LBP Main-category		**Low**	**Medium**	**High**
Nociceptive Pain	Pearson Correlation	0.680*	0.638	0.796
	Sig. (2-tailed)	0.031	0.028	0.032
Neuropathic Pain	Pearson Correlation	0.571	0.762*	0.899**
	Sig. (2-tailed)	0.039	0.013	0.001
Functional Instability	Pearson Correlation	0.548	0.677*	0.873**
	Sig. (2-tailed)	0.041	0.011	0.002
Other diagnosis	Pearson Correlation	0.705*	0.680	0.603
	Sig. (2-tailed)	0.013	0.041	0.018

Note: **. Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed). Statistical interpretation r<0.5 Weak; r≤0.5-0.6 Moderated; r≥0.7-0.9 strong

4.10 Association between LBP sub categories and the risk of chronification

The results indicated that there was significantly strong and positive relationship between S.I joint and high risk of LBP chronification (r=0.861, p-value= 0.001). Non-compressive radiculopathy (r=0.841, p-value=0.004), and central pain (r=0.823, p-value=0.003) had significantly positive and strong association with high risk of chronification. These results are summarised in table 4.11.

Table 4.11: Relationship between LBP sub-categories and risk of chronification

LBP Sub-category		Level of LBP Chronification Risk		
		Low	Medium	High
Discogenic	Pearson Correlation	0.680*	0.438	0.611
	Sig. (2-tailed)	0.018	0.058	0.032
SI Joint	Pearson Correlation	0.571	0.782*	0.891**
	Sig. (2-tailed)	0.043	0.008	0.001
Zygapophyseal Joint Pain	Pearson Correlation	0.448	0.677*	0.861**
	Sig. (2-tailed)	0.057	0.011	0.002
Myofascial Pain	Pearson Correlation	0.705*	0.580	0.603
	Sig. (2-tailed)	0.013	0.041	0.018
Compressive Radiculopathy	Pearson Correlation	0.681*	0.730*	0.753*
	Sig. (2-tailed)	0.019	0.006	0.013
Non-Compressive Radiculopathy	Pearson Correlation	0.520	0.591	0.841**
	Sig. (2-tailed)	0.015	0.041	0.040
Neurogenic Claudication	Pearson Correlation	0.655*	0.600*	0.643
	Sig. (2-tailed)	0.032	0.029	0.031
Central Pain	Pearson Correlation	0.424	0.572	0.823**
	Sig. (2-tailed)	0.005	0.033	0.003
Lumbar Segmental	Pearson Correlation	0.721*	0.671*	0.564
	Sig. (2-tailed)	0.012	0.014	0.041

Note: **. Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed). Statistical interpretation r<0.5 Weak; r≤0.5-0.6 Moderated; r≥0.7-0.9 strong

4.11 Summary of the chapter

Descriptive analysis of the socio-demographic characteristics of the participants showed that, majority were female (65.81%), married (69.68%) with mean age of 49 years. Also, several clinical subgroups of LBP were established; Discogenic pain (7.74%), ZJ pain (17.74%), SIJ pain (33.23%), Myofascial pain (14.5%), Compressive radiculopathy (9.35%), Non compressive radiculopathy (0.97%), neurogenic claudication (0.97%), Central pain (3.23%) and Lumbar segmental instability (5.48%). Furthermore, majority of the participants had low risk of developing chronic LBP (49.03%). Also, results indicated that there was significantly strong and positive relationship between clinical subgroups and risk of chronification. In addition, results show that, some of the LBP main/subcategories had significantly strong and positive relationship with high, medium and low risk of LBP chronification.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Demographic characteristics associated with LBP chronification

Prevalence of LBP was higher in older adults age 41-60 years and above, similar to previous studies by (Robinson, 2017; Wippert *et al*., 2017; Wong *et al*., 2018). Clinically, this may imply that, LBP is common amongst working age adults and this may be attributed by either occupational exposures or age related degenerative changes (Wong *et al*., 2017).The degenerative changes in structural, chemical, and biomechanical aspects are known to occur mainly in the intervertebral discs and facet (Zygapophyseal) joints (Patil *et al*., 2019; Wong *et al*., 2017). Therefore, proper screening for risk of chronification and classification of LBP to isolate other comorbidities within these age groups may be recommended.

Most females reported pain symptoms in the lower back similar to reports from previous studies by (Cordeiro *et al*., 2018: Robinson, 2017;Wippert *et al*., 2017;Murphy & Hurwitz, 2011). The similarities between studies may be due to the reported fact that female gender are more susceptible to develop chronic LBP compared to male, regardless of their age (Wong *et al*., 2017).The main reason being hormonal fluctuations during/after menopause and psychological factors which heighten pain sensitivity in women (Wáng *et al., 2016;* Wong *et al*., 2017). However, it may also imply that, females are more willing to seek medical attention compared to male. Among the factors reported to influence the healthcare seeking behaviour include, female gender, previous history of LBP, perceived disability, beliefs and psychological distress (Balagué *et al*., 2012). Generally, healthcare seeking behaviour in both genders is influenced by knowledge of the condition, trust in the healthcare provider, age and persistent chronic pain experiences (Thompson *et al*., 2016). Thus, early identification of barriers to recovery from LBP particularly physical and psychosocial factors in both genders is suggested.

Most of the married participants reported LBP, similar to a study done in German by Wippert *et al*., (2017) to identify the most common neglected risk factors for

developing chronic back pain, in which most participants were married/in long term relationship (71%). It has been reported that, marital status may increase the odds for developing chronic LBP (Wong *et al*., 2017). Further, Wong *et al*., (2017) found that the odds for developing chronic LBP is 1.5 times higher in older adults who are married, divorced, separated or widowed compared to those who have never married in their lifetime. However, in this study, 14 out of 72 single participants were at high risk of developing chronic LBP. While, half of the married participants (33.23%, n= 103) were at low risk of developing chronic LBP. No scientific explanation was found, but the slight difference between the married people at medium and high risk of LBP chronification may be due to social support between partners (Biglarian *et al*., 2012).

Despite describing the study participants, education level may influence health seeking behaviour, adherence to the recommended healthy lifestyle and rehabilitative interventions (Wong *et al*., 2017). Majority of the participants in this study had primary and secondary education similar to participants in the study by Cordeiro *et al*., (2018) and Wippert *et al*., (2017) who investigated the clinical utility of the SBST and the neglected risk factors for developing chronic back pain respectively. However, current evidence points that, low education is only associated with recurrence and chronic LBP but does not influence its onset (Biglarian *et al*., 2012;Wong *et al*., 2017). Thus, there is a need to explore whether there is a relationship between low education level and onset of low back pain. In addition, there is a need to develop unique educational programmes for LBP patients with different levels of literacy.

It has been established that, smoking induces degenerative changes in the spinal structures such as intervertebral discs (Wong *et al*., 2017). However, more than 80% of participants in this study had no history of smoking, contrary to the study by Wippert *et al*., (2017) to identify the commonly neglected factors of chronic back pain, in which most participants were smoking (38%).

The contrast between these studies may be due to the way this question was posed or the sample size. Results from these studies, may imply that, both the current and previous smokers are both at risk of developing chronic LBP.

5.3 Clinical subgroups of Low back pain

Neuropathic component of LBP

Prevalence of Neuropathic LBP is estimated to be higher in specialized hospital settings, depending on the country's healthcare system (Harrisson *et al*., 2017). On the contrary, the prevalence of Neuropathic symptoms in LBP patients was smaller compared to a study by Freynhagen *et al*., (2006). This could be attributed by different methodological procedures employed in both studies, pain assessment tools and the sample size. While, we enrolled 310 participants with acute LBP<3 months, Freynhagen *et al*., (2006) included 392 participants who had had LBP symptoms for longer than 3 months. Our results may be compared to a study by Beith *et al*., (2011), who reported 16% prevalence of Neuropathic symptoms in LBP patients although most of its participants were identified from primary care settings.

Implying that, Neuropathic symptoms are common amongst LBP patients regardless of the hospital setting. Therefore, clinicians ought to utilize pain assessment tools as well as comprehensive clinical assessment guides to identify them. Neuropathic pain is a result of damage to the peripheral and central nervous system (Baron *et al*., 2016). Persistent firing of nociceptive signalling, often leads to heightened response in the brain (Baron *et al*., 2016). Central sensitization of symptoms often predisposes individuals to depression, anxiety, disturbed sleep, fear and catastrophizing thoughts. This may explain why patients within this category were more likely to develop chronic LBP ($r= 0.899$, p-value = 0.001).

The current study, identified four subgroups of Neuropathic LBP based on the features suggesting compressive radiculopathy, non-compressive radiculopathy, neurogenic claudication or central pain.

Most of the studies investigating Neuropathic LBP utilize either pain assessment tools or clinical examination but not both (Baron *et al*., 2016; Beith *et al*., 2011;Harrisson *et al*., 2017). In our case, we employed both methods to diagnose the Neuropathic LBP subgroups. For instance, on clinical examination, reflexes were assessed (patellar and Achilles' tendons), muscle strength in the lower limbs and nerve tension tests (Straight Leg Raise, Slump test and Femoral Nerve stretch). The LANSS score test was further incorporated to confirm the diagnosis.

Neurogenic claudication

Only 0.97% (n=3) of participants had features suggesting Neurogenic claudication. No cross-sectional study reporting prevalence of neurogenic claudication was found. It is likely that this diagnosis is often under looked as it may present in combination with other forms of peripheral neuropathy, Osteoarthritis (Hip/Knee) or peripheral artery diseases (Vining, 2013). Neurogenic claudication is a result of compression of the nerve roots/cauda equina due to central canal narrowing. Stenosis of the central canal is often a result of degenerative changes in the disc, facet or ligamentum flava (Vining, 2013; Vining et al., 2019). This may explain why, it was positively and significantly associated with aging (r=0.818, p-value 0.003). It may be suggested that, skillful screening for signs of neurogenic claudication in older adults is important.

Central pain

Features suggesting central pain symptoms were found in only 3.23 %, almost similar to 5% reported by Murphy & Hurwitz, (2011) despite the fact that their cohorts had long standing pain. It may be implied that the prevalence of central hypersensitivity in patients with LBP is low.

Also, it is likely that, the means of identifying central pain symptoms in current study were optimal. Similarly, patients within this subgroup were likely to develop disabling chronic LBP (r=0.823, p-value 0.003). Thus, the use of assessment tools to identify signs of maladaptive behavior may be recommended (Fishbain *et al*., 2018).

Compressive radiculopathy and Non compressive radiculopathy

The prevalence of nerve compression signs was 9.35% (n=29) while the prevalence of non-compressive features was 0.97% (n=3). No literature on prevalence was found, it is likely that the two diagnoses are often grouped together. It may also imply that there is no clear cut between compressive and non-compressive radiculopathy symptoms. Furthermore, both compressive and non-compressive radiculopathy were insignificantly associated with high risk of chronification. More research is needed to identify extra neurological features/assessment tools to distinguish between the two.

Nociceptive component of LBP

Majority of participants (73.2%, n=227) reported Nociceptive LBP symptoms, higher than 59% reported by (Beith *et al*., 2011). The difference may be due to dissimilar methodological approach. Nociceptive pain is a result of activation of nociceptors (joints, ligaments, tendons and muscles) in response to chemical, mechanical or thermal stress (Baron *et al*., 2016; Vining, 2013). Absence of the damage to the central and peripheral nervous system, may explain why patients within this category were less likely to develop chronic LBP (r= 0.68). Similar inferences have been made regarding the relationship between nerve compression symptoms and chronic LBP (Baron *et al*., 2011). Within this category, four subgroups were diagnosed based on palpation, centralization with repeated motion and provocative orthopedic movement tests.

Discogenic LBP

Despite the fact that, Discogenic pain is the most common type of LBP in clinical settings, its point prevalence was 7.74% only, contrary to findings by Depalma et al., (2011), Murphy & Hurwitz, (2011) Zhang *et al*., (2010) who reported 42%, 23% and 39% prevalence respectively. The difference may be attributed by the fact that centralization response is more precise when assessed over a course of several visits (Murphy & Hurwitz, 2011).

Thus, the prevalence of discogenic LBP in this study may be under recognized because participants were observed only once. Besides, results indicated a positive relationship between age and discogenic pain (r=0.785, p-value = 0.004). This may imply that aging was significantly associated with Discogenic LBP.

Opposite findings have been reported by Depalma *et al*., (2011) that, young age is significantly associated with Discogenic LBP. Depalma *et al*.,(2011) used diagnostic interventions (discography) or centralization to diagnose Discogenic LBP, while the current study centralization only. Patients with Discogenic symptoms were less likely to develop chronic LBP (r=0.690, p value = 0.018). Clinically this implies that centralization of symptoms is a reliable criteria to indicate good treatment outcome in Discogenic LBP patients (Delitto *et al*., 2012).

Sacroiliac and Zygapophyseal joint pain

In absence of centralization of symptoms, three or more out of 6 provocative orthopedic maneuvers were used to diagnose SI joint pain. These tests (Gaenslen's, Thigh trust, Distraction, Iliac compression and Sacral trust) identified Sacroiliac joint pain as the commonest LBP subgroup in both hospitals. The point prevalence of Sacroiliac joint pain (33.23%) can be compared to studies by Murphy and Hurwitz, (2011) but higher than 18% reported by Depalma *et al*., (2011). Also, the results show a non-significant but positive relationship between age and Sacroiliac joint pain (r = 0.793, p –value=0.008). Furthermore, patients with SI joint pain symptoms were more likely to develop chronic LBP (r=0.891, p-value =0.001). Similar findings regarding age and chronicity were reported by Depalma et al., (2011) with p-value<0.0001.

Inferring that the older the LBP patient with SI joint symptoms the higher the risk of chronicity. On the other hand, the prevalence of 17.74%, zygapophyseal/facet joint pain was slightly lower than 23% and 30.6% by Murphy and Hurwitz, (2011) and Depalma *et al*., (2011) but within the reported range of 15% to 40% (Murphy & Hurwitz, 2011). Also, the results indicated a positive and significant relationship between age and ZJ pain (r=0.838, p-value= 0.002).

Likewise, positive and significant relationship between ZJ pain and high risk of chronification was found (r=0.861, p-value = 0.002). Similar inference was also made by Depalma *et al*., (2011) in a study to investigate the association between age and SI and ZJ as sources of chronic LBP (p-value <0.0001).

Despite diagnostic interventions employed in the previous study, provocative tests on SI and Facet joints have proven to be useful (Gupta *et al*., 2012; Telli *et al*., 2020). Therefore, it can be argued that, provocative movement tests are reliable diagnostic methods of identifying SI and ZJ pain in clinical practice.

Myofascial pain

The prevalence of muscular tenderness and trigger points on palpation was only 14.5% almost similar to Murphy & Hurwitz, (2011) findings. Contrary to 63.5% prevalence reported by Chen & Nizar, Abd, (2011) who assessed 126 chronic back pain patients severally. Equally, Myofascial pain symptoms were insignificantly associated with low risk of developing chronic low back pain (r=0.705, p-value= 0.013). This may imply that; myofascial pain is common but often ignored due to clinicians' poor perception or co-existence with other nociceptive/neuropathic subgroups.

Lumbar segmental instability

A proportion of 17 participants, equivalent to 5.5% had Lumbar instability symptoms, contrary to 13% prevalence reported by (Puntumetakul *et al*., 2014). The current study assessed nonspecific LBP in a general population while Puntumetakul *et al*., (2014), cohort was composed of traditional rice farmers. Traditional farming is often characterized by repetitive flexion-extension movements, trunk twisting and prolonged sustained stooped postures which may affect the active, passive and neuromuscular control of the spine (Puntumetakul *et al*., 2014). Instability may result from insufficiency and compensation between muscles, intervertebral discs, tendons, ligaments and central nervous system which coordinates movement, balance and proprioception (Meier *et al*., 2019).

This may explain why patients with functional instability were more likely to develop chronic LBP (r=0.873, p-value = 0.002). Clinically, the current survey has demonstrated cross-sectional overview of lumbar segmental instabilities in a general population with acute LBP. More research is needed to determine the prevalence of lumbar instability in specific populations such as nurses and farmers.

Other diagnoses

The prevalence of LBP in 5.5% (n=17) was mainly attributed by other diagnoses. The results in this study can be compared to a study by Beith *et al*., (2011), who reported 25% (n=85) unclear diagnoses. Though insignificant, the relationship between other diagnoses and low risk of chronicity was positive (r= 0.705, p-value= 0.013). It may be argued that, the diagnostic guide used to classify LBP symptoms in this study, was sufficient enough to accommodate all possible causes of LBP. Thus, may be recommended to be used in busy clinical setting.

5.4 The risk of developing chronic Low back pain

In this study, 26.8% Participants had high risk of developing chronic LBP compared to 23.4% reported by Katzan et al., (2020). However, in a similar study, Katzan et al., (2020) reported 40.7% medium risk of LBP chronification contrary to 24.2% in the current study. The similarities and contrast may be due to different methodological approaches employed in both studies. The previous study was retrospective while the present study was cross-sectional. It is likely that, SBST scores may change overtime from low to medium and high or remain stable depending on the population, clinical setting, cultural context and LBP episode duration. Similar situations has been reported in previous studies (Cordeiro *et al., 2018; Medeiros et a*l., 2017; Morsø *et a*l., 2014; Pagé *et al*., 2015; Sowden *et al*., 2018). Thus, validation of SBST to test its psychometric properties in Tanzanian context may be suggested.

5.5 Conclusion

This study has established that Nociceptive is the most common category of LBP among patients with acute episodes. Therefore, health practitioners/Physiotherapists should be well knowledgeable with diagnostic and confirmatory tests to rule out Nociceptive LBP and its subgroups.

Similarly, clinicians should come up with intervention strategies to manage Nociceptive LBP and its subgroups in early stages, before the condition progresses to chronification. Also, almost half (49.03%, 5/10) of the participants were at low risk of developing chronification. Clinically, it means that these patients would require less Physiotherapy interventions and their prognosis is good. Only 26.8% (a quarter,1/4) of patients were at high risk of developing chronification/poor prognosis. Therefore, if proper interventions are given in early stages, recovery is promised.

Furthermore, people with Functional instability and Neuropathic LBP are at higher risk of chronification. Therefore, clinicians/Physiotherapists should be able to clinically classify these LBP subgroups which have poor prognosis. In addition, clinicians should come up with effective interventions to manage these subgroups. To conclude, this study has established that early classification of LBP into clinical subgroups and assessment of levels of risk of chronification, will ensure matching right treatment to the right LBP subgroup therefore improve prognosis/treatment outcome among patients with LBP.

5.6 Recommendations

Based on the key findings from this study, the following recommendations are proposed;

1. Guidelines towards diagnosis of Nociceptive LBP and its subgroups category should be emphasised in clinical practice and training of Physiotherapy.

2. Use of prognostic tools to identify people with psychosocial barriers to recovery from LBP should be encouraged in clinical practice and training of Physiotherapy.
3. Guidelines towards effective interventions to manage Functional instability and Neuropathic LBP so as to improve prognosis are important and should be encouraged in clinical practice and training of Physiotherapy.
4. Training Physiotherapists on classification schemes which integrate the multiple dimensions of LBP should be emphasised during the course of training.

Recommendations for further research

1. Psychometric properties of the Swahili version of SBSTS is recommended.
2. Further research on effective physical therapy interventions to manage Functional instability and Neuropathic LBP is recommended.

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APPENDICES

Appendix I: Participants' information sheet

Study title: Clinical characteristics and levels of risk of chronification among patients presenting with low back pain.

Dear Sir/Madam,

You are invited to participate in research study by **Dorice Adrian,** a Master of Science student at the Department of Rehabilitation Sciences, Jomo Kenyatta University of Agriculture and Technology. The purpose of this research is to clinically classify low back pain into 4 clinical subgroups and screen for levels of risk of developing chronicity (persistent pain and disability).

Study procedure

The participant will be requested to fill out a questionnaire (socio-demographic) that will take approximately 5 minutes to complete. Thereafter, researcher will take history of the participant and do physical examination of the back to establish the unique clinical characteristics, LBP clinical subgroups and the levels of risk of chronification.

Risk and discomforts

There are no foreseeable risks or discomfort to participating in this research.

You may decline to answer any or all questions and you may terminate your involvement at any time you choose.

Potential benefits

There are no obvious or direct benefits to you as participant, your time and effort will contribute to the greater good by increasing our understanding of key aspects of low back pain.

Protection of confidentiality

We will do everything we can to protect your privacy. Your identity will not be revealed in any publication resulting from this study. All information you provide will be confidential and anonymous, with no one, including the researchers, being able to link questionnaires and identities. Only a code number, and not your name, will be attached to your questionnaire. While this consent

form will have your name on it, it will not be attached to your survey and will be stored in a separate location. All research documents will be kept in a locked file cabinet in a locked office, accessible only by the researcher. Only the researchers, and no outside parties, will be able to link your identity to the information you provide.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study. If you decide to take part in this study, you will be requested to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed. You may not receive any kind of ***payment*** for participating in this study.

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact the study leader Dr **Nassib Tawa +254750802786 OR nassibtawa@gmail.com (**Jomo Kenyatta University of Technology and Agriculture). If you have any questions or concerns about your rights as a research participant, please contact the **Jomo Kenyatta University of Technology and Agriculture Ethical Review Board P.O.BOX 62000-00200 Nairobi, Kenya OR Tel 0675870225 OR Extn 3209 OR NIMR P.O.BOX 9653 OR Tel +255-22-2121400 OR Fax +255-22-2121360 OR hq@nimr.or.tz OR info@nimr.or.tz**.

Appendix II: Taarifa kwa washiriki

Ndugu mshiriki

Mimi, ni mwanafunzi ninayesomea shahada ya umahiri katika idara ya mazoezi tiba katika Chuo Kikuu cha Kilimo na Teknolojia cha Jomo Kenyatta. Ninataraji kufanya utafiti wenye mada inayoitwa ***"Makundi mbalimbali ya aina za maumivu ya mgongo***". Lengo la utafiti huu ni kuyagawanya kitabibu maumivu ya mgongo katika makundi madogo na kuangalia kiwango cha athari za maumivu hayo.

Hatua za Utafiti

Katika utafiti huu, mshiriki ataombwa kujaza dodoso linalohusiana na taarifa binafsi ambayo itachukua takribani dakika mbili (2) kukamilisha. Baada ya hapo mtafiti atachukua historia ya ugonjwa wa mshiriki na kumfanyia uchunguzi kwenye mgongo ili makundi mbalimbali ya maumivu ya mgongo na kiwango cha athari za maumivu ya mgongo. Muda wa kukamilisha zoezi lote unakadiriwa kuwa dakika 30.

Athari na Madhara

Hakuna athari wala madhara yoyote yatokanayo na utafiti huu. Unaruhusiwa kukataa kujibu swali au maswali na unaruhusiwa kukataa kuendelea kushiriki utafiti huu wakati wowote utakaoona unafaa bila ***kipingamizi*** kutoka kwa mtafiti.

Faida

Hakuna **faida** ya moja kwa moja utakayopata kwa kushiriki utafiti huu, ***isipokuwa*** kwa kujitolea kwako kushiriki utakuwa umechangia kuongeza ***uelewa*** zaidi juu ya changamoto ya ***maumivu ya mgongo***.

Kulinda Hadhi

Tutajitahidi kulinda hadhi yako na usiri katika kipindi chote cha utafiti. Taarifa zako hazitatolewa popote pale wakati wa kuchapisha utafiti huu. Taarifa zote utakazotoa zitahifadhiwa kwa usiri mkubwa bila kuhusianisha jina na taarifa. Mtafiti mkuu atahidhi taarifa zako mahali ambapo hakuna mtu mwingine ataweza kuzifikia. Hatutatumia jina bali msimbo kuwakilisha jina lako katika hojaji. Fomu yenye jina lako haitaambatishwa na taarifa hizi bali itahifadhiwa sehemu tofauti na kwa uangalizi mkubwa. Nyaraka zote za utafiti zitahifadhiwa katika kabati imara na

nyaraka hizo zitakuwa chini ya mtafiti mkuu. Ni mtafiti pekee ndiye atakayekuwa na uwezo wa kufuatilia taarifa za utafiti huu.

Ushiriki

Ushiriki wako katika utafiti huu ni wa ***Hiari. Unaruhusiwa kukataa kushiriki wakati wowote.*** Hutapata madhara yoyote kwa kukataa kushiriki katika utafiti huu. Ikiwa utaridhia kushiriki katika utafiti huu, utaombwa kujaza fomu ya ridhaa ya kushiriki. Unaruhusiwa kukataa kuendelea kushiriki utafiti huu hata baada kujaza fomu ya ridhaa ya kushiriki. Endapo utajitoa kabla ya ushiriki wako katika utafiti huu kukamilika, taarifa zako zitaharibiwa au utapewa. Hakutakuwa na ***Malipo*** ya aina yoyote yatokanayo na kushiriki kwako.

Iwapo una ***swali/maswali*** kuhusu utafiti huu ***au haki yako*** kama mshiriki au kama una ***matatizo yoyote tafadhali unaweza kuwasiliana*** kwa anwani ufuatayo:

Mawasiliano ya Mtafiti: **Dorice Adrian**

Simu: +255 0712 873534; baruapepe: info@jkuat.ac.ke au doriceadrian@gmail.com

Ukiwa na swali lolote kuhusiana na utafiti huu au haki yako kama mshiriki wa utafiti au kama unataka kuripoti tatizo lolote ulilokutana nalo wakati wa utafiti, tafadhali wasiliana nasi kwa anwani ifuatayo:

Mkuu wa Idara ya Sayansi karabati: Msimamizi **Dkt Nassib Tawa**:nassibtawa@gmail.com **AU Dkt. Wallace Karuguti** baruapepe mugambiw80@gmail.com **AU Amidi wa Ndaki ya Sayansi za Afya, Chuo Kikuu cha Kilimo na Teknolojia**: *Jomo Kenyatta. S. L. P* 62000 – 00200 NAIROBI, KENYA

Utafiti huu umeidhinishwa na Kamati ya Seneti ya Utafiti na Itikeli **Chuo Kikuu cha Kilimo na Teknolojia**: *Jomo Kenyatta.*

Appendix III: Information letter to the hospital administration

Study title: Clinical characteristics and risk of chronification among patients presenting with low back pain at Tertiary care level in Tanzania.

Dear Sir/Madam,

My name is **Dorice Adrian,** a Master of Science student at the Department of Rehabilitation Sciences, Jomo Kenyatta University of Agriculture and Technology. I am requesting permission to conduct a study on ***Clinical characteristics and Risk of Chronification among patients presenting with Low back pain at Tertiary care level in Tanzania***. The purpose of this research is to clinically classify low back pain into 4 clinical subgroups and screen for levels of risk of developing chronicity (persistent pain and disability).

Study procedure

The participant will be requested to fill out a questionnaire (socio-demographic) that will take approximately 2 minutes to complete. Thereafter, researcher will take history of the participant and do physical examination of the back to establish the unique clinical characteristics, LBP clinical subgroups and the levels of risk of chronification. The total participation time is estimated to be approximately 30 minutes.

Risk and discomforts

There are no foreseeable risks or discomfort to participating in this research.

Participants may decline to answer any or all questions and may terminate their involvement at any time they choose.

Potential benefits

There are no obvious or direct benefits to participants or the institution. However, it is envisaged that this study will contribute to the greater good by increasing our understanding of key aspects of low back pain.

Protection of confidentiality

Participant privacy will be upheld. Their identity will not be revealed in any publication resulting from this study. All information provided will be confidential and anonymous, with no one, including the researchers, being able to link questionnaires and identities. Only a code number, and not names, will be attached to the questionnaire. Although the consent forms will have names on it, they will not be attached to the survey and will be stored in a separate location. All research documents will be kept in a locked file cabinet in a locked office, accessible only by

the researcher. Only the researchers, and no outside parties, will be able to link participants' identity to the information provided.

Voluntary participation

Participation in this research study is voluntary. Participants may choose not to participate and may withdraw their consent to participate at any time. However, they will not be penalized in any way should they decide not to participate or to withdraw from this study. If they decide to take part in this study, they will be requested to sign a consent form. After they sign the consent form, they will still be free to withdraw at any time and without giving a reason.

If they withdraw from the study before data collection is completed, their data will be returned to them or destroyed. Also, participants will not receive any kind of payment for their involvement in this study.

Contact information

If any questions or concerns about this study or if any problems arise, please contact the study leader Dr **Nassib Tawa +254750802786 OR nassibtawa@gmail.com (**Jomo Kenyatta University of Technology and Agriculture). If you have any questions or concerns about your rights as a research participant, please contact the **Jomo Kenyatta University of Technology and Agriculture Ethical Review Board P.O.BOX 62000-00200 Nairobi, Kenya OR Tel 0675870225 OR Extn 3209 OR NIMR P.O.BOX 9653 OR Tel +255-22-2121400 OR Fax +255-22-2121360 OR hq@nimr.or.tz OR info@nimr.or.tz**.

Appendix IV: Consent form

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study

Participant's signature…….

Date…….

Researcher's signature…….

Date…….

Appendix V: Fomu ya ridhaa ya kushiriki katika utafiti

Nimesoma na kuelewa kila taarifa nilizopatiwa kuhusiana na utafiti huu. Nimepata fursa ya kuuliza maswali. Ninatambua kwamba nina hiari ya kushiriki au kwamba ninaweza kujitoa katika utafiti huu bila kutoa sababu ya kufanya hivyo. Ninaelewa kwamba nitapewa nakala ya fomu hii ya ridhaa. Ninakubali kushiriki katika utafiti huu kwa hiari yangu.

Saini ya mshiriki..... **Tarehe.....**

Saini ya mtafiti..... **Tarehe.....**

APPENDIX VI: Demographic Questionnaire

Instructions: For choice fields please place a firm cross e.g. ☒ in a single box per item. For all numeric responses (including dates) please complete all the boxes with leading zeros as required e.g. 05 All dates are in dd/mm/yyyy format.

Initials ☐☐☐☐ **Date of birth** d d / m m / y y y y

Gender
- Male ☐
- Female ☐

Marital status
- Single ☐
- Married ☐
- Divorced or separated ☐
- Widowed ☐

Educational attainment
- Primary school ☐
- Secondary school ☐
- College/Diploma ☐
- University/Degree ☐
- Postgraduate ☐

Ethnic origin
- Caucasian ☐
- Black ☐
- Asian/Chinese ☐
- Mixed ☐

Religious affiliation
- Christian ☐
- Muslim ☐
- Hindu ☐
- None ☐
- Prefers not to say ☐
- Other ☐

Occupational group
- Professional ☐
- Managerial & technical ☐
- Skilled non manual ☐
- Skilled manual ☐
- Unskilled ☐
- Not applicable ☐

Occupational status
- Employed full-time ☐
- Employed part-time ☐
- Retired ☐
- Unemployed ☐
- Casual worker ☐
- Not working due to ill health ☐
- Housewife ☐
- Other ☐

Smoking history
- Never ☐
- Previously ☐
- Current ☐

Date completed d d / m m / y y y y Signed _____

Appendix VII: Diagnostic Classification Checklist

Appendix A
Diagnostic Classification Checklist.

Screening		
Is there evidence of progressive neurological deficit?	❑ No	❑ Yes
Is there evidence of pathologic fracture, infection or malignancy?	❑ No	❑ Yes
Are there gait difficulties, spasticity or other signs of myelopathy?	❑ No	❑ Yes
Recent history of unplanned or unexplained weight loss?	❑ No	❑ Yes
Is there evidence of acute injury?	❑ No	❑ Yes
Is there evidence of seronegative spondyloarthropathy?	❑ No	❑ Yes
Nociceptive Pain		
Discogenic Pain		
Centralization with repeated motion	❑ No	❑ Yes
Any two: (Centralization w/ repeated motion, vulnerable/apprehensive when stooped, & exten. loss)	❑ No	❑ Yes
SI Joint Pain (3 or more of 6 tests)		
Three or more of 6 + SI Joint tests without centralization with repeated motion	❑ No	❑ Yes
(Gaenslen's L & R, Thigh Thrust [symptomatic side], Distraction, Iliac Compression, Sacral Thrust)		
Zygapophyseal (Facet) Joint Pain (3 or more)		
Age > 50	❑ No	❑ Yes
Pain relieved when walking	❑ No	❑ Yes
Pain relieved when sitting	❑ No	❑ Yes
Onset of pain was paraspinal	❑ No	❑ Yes
Positive Extension-Rotation test	❑ No	❑ Yes
Myofascial Pain		
Ache-type pain with aggravation by use of involved muscle	❑ No	❑ Yes
Trigger point in muscle with possible radiation	❑ No	❑ Yes
Neuropathic Pain		
Compressive Radiculopathy		
Absent ankle/knee reflex	❑ No	❑ Yes
Leg pain worse than back pain?	❑ No	❑ Yes
Dermatome distribution (cough, sneeze, strain)	❑ No	❑ Yes
Paresis (extremity motor strength loss)	❑ No	❑ Yes
Finger floor distance during flexion >25cm	❑ No	❑ Yes
LANSS score >12	❑ No	❑ Yes
Non-compressive Radiculopathy		
LANSS score >12	❑ No	❑ Yes
Compressive Radiculopathy criteria are satisfied	❑ No	❑ Yes
Neurogenic Claudication		
Score of 7 or more on clinical prediction rule	❑ No	❑ Yes
ABI greater than 0.9 (if indicated)	❑ No	❑ Yes
Central Pain		
Pain disproportionate to injury/pathology	❑ No	❑ Yes
Disproportionate, non-mechanical, unpredictable pattern of aggravating/relieving factors	❑ No	❑ Yes
Strong association with maladaptive psychosocial factors	❑ No	❑ Yes
(neg. emotions, poor self efficacy, maladaptive beliefs & pain behaviors, conflicts [family, work…])		
Diffuse or non-anatomic distribution of tenderness to palpation	❑ No	❑ Yes

Appendix B

Clinical evaluation procedures included in the diagnostic classification checklist.

Discogenic

Repeated end range loading

1. Left lateral shift (standing)
   ❑ Centralize ❑ Peripheralize ❑ Status Quo
2. Flexion (standing)
   ❑ Centralize ❑ Peripheralize ❑ Status Quo
3. Supine flexion
   ❑ Centralize ❑ Peripheralize ❑ Status Quo
4. Finger to floor distance
   ❑ <25 cm ❑ ≥ 25 cm

Right lateral shift (standing)
❑ Centralize ❑ Peripheralize ❑ Status Quo

Extension (standing)
❑ Centralize ❑ Peripheralize ❑ Status Quo

Prone extension
❑ Centralize ❑ Peripheralize ❑ Status Quo

SI Joint

1. Gaenslen's L	❑ Neg	❑ Pos
2. Gaenslen's R	❑ Neg	❑ Pos
3. Thigh Thrust	❑ Neg	❑ Pos
4. Distraction	❑ Neg	❑ Pos
5. Iliac Compression	❑ Neg	❑ Pos
6. Sacral Thrust	❑ Neg	❑ Pos

Neuropathic Pain

Reflexes	Left	Right
(L2-4) Patellar	_____ (0-5)	_____ (0-5)
(S1,2) Achiles	_____ (0-5)	_____ (0-5)
Other	_____ (0-5)	_____ (0-5)

Muscle strength	Left	Right
(L4-S1) Tibialis Anterior	____	____
(L4, L5, S1) Extensor Hallicus Longus	____	____
(L4-S1) Peroneus Longus	____	____
Other	____	____

Nerve tension

1. Straight Leg Raise	❑ Neg	❑ Pos
2. Slump test	❑ Neg	❑ Pos
3. Femoral Nerve Stretch	❑ Neg	❑ Pos

LANSS Examination

4. Does stroking the painful area of skin with cotton produce pain	❑ No	❑ Yes
5. Does pinprick at the painful area of skin feel different than at a normal area	❑ No	❑ Yes

Zygapophyseal (Facet)

1. Extension-rotation test ❑ Neg ❑ Pos

Myofascial

1. Evidence of trigger points ❑ No ❑ Yes

Functional Instability ❑ Not indicated

1. Prone passive lumbar extension	❑ Neg	❑ Pos
2. Hypomobility detected L1-L5	❑ No	❑ Yes
3. Hypermobility detected L1-L5	❑ No	❑ Yes

Ankle Brachial Index

	Left	Right
A. Post. tibial systolic pressure	____	____
B. Highest brachia systolic pressure (L or R)		____

Calculate

Left (A. / B.) ____

Right (A./ B.) ____

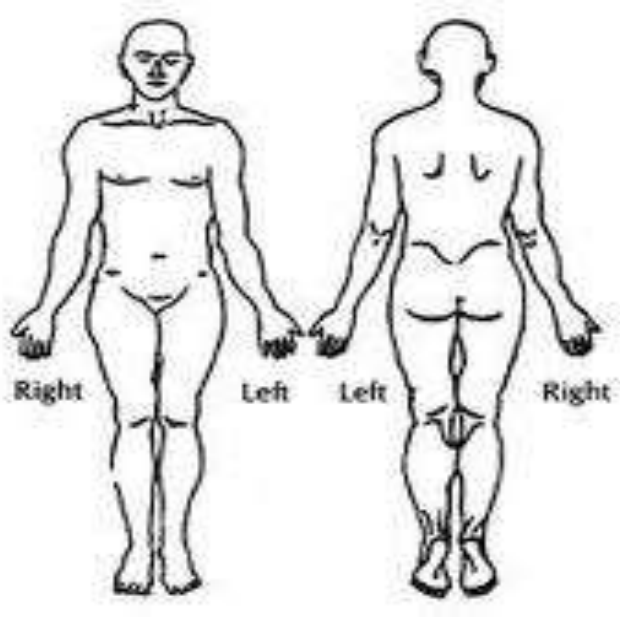
Results

❑ Normal	(1.0 – 1.1)
❑ Borderline	(.91 - .99)
❑ Abnormal	(less than .9)

_____

Other

Appendix VIII: LBP symptom body chart



Appendix IX: The STarT Back Screening Tool

The Keele STarT Back Screening Tool

Patient name: _____ Date: _____

Thinking about the **last 2 weeks** tick your response to the following questions:

		Disagree 0	Agree 1
1	My back pain has **spread down my leg(s)** at some time in the last 2 weeks	☐	☐
2	I have had pain in the **shoulder** or **neck** at some time in the last 2 weeks	☐	☐
3	I have only **walked short distances** because of my back pain	☐	☐
4	In the last 2 weeks, I have **dressed more slowly** than usual because of back pain	☐	☐
5	It's not really safe for a person with a condition like mine to be physically active	☐	☐
6	**Worrying thoughts** have been going through my mind a lot of the time	☐	☐
7	I feel that **my back pain is terrible** and **it's never going to get any better**	☐	☐
8	In general I have **not enjoyed** all the things I used to enjoy	☐	☐

9. Overall, how **bothersome** has your back pain been in the **last 2 weeks**?

Not at all	Slightly	Moderately	Very much	Extremely
☐	☐	☐	☐	☐
0	0	0	1	1

Total score (all 9): _____ **Sub Score (Q5-9):**_____

APPENDIX X: *The STarT Back Screening Tool (Swahili version)*

Jina la mgonjwa: _____ Tarehe: _____

Fikiria kuhusu **wiki mbili** zilizopita, kisha jibu maswali yafuatayo:

Ndiyo	Hapana
1	0

1. Maumivu yangu ya mgongo wakati mwingine **yanasambaa mpaka mguuni/miguuni ndani** ya wiki mbili zilizopita. ☐ ☐

2. Wakati mwingine nimekuwa nikipata maumivu **begani au shingoni** ndani ya wiki mbili zilizopita. ☐ ☐

3. Nimekuwa nikitembea **umbali mfupi** tu, kwasababu ya maumivu ya mgongo. ☐ ☐

4. Katika wiki mbili zilizopita, nimekuwa **nikivaa nguo taratibu** zaidi kuliko kawaida yangu kwa sababu ya maumivu ya mgongo. ☐ ☐

5. Sio salama kwa mtu mwenye hali kama yangu kushughulisha mwili wake. ☐ ☐

6. Wasiwasi na hofu vinatawala akili yangu muda mwingi. ☐ ☐

7. Ninahisi **maumivu yangu ya mgongo ni makali sana na sitapata nafuu** ☐ ☐

8. Nimekuwa **sifurahii** mambo yote niliyokuwa nikiyafurahia hapo awali. ☐ ☐

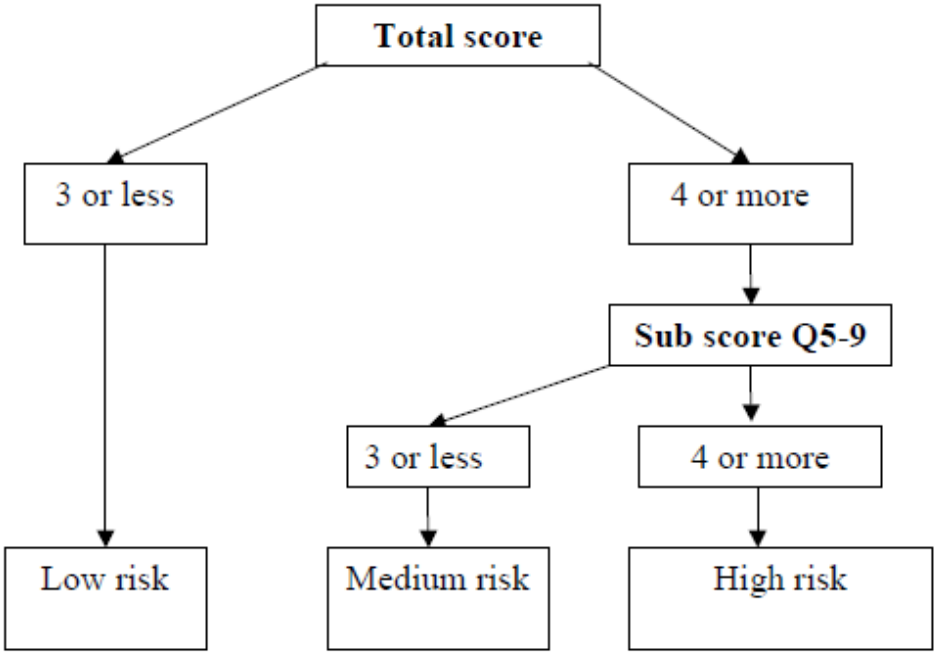
9. Kwa ujumla, maumivu ya mgongo **yamekukera** vipi ndani ya wiki mbili zilizopita?

Hayajanikera □ Kidogo sana □ Kiasi □ Sana □ Kupita kiasi □

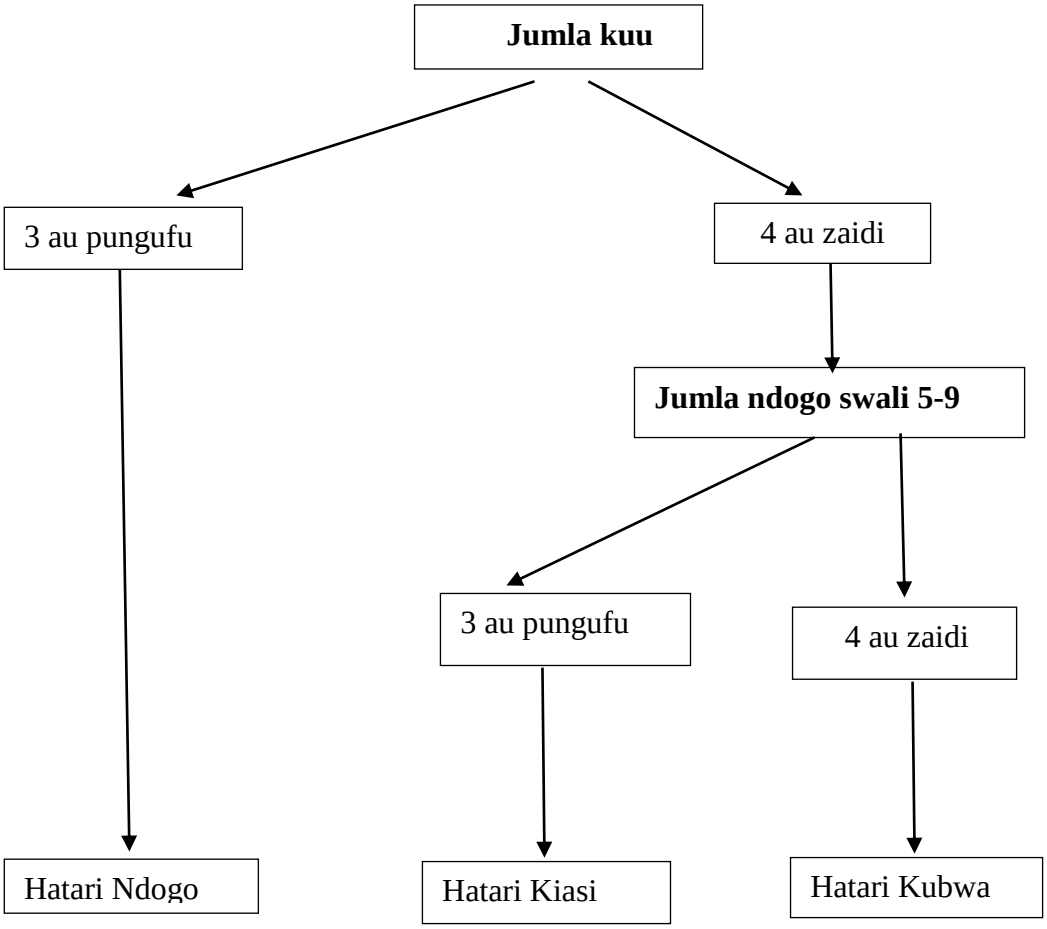
Jumla kuu (yote 9) _____ **Jumla ndogo (swali la 5-9):** _____

Appendix XI: The STarT Back scoring system

The STarT Back Tool Scoring System



Appendix XII: Mfumo wa usahihishaji STarT Back Screening Tool



Appendix XIII: STROBE checklist

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in

conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Appendix XIV: Publication

SWAHILI TRANSLATION AND CROSS-CULTURAL ADAPTATION OF THE START BACK SCREENING TOOL

D. A. Magayane, N. Tawa, W. Karuguti and E. Opondo

ABSTRACT

Objective: The aim of this study was to translate and culturally adapt the **STarT Back** Screening Tool into Swahili language.

Design: Translation and cultural adaptation of a questionnaire**.**

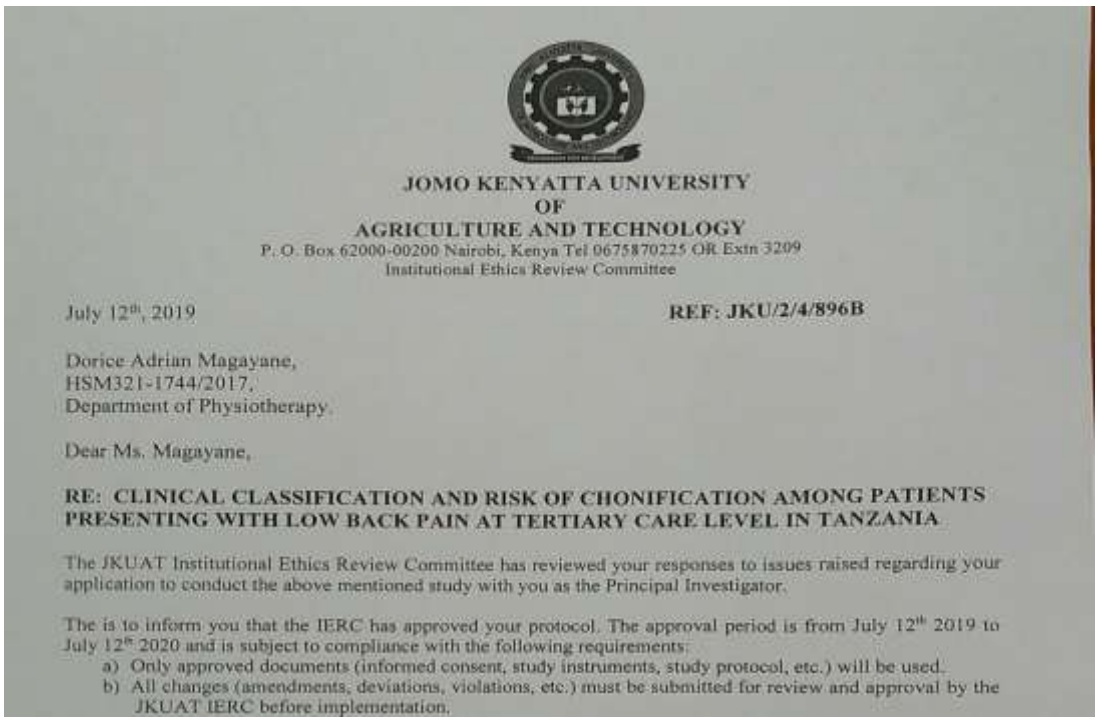
Setting: Physiotherapy outpatient clinics in Muhimbili National hospital and Jomo Kenyatta University of Agriculture and Technology hospital in Tanzania and Kenya respectively**.**

Subjects: Adults patients presenting with Low back pain.

Results: Minor semantic alterations were done in question 5, 6 and 7 during the expert committee review. Pre-testing of the tool and cognitive interview indicated that all questions were well understood**.**

Conclusion: The Swahili version of the STarT Back Screening Tool, has shown to be comprehensible and well adapted to the Swahili speaking population. Future studies should investigate its psychometric properties**.**

Appendix XV: Ethical Approval Letters



JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
P. O. Box 62000-00200 Nairobi, Kenya Tel 0675870225 OR Extn 3209
Institutional Ethics Review Committee

July 12th, 2019 REF: JKU/2/4/896B

Dorice Adrian Magayane,
HSM321-1744/2017,
Department of Physiotherapy.

Dear Ms. Magayane,

RE: CLINICAL CLASSIFICATION AND RISK OF CHONIFICATION AMONG PATIENTS PRESENTING WITH LOW BACK PAIN AT TERTIARY CARE LEVEL IN TANZANIA

The JKUAT Institutional Ethics Review Committee has reviewed your responses to issues raised regarding your application to conduct the above mentioned study with you as the Principal Investigator.

The is to inform you that the IERC has approved your protocol. The approval period is from July 12th 2019 to July 12th 2020 and is subject to compliance with the following requirements:

a) Only approved documents (informed consent, study instruments, study protocol, etc.) will be used.
b) All changes (amendments, deviations, violations, etc.) must be submitted for review and approval by the JKUAT IERC before implementation.

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NIMR/HQ/R.8a/Vol. IX/3197

23rd August, 2019

Dorice Adrian Magayane
Jomo Kenyatta University of Agriculture and Technology
C/o Mr Lucas Machage Bunde
Muhimbili Orthopaedic Institute (MOI),
P.O. Box 65474
Dar-es Salaam,
Tanzania

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: Clinical classification and risk of chronification among patients presenting with low back pain at tertiary care level in Tanzania (Magayane DA. et al), whose local investigator is Mr Lucas Machage Bunde of MOI, has been granted ethical clearance to be conducted in Tanzania.

MUHIMBILI NATIONAL HOSPITAL

ETHICAL CLEARANCE CERTIFICATE

Dr. Dorice Adrian Magayane
Jomo Kenyata University of Agriculture and Technology

11th September, 2019

Certificate Reference Number: MNH/IRB/2019/026

Study Title: "Clinical Classification and Risk of Chronification among Patient's Presentation with Low Back Pain at Tertiary Care level in Tanzania".

Principal Investigator: **Dr. Dorice Adrian Magayane**

MOI/PF.807/41 **17th July 2019**

Dorice Adrian,
Jomo Kenyatta University of Agriculture and Technology,
P.O.Box 62000,
Nairobi,
Kenya

RE: APPROVAL TO CONDUCT A RESEARCH PROJECT AT MOI

Reference is made to your letter dated 15th July 2019 with the above mentioned heading.

On behalf of the management of the institute (MOI), I would like to officially inform you that permission has been granted for your to conduct a study titled '*Clinical classification and risk of chronification among patients presenting with low back pain at tertiary care level in Tanzania*' at Muhimbili Orthopedics Institute. The study period is from July to August 2019 as indicated in your application. Therefore very kindly be informed accordingly.