



**UNIVERSITY OF NAIROBI**

**A COMPARATIVE ANALYSIS OF PATTERNS AND TYPES OF  
ORTHOPAEDIC AND TRAUMA ADMISSIONS TO KENYATTA  
NATIONAL HOSPITAL AND THE ASSOCIATED FACTORS: BEFORE  
AND AFTER ENFORCEMENT OF REFERRAL GUIDELINES**

**BY**

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**H58/34788/2019**

**A dissertation thesis to be submitted in partial fulfillment of the requirement  
for the award of the Degree of Master of Medicine in Orthopedic Surgery,  
University of Nairobi**


**@ Department of Surgery**

**August 2023**

## DECLARATION

I hereby declare that this thesis is my original work and has not been presented as a thesis at any other University. Where other people's work has been used, this has been acknowledged and referenced according to the University of Nairobi's requirements. I have not sought or used the services of any professional agencies to produce this work.

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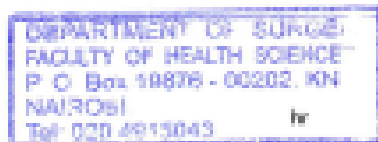
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## **LIST OF ABBREVIATIONS AND ACRONYMS**

ANOVA	Analysis of Variance
A & E	Accident and Emergency
COC	Corporate Outpatient Care
A&E	Accident and Emergency
ERC	Ethical Review Committee
FGD	Focussed Group Discussion
GOK	Government of Kenya
ISS	Injury Severity Score
IQR	Interquartile Range
KII	Key Informant Interview
MOH	Ministry of Health
NMA	Nairobi Metropolitan Area
NMS	Nairobi Metropolitan Services
KNH	Kenyatta National Hospital
MNH	Muhimbili National Hospital
PCEA	Presbyterian Church of East Africa
QGIS	Quantum Geographical Information System
RTA	Road Traffic Accident
RA	Research Assistant
RC	Research Coordinator
SD	Standard Deviation
SPSS	Statistical Package for Social Science
OC	Outpatient Clinic
UTH	University Teaching Hospital
UON	University of Nairobi
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

## **OPERATIONAL DEFINITION**

**Orthopaedics:** Orthopaedics is a discipline of surgery concerned with musculoskeletal conditions.

**Admission:** Orthopaedic admission refers to patients' stay in the hospital for observation, investigation, treatment, and care due to conditions involving the musculoskeletal system.

**Patterns:** Orthopaedic patterns of admissions refer to observed way in which orthopaedic admissions happen in a repeated or regular way at KNH.

**Types:** Type of Orthopaedic admissions refers to categories of musculoskeletal conditions that distinguish them as a group of conditions or pathology.

**Referral guidelines:** Referral guidelines is a guide to the management of referral processes for continuity of care, cost-effective management of the health care services, and ensuring patients receive health care closest to their homes.

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## ABSTRACT

Inappropriate utilization of higher-level health facilities and ineffective management of the referral processes in resource-limited settings is increasingly becoming a concern in health care management in developing countries. This is characterized by self-referrals and frequent bypassing by patients of nearest health facilities with low formal referral mechanisms. This scenario lends itself to a situation where uncomplicated medical conditions are unnecessarily managed in a high-cost health facility. On 1<sup>st</sup> July 2021, Kenyatta National Hospital (KNH) enforced the referral guidelines that required patients to have a formal referral letter to KNH to reduce the number of walk-ins and allow KNH to function as a referral facility as envisioned by KNH legal statute of 1987. **Study Objective:** To determine the patterns and types of orthopaedic and trauma admissions to KNH and the associated factors before and after the enforcement of the referral guidelines. **Methodology:** This was a descriptive analytical study design. The study was conducted amongst the orthopaedic admission caseload for 2021 with a sample size of 459 and 446 before and after enforcement of referral guidelines. Quantitative data was analysed using SPSS version 21 and qualitative data using NVivo version 12. **Findings** The enforcement of the referral guidelines reduced the proportion of walk-ins' admissions from 54.9% to 45.1% ( $p=0.013$ ) and was associated with decline of admissions through A&E from 84.1% and 72.0% ( $p < 0.001$ ). There was an increase in admissions through COC from 10.5% to 19.5% ( $p=0.011$ ). Emergency admissions declined from 84.7% to 73.4% and elective admissions increased from 15.3% to 26.6% ( $p=0.001$ ). The Non-trauma admissions doubled ( $p=<0.001$ ). Admissions with active insurance cover increased from 24.7% to 37.8% ( $p < 0.001$ ). Most of the admissions were from Nairobi County and its environs. Majority of the admissions had lower limb injury followed by upper limb injuries with least admissions due to acetabular injuries before and after the enforcement of the referral guidelines. The major factors associated with admissions to KNH were inadequate human resource capacity and availability, patient's preference, financial constraints, inadequate orthopaedic equipment's and implants availability and health facility infrastructure. **Conclusions:** the enforcement of the referral guidelines reduced the proportion of walk-ins. The majority of the admissions were from Nairobi County and its environs. Lower limb and upper limb injuries were the most common. Inadequate human resource capacity and availability, patient's preference, financial constraints, and inadequate orthopaedic equipment's and implants availability from peripheral health facilities were associated with referrals to KNH.

# 1.0 INTRODUCTION

## 1.1 Background

Approximately 90% of the estimated traumatic injuries occur in low and middle-income countries according to World Health Organization (WHO) (1) and this represents an important global public health problem now and in the coming years (2, 3).

Admission patterns for trauma cases have shown gender bias with men affected more than females. The young population age-group less than 40 years are affected as compared to the older population with the most common injury mechanism being road traffic accidents, falls, assaults. The lower limbs did get injured more often than the upper limbs, spine, and pelvis. However, there is paucity of data regarding the patterns of admissions in developing countries and particularly sub-Saharan Africa. The few studies done in the Western context focuses on traumatic orthopaedic injuries and the non-traumatic orthopaedic cases have been left unaddressed. Understanding the patterns of admission is important for patient planning and management and in a university facility, this is critical in planning for quality training. The types of admission need to reflect the level of health facility with tertiary facilities expected to handle more complex cases while lower-level health facilities should focus on the lesser-complicated cases due to the presence of limited equipment, physical infrastructure, and human resources. The reason for bypassing nearest health facilities seems to be multifactorial. Factors such as patients' perception of high quality of health care and resource availability at referral hospitals play a role (4, 5). The fact that for many urban populations a referral hospital may simply be the closest health facility, are some of the reasons for apparent by-passing peripheral facilities to seek health care at a tertiary level health facility (6).

Tertiary hospitals in resource-limited countries treat patients referred but in most cases are the first level of care for the vast majority of patients (6). One of the challenges in health care delivery in resource-limited settings is inappropriate utilization of tertiary health facilities that results in patients' congestion in referral hospitals with simple conditions that can be effectively managed at the lower peripheral health facilities. The majority of these patients are self-referred, bypassing lower-level health facilities in the process (4, 7-9).

A study done in Lusaka demonstrated how University Teaching Hospital is bypassed and as a result the tertiary facility effectively functions as a primary health care facility. The urban

phenomenon of widespread self-referral is associated with low rates of formal referral from peripheral health facilities (8, 10). The net result is lesser medical conditions end up being managed in high-cost referral health facilities leading to overcrowding, long waiting times, and scarce staff time consumed by lesser medical conditions at the expense of complex medical conditions (6, 11, 12). Tertiary health care is compromised by the huge demand for primary health care and in the process cripples the primary health care system and this effectively ensures that primary health care facilities remain underused and inefficient (11). It is therefore imperative that attempts need to be made to ensure patients make use of lower health facilities by creating disincentives for patients by-passing these health facilities (6, 12).

Kenyatta National Hospital (KNH) was established as a National Referral and Teaching Hospital, to provide training and medical research. KNH was established in 1901 and became a State Corporation in 1987 and sits at the peak of the health referral system in Kenya (13). According to the KNH Board order of 1987 contained in the Legal Notice No. 109, the functions of KNH were spelled out as a) to receive patients on referral for specialized health care; b) to provide facilities for medical education for the University of Nairobi and other health allied courses; c) to contribute to national health planning (13). This understanding has been reinforced by the Kenya Health Sector Referral Implementation Guidelines, 2014, and the Constitution of Kenya 2010 which tasks KNH with the responsibility for health policy formulation (14, 15).

Orthopaedic wards in KNH have consistently recorded the highest bed occupancy percent for the last couple of years. In 2018, 2019 and 2020 it recorded bed occupancy percent of 142.2%, 138.2% and 116.5% respectively against the KNH bed occupancy percent of 106.2%, 113.4 percent and 91.5% (16). The consequence of this is the low nurse-patient ratio of 1:10 that compromises not only the quality of nursing care given to patients but also compromises the ability of KNH to effectively perform its statutory obligations.

One of the factors affecting the patient outcome is the quality of nursing care that is directly affected by the low nurse-patient ratio. Various studies have demonstrated that an appropriate nurse-patient ratio is associated with the reduction in medical errors, decubitus ulcers, hospital-

acquired infections, long duration of hospital stay, high readmission rates, and compromised patient well-being and safety due to the nurse burnout (17-19).

On 1<sup>st</sup> July 2021, KNH management made a decision to reinforce the Kenya Health Sector Referral Guidelines 2014 that places KNH at the tip of the health sector referral system. This meant that patients will be seen based on referral letters from other health facilities to reduce the number of walk-in patients who would have otherwise been appropriately seen at the peripheral health facilities. This would then allow KNH to focus on the management of complex medical conditions and allow uncomplicated medical conditions to be managed at lower-level health facilities. In addition, this would allow KNH to focus on its statutory functions. The purpose of this study is to conduct a descriptive comparative analysis of the patterns and types of orthopaedic admissions to KNH before and after the enforcement of these referral guidelines. The study will also seek to understand the factors associated with orthopaedic and trauma admissions during the study period.

## **1.2 Study justification**

This study is critical in understanding the patterns, types of orthopaedic and trauma admissions to KNH with the view to streamline and strengthen the referral system for Orthopaedic and trauma cases. This will position KNH at the tip of the health sector referral system in Kenya as envisioned in the Kenya 2010 constitution, KNH Board order of 1987 and Kenya Health Sector Referral Implementation Guidelines, 2014. The Fourth Schedule of the Kenya 2010 constitution guides services provided by the county vis-à-vis national governments. In the health sector, primary and secondary health care delivery is assigned to county governments, while the national government is responsible for health standards and guidelines, policy formulation, and oversight of national tertiary health facilities. This will contribute to the decongestion of KNH Orthopaedic and trauma caseloads and allow KNH to effectively execute its statutory functions of managing and providing quality care to complex orthopaedic and trauma cases from other hospitals, provide quality medical education for the UoN and other health allied professions, and participate in national health planning.

Following the enforcement of the referral guidelines by KNH with effect from 1<sup>st</sup> July 2021, the study seeks to determine the patterns and types of orthopaedic and trauma admissions and the



associated factors before and after the referral guidelines enforcement. Furthermore, the findings of this study will help formulate policy and guidelines on orthopaedic and trauma essential care at the peripheral and tertiary health facilities in Nairobi Metropolitan Area (NMA) and the country at large. It will also provide evidence-based information that will contribute to the review of Kenya Health Sector Referral Implementation Guidelines of 2014 whose review is overdue. It will also guide on what facilities should be available in various levels of hospital and how patients can be managed effectively without the need for movement to a referral facility.

### **1.3 Study Hypothesis:**

*Null hypothesis:* The proportion of walk-in orthopaedic and trauma patients admitted to KNH before and after enforcement of referral guidelines is the same.

### **1.4 Study questions**

1. What are the patterns and types of Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines;
2. What are the factors associated with Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines?

### **1.5 Broad objective**

To determine patterns and types of orthopaedic and trauma admissions to Kenyatta National Hospital and the associated factors pre-and post-enforcement of referral guidelines.

#### **1.5.1 Specific objectives**

1. To determine the patterns and types of Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines;
2. To determine the factors associated with Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines

## **2.0 LITERATURE REVIEW**

### **2.1.1 Patterns of Orthopaedic and Trauma admissions**

In India health care system is characterised by overcrowding, lack of both specialist doctors and an effective referral system. Despite having a referral guideline that details referral of patients from lower levels to sub-district, district and then to tertiary hospitals, the actual practices are that patients go to any level of health care system without any referral (20). This creates burden on the secondary and tertiary level hospitals. According to an observational study done in Delhi in 2020, 72.5% of injured patients were below 40 years of age with 26.7% being aged 19-30 years and 22.74% aged 31-40years. Only 4.6% were below 18 years of age. About 24.3% and 37.8% of injured patients had reached primary school and high school education respectively. Majority of patients were male (67.5%) while 32.5% were females. About 57.5% were married and 42.5% were unmarried. Vehicle collision was the leading mode of injury at 45.94% then by assault at 18.9% (21).

A retrospective study of trauma admissions in the USA between 1993 to 1996 revealed that 40% of trauma patients were under 30 years of age while males constituted 74% of the victims. Cause of injury were motor vehicle accident at 36%, fall at 27%, gunshot at 17%, stab at 7%, and assault at 6%, and swimming or diving accident at 3%. It also revealed that about 50% were admitted directly from the accident scene. Admissions tended to occur between Friday and Sunday at 52% and between 4:00 pm and midnight at 46% (22).

A cross-sectional observational study was done between 1<sup>st</sup> July 2013 to 30<sup>th</sup> June 2016 from the Trauma Registry of the American College of Surgeons showed trauma cases were common on Saturdays and Sundays as compared to weekdays. About 75% were male with a mean age of 46 years (23).

A retrospective study done in a multispecialty hospital in Warangal-A in India showed that about 2/3 of the total orthopaedic admissions had bone and joint injuries. The mean age of these admissions was 41 years with a male to female ratio of 61:39. Admission rates had two peaks namely at 35 years of age and above 45 years. The number of patient admissions each month was relatively constant throughout the year (24).

In Taiwan where we have a free-access systems, bypass of primary care and seeking secondary care through self-referral is rampant despite Taiwan's government taking various initiatives to mitigate bypass (25). A 10-year national-wide retrospective study done from 2002 to 2011 in Taiwan revealed that males comprised 59.4% and females 40.5% for those admitted due to road traffic accidents. Those aged 30-49years were 31.28%, followed by 18-29years at 29.07%, 50-64years at 24.17%, above 65years at 16.51%, and those below 17years at 7.014% (26).

A retrospective review of trauma admissions at Princess Marina Hospital General Surgical (GS) wards between August 2017 to July 2018 revealed that 79.35% of trauma admissions were male. The median age in years was 30 years with the interquartile range of 13-97 years (27).

A retrospective study done between September 2013 to September 2014 in England revealed that the average age of orthopaedic admissions was 53 years with the male to female ratio of 51:49 (28).

A prospective study done in 2013 on distribution and patterns of injury admissions to Trauma Centre in Lucknow, India revealed that 29% of the injuries involved lower extremities. The average age of the victims was 40.81years with 83.60% being males and 16.40% being females. The mean time to admission was 54.22 hours. 63.64% sustained injuries due to RTA, 20.80% sustained injury due to a fall, and 4.2% were assaulted. Gunshots, struck by a falling object, building collapse, and machine injury was the cause in 2.45%, 2.45%, 2.10%, and 1.57% respectively. It also revealed that 29% of the injuries involved lower extremity, 11.11% upper extremity injuries and 6.1% were spinal injuries (29).

A retrospective review of trauma victims' records treated from January to July 2014 in a hospital in Brazil showed 67.9% of patients were men. The mean age of injured patients was 44.2years (30).

A study done in the USA in 2020 revealed that admissions on weekends were younger than 45 years, male, and uninsured as compared with weekday admissions (31, 32).

In 2008, an assessment done in South African Public health sector revealed that patients were accessing the health system at inappropriate levels and bypassing primary health care to attend to regional and tertiary hospitals their initial visit leading to overcrowding and unnecessary costs to the referral facilities (33). In cross-sectional study was done to review the self-referrals to a

District-Regional Hospital in KwaZulu Natal, South Africa showed 36% were self-referrals with most of them being male (51.5%) and of African race (57.2%). Majority (64%) were appropriately referred with written referral letters (33).

A retrospective review done between 1<sup>st</sup> January 1997 to 31<sup>st</sup> December 2000 on admissions in South Africa showed about 80% were males male-female ratio of 5:1, mean age of 44.4 years. Young adults consisted of about 50% and children were 28%. Those who were single were 78.9% poor were 85% of total admissions. Inter-personal violence represented 60% of admissions while motor vehicle accidents accounted for about 19% (34).

A study done in a Hospital in KwaZulu Natal in South Africa showed that 36% were self-referrals with the majority (64%) being referrals with a formal referral letter. Of all self-referrals 51.5% were male with 57.2% of African race. The mean age of the referred and self-referred patients was 44.7 years and 40 years respectively. Most patients in the self-referral groups had a tertiary education (15.20%) compared to the referred group (7.70%) (33).

In all, 48.6% of patients were referred from facilities in Mthatha, <10 km away, with most from the academic hospital and from the city's general hospital; 38.6% of patients came from district hospitals >50 km from the Bedford Orthopedic Center; and 12.7% were from hospitals 11–50 km away (35).

A retrospective descriptive study of orthopaedic admissions at Princess Marina Hospital in Botswana between August 2014 to January 2015 in Botswana showed a median age of about 34 years with a male to females' ratio of 7:3. However, above 60 years of age, females were disproportionately affected. The study also revealed that falls accounted for 39% of injuries, followed by RTAs at about 26%, assault at 15%, sports injuries at 8%, machine-related injuries at 7%, and gunshot injuries at 1%. The most frequent injuries involved the lower limbs at about 46%, followed by the upper limbs at 22%, spine at 5% and pelvis at 4%, amputations at 3%, crush injury at 2%, and spinal cord injury at 1% (36).

A study on referral system in Nigeria showed that 92.9% reported to tertiary hospital directly without referral while 7.1% were referred. The result of this is overcrowding of the tertiary facilities with conditions that can be managed at lower level health facilities (12). According to a retrospective study done in Irrua Specialist Teaching Hospital in Nigeria in 2015, adult orthopaedic

trauma admissions were 85.58% while paediatric admissions were 14.42%. The median age was 44 years with a male to female ratio was 2:1 (37).

A retrospective cohort study was done between January 1, 2013, and December 31, 2013, from three Rwandan district hospitals for referral patients with injuries showed approximately 85.7% of the referrals were to public referral hospitals while 10.7% of the referrals were from private referral hospitals and other district hospitals. It revealed that 63.9% were men and 42.4% were above 35 years of age. Among 55.7% that had documented occupation about 49.0% were farmers and unskilled laborers, 40.8% were children or students and 1.3% were retirees. Concerning the origin of the patients, 91.1% were from within the hospital catchment area and 8.9% outside the hospital catchment area. About 82.2% had community health insurance, 5.7% had other private insurance while 12.1% were not insured. Concerning the mechanism of injury, Road Traffic Injuries represented 36.5% of referrals, violence/intentional injuries 17.7%, falls 27.0% of referrals (38).

A descriptive study was conducted on tibia or femur fracture admissions to Mulago National Referral Hospital in Kampala, Uganda between September 30, 2013, and October 11, 2013, showed 86% were male with a mean age of 43 years. Motor vehicles accounted for 80% of the admissions (39).

A study reviewing surgical referrals in Northern Tanzania revealed that 77% were to zonal hospital, followed by the regional hospitals (17%) and district hospitals (12%) (40). A prospective study done at Muhimbili National Hospital, Tanzania to examine the medical referral pattern of patients in 2004, revealed that 72.5% were self-referrals with 70% of them requiring admission. About 1% of referrals were from outside the region. About 22.4% of admissions were from public health facilities while 4.2% were from private health facilities (41).

A retrospective descriptive study was done in Bugando Medical Centre, Mwanza, Tanzania between January 2015 to December 2017 revealed that 73.1% of admissions were males and about 7.7% were under five years of age. Falls accounted for 28.7% of injuries and motor traffic accidents accounted for 17.9% (42).

In a study on Kenyan health seeking behaviour showed that of all new patients visiting hospitals about a quarter bypassed the nearest health facility. The rates of formal clinic to hospital referral were very low with patients who are least educated less likely to have a written referral compared

to the more educated patients. Self-referrals accounted for about 80% of referrals to Meru District hospital (43).

A retrospective study on trauma admissions to Rift Valley Provincial General Hospital in Kenya revealed that 73.5% of admissions were males while about 57.6% were in the 21–60-year age bracket. Approximately 32.7% of admissions were due to road traffic accidents, 23.8% due to assaults, 15.5% due to falls, and 13% due to burns (44).

A study on the road traffic accident admissions to KNH between 1<sup>st</sup> June to 31<sup>st</sup> August 2011 revealed that 59.1% were pedestrians, 24.4% were motor vehicle passengers, and 9.7% were motorcyclists (45).

From the foregoing, it is clear that the existing literature is limited in scope and variables. There is little mention on the patterns of referral system for orthopaedic admissions. The empirical studies have focused mainly on western contexts with no similar studies done in the study area or similar context making it difficult to generalize the findings. The literature review depicts a lack of granularity and hence of limited utility in the planning/management of patients. In addition, studies focused on traumatic orthopaedic cases with non-traumatic orthopaedic cases not being considered. Therefore, this study sought to determine the patterns and types of Orthopaedic and trauma admissions at KNH for orthopaedic care and help come up with appropriate referral guidelines for inpatient management and also help in informing resource planning and prioritization in the management of Orthopaedic cases in KNH.

### **2.1.2 Types of Orthopaedic admissions**

According to an observational study done in Delhi in 2020, Upper limb fractures at 42.3% were the leading type of injury followed by lower limb fractures at 25.2% and head injury at 21.6% (21).

A retrospective study on epidemiology of orthopedic trauma admissions in a multispecialty hospital in Warangal-A, India showed that 32.35% were lower limb fractures, 8.92% were upper limb fractures, 27.94% were spine degenerative disease injuries, 1.56% were spinal injuries and 0.29% were cellulitis (24).

A retrospective descriptive study on epidemiology of Orthopaedic admissions at a teaching Hospital of Eastern Nepal revealed that trauma accounted to majority of Orthopaedic admissions (67.9%) and Infection lied second in order (12.4%). Upper and Lower limb fractures contributed to highest numbers of trauma respectively (46).

A study on pattern of fractures among road traffic accident victims requiring hospitalization in Saudi Arabia observed that the most commonly fractured bone among males was the femur (28.2%) while a humerus fracture was the most common among females (20.8%) (47).

A retrospectively collected data at Princess Marina Hospital in Botswana revealed that fractures comprised of 75.5% of orthopedic admissions at the facility. About 45.7% were lower limb fractures, 21.6% were upper limb fractures, 4.8% were spine fractures and 3.5% were pelvic fractures. Soft tissue injuries comprised of 7.5%, dislocations and subluxations comprised of 10.1% while spinal cord injury comprised of 1.3% and of total orthopedic admissions (36).

A study on epidemiology of injured patients in rural Uganda revealed that the most common anatomic locations of injury were the upper (37.7%) and lower extremities (35.8%) and the most common types of injury were fracture (30.9%) (48).

A study done in Addis Ababa, Ethiopia on patterns of orthopaedic injuries related to Road Traffic Accident revealed that of all injury types, fractures were the most common type of injury (71.7%) followed by soft tissue injury (12.8%) then dislocation (8.6%). The common site of fracture is lower limb fracture (42.1%) and multiple fractures (22.3%) then pelvic fractures (8.0%), upper limb fracture (5.4%) and the least was spinal fracture (0.9%). Compound fracture is the most common type of fracture 122 (52.4%) followed by a simple fracture 111 (47.6%). Shoulder 19 (5.7%) was the most common site of dislocation followed by elbow 14 (4.2%), whereas knee dislocation encounters the least 8 (2.4%). More than half victims (59.5%) had open wounds (49).

An observational study using prospectively collected emergency orthopaedic trauma data between January 2018 and December 2021 from Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia revealed Injuries of the lower limb accounted for 66% of injuries, the femur being the most affected (22%), followed by the pelvis and acetabulum (16%) (50).

A cross-sectional study on the burden of orthopedic disease admitted to orthopedic ward at a tertiary referral center in Moshi, Tanzania showed femur fractures were the most common injury

(31.0%), followed by tibia fractures (13.5%), isolated fibula fractures (11.5%) and foot fractures (11.5%) (51).

A retrospective study on epidemiology of orthopedic admissions at tertiary facility in Kenya showed that trauma accounts for 53.04% of all admissions while joint replacement, shoulder and knee, limb deformities, infection, removal of hardware, ankle and foot and tumor procedures accounts for 15.01%, 8.87%, 7.29%, 6.44%, 3.94% and 3.23% respectively (52).

From the foregoing it is clear from the existing literature review that no study has been done on the types of orthopedic admissions at Kenyatta National Hospital, which sits at the apex of Kenya Health care referral system. In addition, no study has been done to determine the impact of enforcement of referral guidelines on types of orthopedic admissions in a tertiary health facility.

## **2.2 Factors associated with Orthopaedic admissions**

A study done to identify predictors of hospital admission among patients a fracture of the proximal humerus revealed that increasing age, visit on a weekday, insurance cover, open fracture, injury due to motor vehicle crash, and polytrauma was associated with admissions (53).

A retrospective study done on orthopaedic referrals from January 2015 to December 2017 in the Netherlands revealed that increasing age was linked with increased orthopaedic referrals (54).

A couple of qualitative studies have revealed the quality of health care services is a determinant of the choice of health care providers (55, 56). This reinforced the findings of a study that revealed that patients' perception of their hospital rooms and patients' perception of nurses predicted patients' perception of health facility quality of service (57).

A case study done in Turkey in 2004 showed that accessibility of hospital services and the health facility image, technological advancement, and infrastructure influenced patients' choices (58).

A study done on patient-doctor relationship and hospital image revealed preferences of old patients to nearby facilities and those better equipped. Patients with complex medical conditions and well-off financially were likely to bypass their nearest health facility (59). In addition, patients preferred health facilities with more capacity in terms of beds, infrastructure, and equipment (60).

A survey done in Sri Lanka revealed that severely ill patients tend to bypass and travel far away to seek health care services than those who are not severely ill. In addition, health facilities with



more equipment, infrastructure, health care workers, and hospital supplies were unlikely to be bypassed. Furthermore, costly health facilities were shown to be likely to be bypassed as compared to less costly health facilities (61).

A prospective study done at Muhimbili National Hospital (MNH) in Tanzania in 2004, depicted that 96.3% mentioned lack of expertise and lack of equipment at the lower-level health facilities as the reasons for referrals to MNH. About 53.8% and 50.0% of health facilities reported a lack of drugs and space respectively as reasons for referral. About 40.0% of private health facilities cited affordability as a reason for referrals (41).

A retrospective study done in 2011 on trauma patients referred to KNH showed that most of the patients reported to the emergency unit of the referral hospital primarily without having been seen elsewhere and the referral hospital was therefore being used as a primary institution for management. Self-referral by patients bypassing local facilities due to perceived or real lack of services (62).

Existing literature to determine factors associated with admissions of Orthopaedic cases is limited in scope and does not link the admission pattern and types to the patient, facility, and economic factors. This study will seek to determine the factors associated with orthopaedic admissions in KNH and this will help in essential orthopaedic and trauma care service planning and provision within Nairobi Metropolitan Area.

### 2.3 Conceptual framework

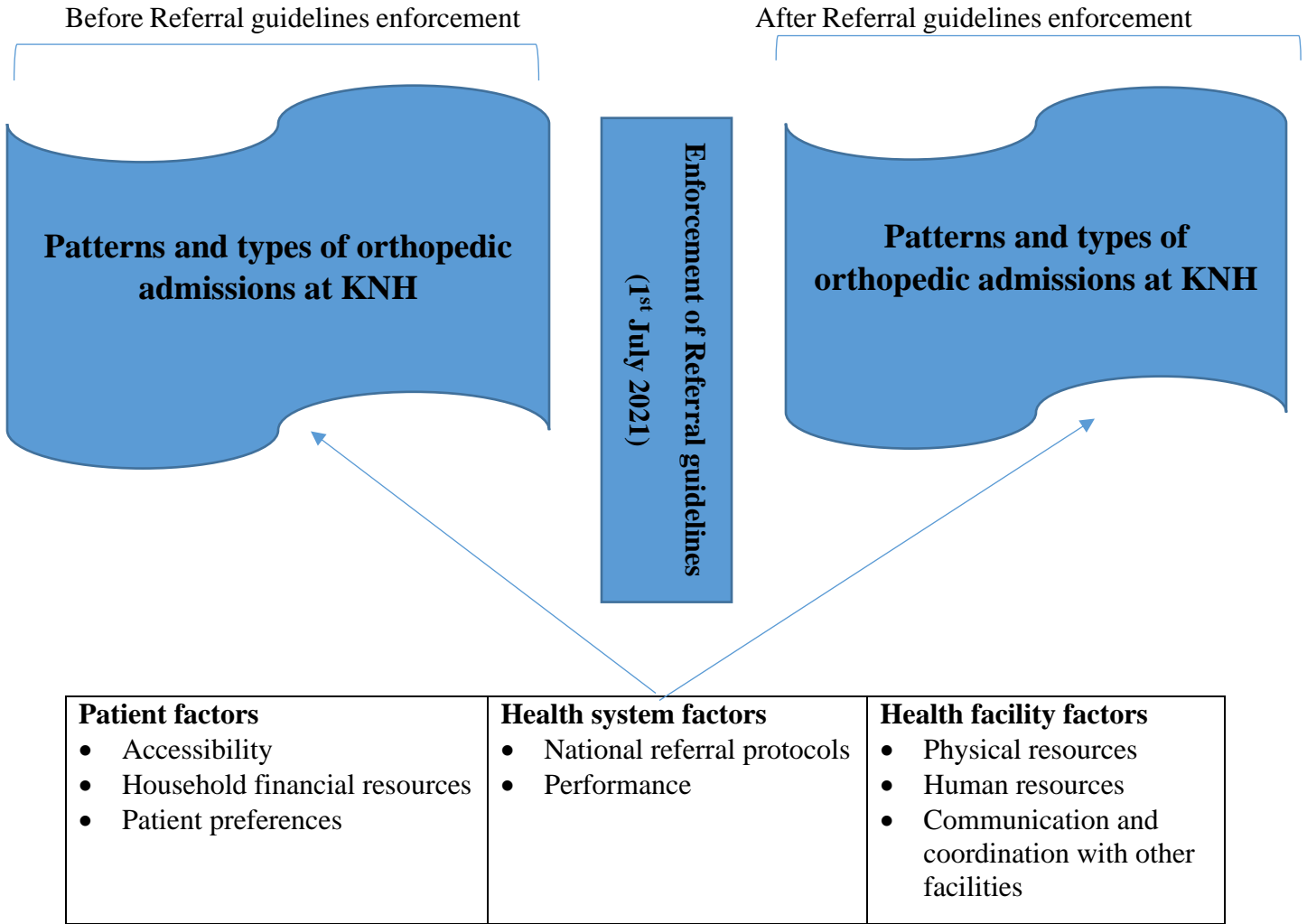


Figure 2: Conceptual framework

Figure 2 shows the relationship between patient factors, health system factors, and health facility factors and their potential contribution in influencing the patterns and types of orthopaedic admissions in KNH before and after the enforcement of the referral guidelines on 1<sup>st</sup> July 2021.

## **3.0 METHODOLOGY**

### **3.1.0 Study design**

This was an analytical descriptive study design.

### **3.1.1 Study area**

Kenyatta National Hospital (KNH) Orthopaedic Wards were the study area. KNH is the national teaching and referral hospital based in Upperhill, Nairobi, the Capital city of Kenya. It is located along Hospital Road, about 5km from the city centre. It has a bed capacity of approximately 2000 beds.

### **3.1.2 Study duration**

The study duration was from 1<sup>st</sup> January 2022 to 31<sup>st</sup> September 2022. The data abstraction covered 5 months before and 5 months after enforcement of the referral guidelines, that is, from 1<sup>st</sup> February to 30<sup>th</sup> June 2021, before enforcement of the referral guidelines and from 1<sup>st</sup> August to 31<sup>st</sup> December 2021 after enforcement of the referral guidelines. The referral guidelines were enforced from 1<sup>st</sup> July 2021.

### **3.1.3 Study population**

- a) Orthopaedic and trauma inpatient caseload before and after enforcement of referral guidelines
- b) Key Orthopaedic and trauma staff from the ten health facilities namely KNH, Mama Lucy Kibaki Hospital, Mbagathi Hospital, Machakos County Hospital, Mwingi County Hospital, Thika Level 5 Hospital, Ngong Sub- County Hospital, St Peters Orthopaedic Specialist Hospital, St Francis Community Hospital and Arthi River Shalom Community Hospital.

### **3.1.4 Eligibility criteria**

#### **3.1.4.1 Inclusion criteria**

- a) All orthopaedic admissions to KNH during the study period;
- b) Patients and/or their guardians/next of kin that consent voluntarily to participate in the study;
- c) Key staff from KNH and other referring facilities who are at least 12 months in their current posting;

### 3.1.5 Sample size calculation

Using an adjusted formula for calculating sample sizes that compare two binomial distributions (63):

$$m = \frac{(Z_{\alpha}\sqrt{2p_vq_v} + Z_{\beta}\sqrt{p_1q_1 + p_2q_2})^2}{(\delta)^2}$$

$p_1$  = Estimated non-referral proportion in pre-enforcement is 84% (0.84) (16)

$p_2$  = Estimated non-referral proportion in post-enforcement is 77% (0.77)

$q_1 = 1 - p_1 = 1 - 0.84 = 0.16$

$q_2 = 1 - p_2 = 1 - 0.77 = 0.23$

$p_v$  = Mean of  $P_1$  and  $P_2$  and is represented by 80.5% (0.805)

$q_v = 1 - p_v = 1 - 0.805 = 0.195$

$Z_{\beta}$  = The probability of type II error 20% is used for the study (-0.842)

$Z_{\alpha}$  = The probability of type I error is set at 5% level of significance (-1.645)

$\delta$  = desired level of precision set to 7% (0.07). This is represented by  $p_1 - p_2$ .

$n$  = sample size per arm

$$n = \frac{[-1.645\sqrt{2} \times 0.805 \times 0.195 + (-0.842)\sqrt{0.84 \times 0.16 + 0.77 \times 0.23}]^2}{0.07^2}$$

$n = 404$

Using the above assumptions, the minimum sample size required is 404 cases per arm. To factor for missing files and incomplete data 10% adjustment will be made to the calculated sample size and therefore the minimum sample size will be 444 per arm. With a monthly orthopedic admission of about 100 patients, this translates to about 5 months' time period before and 5 months after the enforcement of the referral guidelines. A total of 457 files before and 446 files were abstracted after the enforcement of the referral guidelines.

Ten Key Informant Interviews (KIIs) were conducted by the Principal Investigator using a KII guide formulated for this purpose.

### 3.1.6 Sampling procedure

All admitted orthopaedic patients were consecutively enrolled in the study until the sample size was achieved.

### 3.1.7 Recruitment and consenting procedures

The study sites were KNH wards and the nine key referring health facilities. Three research assistants (Ras) were recruited to collect and abstract patient data from patient files. The Ras were health care workers with a diploma in an orthopedic-oriented course (Diploma in Orthopedic Trauma or Orthopedic Technician with experience in research data collection). The PI was the research coordinator for the data collection. The orthopedic admissions were identified from the a) admission desk of Health Information System at KNH Accident and Emergency Unit b) KNH Orthopedic Outpatient clinic 5 records c) Health Information System (Room 19). They were then recorded in a logbook (Appendix 3: Logbook). This logbook served as a master register for all patients admitted and therefore the sampling frame for the study. All admissions were logged into the logbook from the admission books stationed in these three services points. Population Proportional to Size (PPS) was then used to decide on the numbers to be sampled per month from each of these three services points so that the sample size would be a representative of the admissions by month from each of these three orthopedic admissions entries point (Table 3.1).

Table 3: 1: Orthopaedic and trauma admissions to KNH stratified by point of admission, 2021

	Month of the year, 2021`	Point of admission			
		A&E	Clinic	COC	Total
Before	February	94	10	9	113
	March	68	4	9	81
	April	79	3	10	92
	May	67	3	11	81
	June	78	5	9	92
	Total	386	25	48	459
After	August	62	10	15	87
	September	66	8	14	88
	October	82	8	12	102
	November	45	6	27	78
	December	66	6	19	91
	Total	321	38	87	446

The 4 research assistants were reporting to and working under the direction of the principal investigator. The RA were trained for two days by the principal investigator on the research protocol, data collection tools, data collection procedures and that included pilot testing of the data collection tools as well before the actual data abstraction. The study schema below (Figure 2) was used to guide the training and the close monitoring of the study.

Orthopedic and trauma patients admitted were sampled using systematic sampling till sample size was attained.

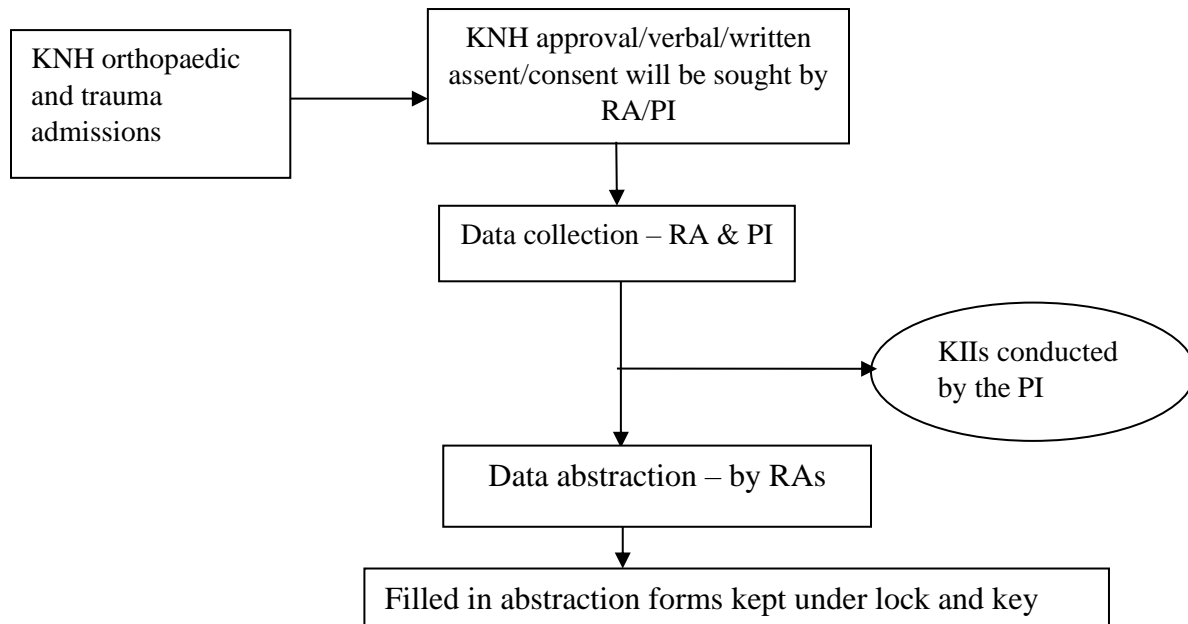


Figure 2.1 shows the study schema that depicts how the study was conducted.

### 3.1.7.1 Informed consent and confidentiality

Administrative approval was obtained from KNH Orthopedics and Medical Research Departments to allow for data collection and abstraction from the patient files. Verbal or written consent was obtained from those enrolled to get information on missing data or clarify the reasons for referral. Those who were interviewed face-to-face due to missing data or clarification of given information while still in the wards were interviewed in a private space provided by Ward to ensure audio and visual privacy and confidentiality. The location of the interview room was in the KNH Orthopedic Wards nursing office. The interviews were conducted by the RAs in English. Respondents were informed that they had the right to decline participation or withdraw from the study at any point

and this would not affect the care they were entitled to, for those who were still receiving care at KNH. This guaranteed voluntary participation during the study period. To assure confidentiality, telephone- interviews were conducted in a room or an area that affords audio privacy.

### **3.1.8 Variables**

#### **3.1.8.1 Variables**

- |   |                          |
|---|--------------------------|
| a) Socio-demographic characteristics –<br>age, sex, marital status, religion,<br>current residence, Sub- County of<br>residence, County of residence,<br>country of residence, education level,<br>area of accident | d) Type of admission;    |
| b) Nature of admission;   | e) Level of a facility;  |
| c) Occupation;  | f) Diagnoses;            |
|   | g) Mode of payment;      |
|   | h) Admission date;       |
|   | i) Mechanisms of injury; |
|   | j) Type of injury;       |

### **3.1.9 Data collection procedures**

Data collection was done through a data abstraction form from the patient files, document reviews of KNH reports and records and KIIs was done with the key Orthopaedic staff from KNH, Mama Lucy Kibaki Hospital, Mbagathi Hospital, Machakos County Hospital, Mwingi County Hospital, Thika Level 5 Hospital, Ngong Sub- County Hospital, St Peters Orthopaedic Specialist Hospital, St Francis Community Hospital and Arthi River Shalom Community Hospital.

- a) **Data Abstraction form** – The three RAs did data abstraction using a data abstraction form (Appendix 2c: Data abstraction) as per the research protocol. The PI reviewed daily all the filled-in abstraction forms for completeness and accuracy during the entire data collection period and providing feedback to the RAs on a timely manner to ensure data quality and compliance to the study protocol. All the completed and verified data abstraction forms were then collected and filed by the principal investigator at the end of every week under a lockable cabinet.

The patients' files were allocated unique 5-digit study numbers based on their KNH in-patient admission numbers given at the time of admission. The RAs documented the outcome of this

process by completing the record of files abstracted in a logbook (Appendix 3: Logbook). Clinical diagnoses were extracted from the patients' medical records.

b) **Key Informant Interviews (KIIs)** – Ten KIIs were conducted by the PI using a KII guide (Appendix 2a: KII Guide) formulated for this purpose. The Key informants were Clinical Officers, Medical Officers and Orthopaedic Consultants covering Accident and Emergency Departments from the health facilities outlined in section 3.1.3 Study population (page 14). The purpose of the KIIs was to collect data on factors associated with the patients' admissions and referrals to KNH before and after the enforcement of the referral guidelines.

The PI moderated the KIIs and served as the primary note-taker and the KII sessions were audiotaped using a Sony audio recorder and audio files were transcribed by transcription assistant into written scripts. The PI reviewed the scripts alongside the audio recordings to ensure accuracy and the transcripts were taken verbatim.

### **3.2.0 Training procedures**

Research assistants underwent a two-day training on study protocol. The training covered study procedures, obtaining verbal and written informed consent and assent, ensuring confidentiality and privacy during interviews (for patients still admitted in the wards or those attending clinics), the autonomy of participants, and data abstraction process and filling in of the data abstraction forms.

### **3.2.1 Quality assurance & quality control procedures**

A pilot study was conducted during the design of the study protocol to test the data collection tools for relevance, appropriateness to answer the research questions and adjustments of the data collection tools made as necessary. During the two-day training a repeat pilot study was done with the three RAs to have them familiarize with the data collection procedures and abstraction of files and filling in of the abstraction forms.

### **3.2.2 Ethical considerations**

The proposal was presented and approved by the Department of Orthopaedics, UoN. UoN/KNH Ethics and Research Committee granted ethical approval (ERC No: P852/10/2021).



### **1.2.3 Data management, analysis, and presentation**

The data abstraction forms were accessed by the PI as necessary for quality checks and to confirm adherence to research protocol. The data were entered into a password-protected Redcap database kept by the KNH Medical Research Department. The qualitative data were subjected to thematic analysis using NVIVO 12 Pro. Summary memos for the transcripts were reviewed and coding strategy developed by noting down key issues coming from the interviews on the transcripts and excel sheet. Seeing how these key issues relate to the research questions, a coding framework was developed [Generation of Nodes/Codes]. This was done for data collected before and after the enforcement of the referral guidelines. Transcripts and excel sheet were imported into NVIVO for coding process.

The quantitative data was analyzed using SPSS version 21. Comparative analysis of patterns and types of orthopedic and trauma caseloads before and after the enforcement of the referral guidelines were determined using descriptive statistics such as frequencies, measures of central tendencies, measures of dispersions while inferential statistics will be calculated using Pearson's chi-squared tests, unpaired T-tests, binary and multinomial regression analysis. Density plots to depict the patterns and distribution of the orthopedic and trauma admissions were analysed and mapping done using Geographic Information System (QGIS 2.18.19) [1]. The calculations were done at a 95% level of confidence with prior probabilities less than 5% deemed statistically significant. The results are presented using tables, graphs and density plots.

### **3.2.4 Study results dissemination plan**

The findings of this study will be presented at the Orthopaedics Department, the University of Nairobi, KNH Senior Management Team, KNH Scientific Conference, Nairobi Metropolitan Service – Health Department, and Nairobi County and sub-county Health Management Teams. Hard and soft copies of the final report will be deposited in the University of Nairobi library and KNH depositories. Manuscripts will be generated and published in reputable peer-review journals.

### **3.2.6 Study limitations**

- a) Recall bias given that this was a retrospective study – this was be minimized by limiting the study period to within 6 months before and after the enforcement of the referral guidelines;

- b) Incomplete and missing records – this was addressed by increasing the sample size by 10%;
- c) Effect of COVID 19 pandemic on referrals of cases from peripheral health facilities and walk-in patients – this was addressed by ensuring the data collection period covered the covid period.

## 4.0 FINDINGS

### 4.1 Patterns and types of orthopaedic and trauma admissions to Kenyatta National Hospital Before and After Enforcement of Referral Guidelines.

#### 4.1.0 Basic Profile of the sample population

This was a comparative descriptive study design done before and after enforcement of Kenyatta National Hospital (KNH) referral guidelines. The KNH referral guidelines were enforcement as of 1<sup>st</sup> July 2021. A total of 905 files were abstracted with 459 (50.7%) before and 446 (49.3%) after the enforcement of the referral guidelines.

The mean age was 33.816 (SD 16.5408) with range of 1 - 93 years. Majority 600 (66.3%) were between 25 – 64 years with those above 65 years being 40 (4.4%). Children 0-14 years comprised 99 (10.9%) of the orthopaedic and trauma admissions. About 446 (49.3%) were married, 275 (30.4%) were single and 110 (12.2%) were minor. With regard to sex, 703 (77.7%) were male and 198 (21.9%) were female. Christians were the majority at 865 (95.6%) of the orthopaedic and trauma admissions. About 405 (44.8%) were casual workers, 183 (20.2%) unemployed. With regard to education level 308 (34.0%) had primary education, 317 (35.0%) had secondary education. With regard to the behavioural profile, 680 (75.1%) were smokers and 515 (56.9%) drunk alcohol (Table 4.1.0.1).

Table 4.1.0 1: Basic profile of the sample population

Variable	Category	Frequency n (%)	Variable	Category	Frequency n (%)
Age	0 – 14 years	99 (10.9%)	Occupation	Businessman/woman	112 (12.4%)
	15 – 24 years	166 (18.3%)		Casual	405 (44.8%)
	25 – 64 years	600 (66.3%)		Employed	135 (14.9%)
	Above 65 years	40 (4.4%)		Other	59 (6.5%)
Sex	Female	198 (21.9%)		unemployed	183 (20.2%)
	Male	703 (77.7%)	Education	None	55 (6.1%)
Marital status	Married	446 (49.3%)		Pre-school	22 (2.4%)
	Minor	110 (12.2%)		Primary	308 (34.0%)
	Separated & divorced	49 (5.4%)		Secondary	317 (35.0%)
	Single	275 (30.4%)		Tertiary	182 (20.1%)
	Widow	24 (2.7%)	Alcohol	Yes	515 (56.9%)
Religion	Atheist	3 (0.3%)		No	344 (38.0%)
	Christian	865 (95.6%)	Smoking	Yes	680 (75.1%)
	Hindu	3 (0.3%)		No	178 (19.7%)
	Muslim	24 (2.7%)			

#### 4.1.1 Patterns of orthopaedic and trauma admissions to Kenyatta National Hospital Before and After Enforcement of Referral Guidelines

The proportion of walk-ins declined from 54.9% (95% CI: 50.15% - 59.52%) to 45.1% (95% CI: 40.48% - 49.83%) before and after the enforcement of the referral guidelines respectively while facility referrals increased from 46.6% to 53.4% during the same periods. This was statistically significant ( $p=0.013$ ) (Table 4.1.1.1) with an odds ratio of 1.394 (95%CI: 1.073 – 1.811). This means the enforcement of the referral guidelines had significantly reduced the walk-ins while increasing numbers and proportion of referred cases during the study period.

Table 4.1.1 1: Walk-in and Facility Referrals before and after enforcement of referral guidelines, 2021

	Before	After	$X^2$ ; $p$ -value
Walk-ins	248 (54.9%; 95% CI: 50.15% - 59.52%)	204 (45.1%; 95% CI: 40.48% - 49.83%)	6.219; $p=0.013$
Facility referrals	211 (46.6%; 95% CI: 41.91 – 51.29%)	242 (53.4%; 95% CI: 48.71% - 58.09%)	
Total	459 (50.7%)	446 (49.3%)	

Odds Ratio Estimate: 1.394 (95% CI: 1.073 – 1.811)

Facility referrals are expected to be accompanied by official written referral letters from the referring facilities to KNH. However, there was a slight increase in number of referrals not having referral letters despite the enforcement of the referral guidelines. This observation was not statistically significant ( $p=0.821$ ) (Table 4.1.1.2).

Table 4.1.1 2: Facility referrals with referral letters before and after enforcement of referral guidelines, 2021

		Facility referrals		$X^2$ ; $p$ -value
		Before	After	
Have referral letters	No	101 (48.1%)	118 (49.2%)	0.051; $p=0.821$
	Yes	109 (51.9%)	122 (50.8%)	
Total		210 (100.0%)	240 (100.0%)	

Though the majority of orthopaedic and trauma admissions were admitted through Accident and Emergency (A&E) department, there was a notable decline from 386 (84.1%) and 321 (72.0%) before and after enforcement of the referral guidelines respectively ( $p=0.0001$ ) with the least admissions through the Orthopaedic Clinics. There was also a notable increase in orthopaedic

admissions through Corporate Outpatient Care (COC) after enforcement of the referral guidelines from 48 (10.5%) to 87 (19.5%) and this was statistically significant ( $p=0.011$ ) (Table 4.1.1.3).

Table 4.1.1 3: Orthopaedic and trauma admissions to KNH stratified by point of admission, 2021.

	Before	After	Total	<i>p</i> -value
Accident & Emergency	386 (84.1%)	321 (72.0%)	707 (78.1%)	0.0001
COC	48 (10.5%)	87 (19.5%)	135 (14.9%)	0.011
Orthopaedic Clinics	25 (5.4%)	38 (8.5%)	63 (7.0%)	0.315
Total	459 (100.0%)	446 (100.0%)	905 (100.0%)	

The study also sought to determine the orthopaedic and trauma admissions to KNH wards. Majority of the admissions were in wards 6A, 6C and 6D that represented 73.5% of total orthopaedic admissions to KNH (Table 4.1.1.4).

Table 4.1.1 4: Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines, 2021

Admission Ward	Before	After	Total
6D	120 (26.1%)	112 (25.1%)	232 (25.6%)
6C	126 (27.5%)	104 (23.3%)	230 (25.4%)
6A	105 (22.9%)	99 (22.2%)	204 (22.5%)
6B	40 (8.7%)	31 (7.0%)	71 (7.8%)
9A	7 (1.5%)	5 (1.1%)	12 (1.3%)
9B	8 (1.7%)	14 (3.1%)	22 (2.4%)
9C	0 (0.0%)	2 (0.4%)	2 (0.2%)
9D	1 (0.2%)	3 (0.7%)	4 (0.4%)
10A	16 (3.5%)	25 (5.6%)	41 (4.5%)
10B	9 (2.0%)	15 (3.4%)	24 (2.7%)
10C	9 (2.0%)	11 (2.5%)	20 (2.2%)
10D	0 (0.0%)	13 (2.9%)	13 (1.4%)
Others*	18	12	30
	459	446	905

\* Represents: 4C, 4D, 5A, 5B, 5D, 7B, 8B, 8D, GFD and A&E.

The type of orthopaedic admissions was also reviewed before and after enforcement of referral guidelines. Emergency admissions accounted for about 387 (84.7%) and 325 (73.4%) of total orthopaedic admissions before and after enforcement of the referral guidelines, respectively ( $p=0.0001$ ). Elective admissions were 50.2% less likely to occur before as opposed to after enforcement of referral guidelines (Table 4.1.1.5). This means that elective cases increased after the enforcement of the referral guidelines.

Table 4.1.1 5: Type of orthopaedic admission and trauma before and after enforcement of referral guidelines, 2021

Characteristics		Before	After	$X^2$ ; $p$ -value	OR Estimate (95% CI)
Type of admission	Elective	70 (15.3%)	118 (26.6%)	17.441; $p=0.0001$	0.498 (0.358 – 0.693)
	Emergency	387 (84.7%)	325 (73.4%)		
	Total	457 (100.0%)	443 (100.0%)		

The study reviewed key socio-demographic characteristics namely age, sex, marital status, religion, occupation, education level, alcohol intake, smoking status and mode of payment and how that influenced orthopaedic and trauma referrals before and after enforcement of the referral guidelines. The enforcement of the referral guidelines had no statistically significant difference in the orthopaedic admissions to KNH with regard to age, marital status, religion and occupation. However, there was a statistically significant differences with regard to sex and education level before and after the enforcement of KNH referral guidelines ( $p < 0.05$ ) (Table 4.1.1.6).

The mean age was 33.82 years (SD 16.54) with mean age rising among females from 32.16 (SD 19.88) to 37.99 (SD 20.37) after the enforcement of the referral guidelines ( $p=0.046$ ). For males there was a slight increase in the mean age from 32.80 (SD 15.58) to 33.97 (SD 14.98) after the enforcement of the referral guidelines ( $p=0.311$ ). Based on age groups, children represented 59 (12.9%) and 40 (9.0%) of the orthopaedic and trauma admissions before and after enforcement of the referral guidelines respectively while majority of the admissions, 303 (66.0%) and 297 (66.6%) were observed among age group 25 – 64 years old before and after respectively. Orthopaedic and trauma admissions above 65 years of age represented 14 (3.1%) and 26 (5.8%) before and after enforcement of the referral guidelines respectively (Table 4.1.1.6).

Orthopaedic and trauma admissions who were male before and after enforcement of referral regulations were 374 (81.8%) and 329 (74.1%) respectively. While females were 83 (18.2%) and 115 (25.9%) before and after enforcement of the referral guidelines. These differences were statistically significant ( $p=0.0005$ ). In addition, there was a statistically significant association with regards to education level before and after the enforcement of the referral guidelines ( $p=0.001$ ) (Table 4.1.1.6).

Table 4.1.1 6: Bivariable analysis of socio-demographic characteristic of orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines, 2021

Characteristics		Before	After	$\chi^2$ ; $p$ -value
Age	0 – 14 years	59 (12.9%)	40 (9.0%)	7.121; $p=0.068$
	15 – 24 years	83 (18.1%)	83 (18.6%)	
	25 – 64 years	303 (66.0%)	297 (66.6%)	
	Above 65 years	14 (3.1%)	26 (5.8%)	
	Total	459 (50.7%)	446 (49.3%)	
Sex	Female	83 (18.2%)	115 (25.9%)	<b>7.866; <math>p=0.005</math></b>
	Male	374 (81.8%)	329 (74.1%)	
	Total	457 (50.7%)	444 (49.3%)	
Marital status	Married	218 (47.5%)	228 (51.2%)	4.450; $p=0.349$
	Minor	61 (13.3%)	49 (11.0%)	
	Separated & Divorced	20 (4.4%)	29 (6.5%)	
	Single	147 (32.0%)	128 (28.8%)	
	Widow	13 (2.8%)	11 (2.5%)	
	Total	459 (50.8%)	445 (49.2%)	
Religion	Atheist	2 (0.4%)	1 (0.2%)	2.113; $p=0.549$
	Christian	433 (96.0%)	432 (97.3%)	
	Hindu	1 (0.2%)	2 (0.5%)	
	Muslim	15 (3.3%)	9 (2.0%)	
	Total	451 (50.4%)	444 (49.6%)	
Occupation	Businessman/woman	58 (12.8%)	54 (12.2%)	1.302; $p=0.861$
	Casual	206 (45.5%)	199 (45.1%)	
	Employed	64 (14.1%)	71 (16.1%)	
	Other	33 (7.3%)	26 (5.9%)	
	Unemployed	92 (20.3%)	91 (20.6%)	
	Total	453 (50.7%)	441 (49.3%)	
Education level	None	33 (7.4%)	22 (5.0%)	<b>18.128; <math>p=0.001</math></b>
	Pre-school	18 (4.0%)	4 (0.9%)	
	Primary	157 (35.0%)	151 (34.6%)	
	Secondary	166 (37.1%)	151 (34.6%)	
	Tertiary	74 (16.5%)	108 (24.8%)	
	Total	448 (50.7%)	436 (49.3%)	

Binary and multinomial Logistic regression was used to estimate the probability of occurrence of key characteristics before and after the enforcement of the referral guidelines namely sex, education level and mode of payment. With regard to mode of payment, the odds of being a cash payer were 1.846 (1.387 – 2.458) more before as compared to after the enforcement of referral guidelines and this was statistically significant. This means that the enforcement of the referral

guidelines was associated with a statistically significant increase in the number of orthopaedic and trauma admissions with active insurance cover (Table 4.1.1.7).

The study revealed that the likelihood of being a male was 1.575 (1.145 – 2.166) more compared to female before the enforcement of the referral guidelines as compared to after the enforcement of the referral guidelines and this was statistically significant (Table 4.1.1.7).

With regards to education level, the study revealed that the likelihood of having tertiary level of education was about 54.4% less before the enforcement of the referral guidelines as opposed to after the enforcement of the referral guidelines this was statistically significant. This means that more orthopaedic admissions had tertiary level of education after enforcement of the referral guidelines. However, there was no observable difference in number and proportion of referrals based on levels of education namely pre-school, primary and secondary levels of education before and after enforcement of the referral guidelines (Table 4.1.1.7). This means that the likelihood of orthopedic admissions having insurance cover increased after enforcement of the referral guidelines.

The likelihood of orthopedic and trauma admissions having insurance cover was 46.2% less likely before enforcement of referral guidelines as compared to after enforcement of referral guidelines and this was statistically significant (Table 4.1.1.7). This means that the likelihood of orthopedic admissions having insurance cover increased after enforcement of the referral guidelines.

Table 4.1.1 7: Multivariable analysis of socio-demographic characteristic of orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines, 2021

Characteristics		Before	After	$\chi^2$ ; $p$ -value	Logistic regression (95% CI)
Sex	Female	83 (18.2%)	115 (25.9%)	7.866; $p=0.005$	1.0
	Male	374 (81.8%)	329 (74.1%)		<b>1.575 (1.145 – 2.166)</b>
Education level	None	33 (7.4%)	22 (5.0%)	18.128; $p=0.001$	1.0
	Pre-school	18 (4.0%)	4 (0.9%)		3.0 (0.894 – 10.063)
	Primary	157 (35.0%)	151(34.6%)		0.693 (0.387 -1.243)
	Secondary	166 (37.1%)	151 (34.6%)		0.733 (0.409 – 1.313)
	Tertiary	74 (16.5%)	108 (24.8%)		<b>0.457 (0.247 – 0.845)</b>
Mode of payment	Cash	344 (75.3%)	277 (62.2%)	17.837; $p=0.0001$	1.0
	Insurance	113 (24.7%)	168 (37.8%)		<b>0.538 (0.404 – 0.716)</b>

The mode of payment and its association with sex was reviewed and it showed no statistically significant association before the enforcement of the guidelines. However, male were 2.366 times



more likely to be cash payers compared to female after enforcement of the referral guidelines (Table 4.1.1.8). This means more females admissions had insurance cover after enforcement of referral guidelines.

Table 4.1.1 8: Multivariable analysis of sex of orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines, 2021 disaggregated by mode of payment

		Cash	Insurance	$\chi^2$ ; $p$ -value	OR (95% CI)
Before	Female	58 (17.0%)	25 (22.1%)	1.519; $p=0.218$	1.0
	Male	284 (83.0%)	88 (77.9%)		1.391 (0.822 – 2.355)
After	Female	54 (19.6%)	61 (36.5%)	15.574; $p=0.0001$	1.0
	Male	222 (80.4%)	106 (63.5%)		2.366 (1.534 – 3.649)

Legend: chi-square test of independence showed a  $p = 0.013$  before and  $p = 0.0001$  after enforcement of referral guidelines, 2021

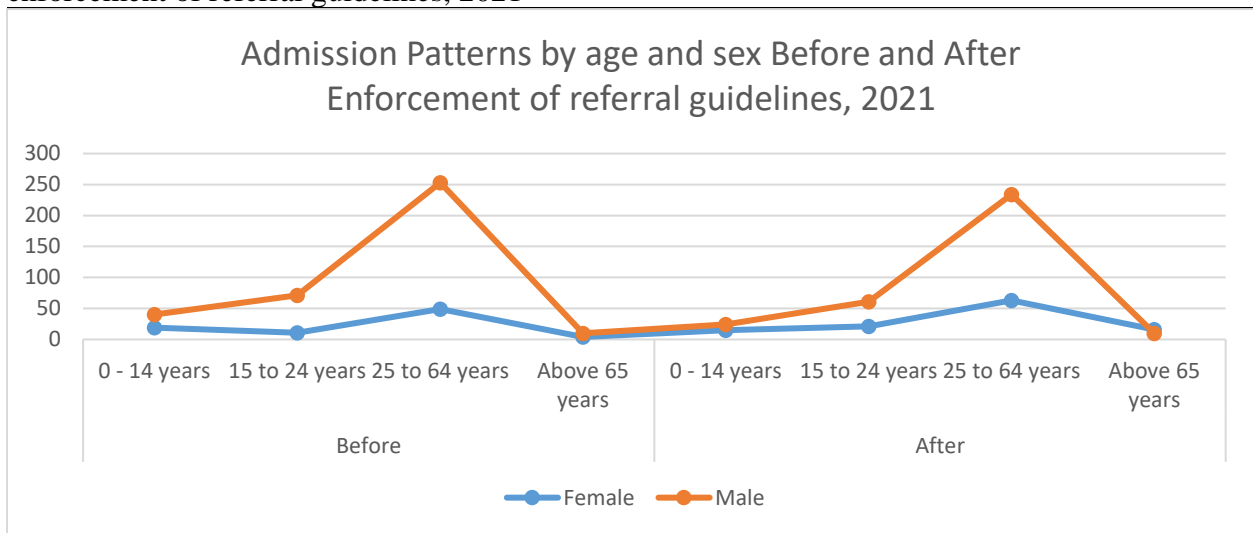


Figure 4 1: Admission patterns by age group and sex, before and after enforcement of referral guidelines, 2021

Male admissions predominated and peaked at 25 – 64 years and these admissions declined steadily to 65years of age.

The study also reviewed the mechanism of injury to depict the patterns of orthopaedic admissions to KNH in 2021. Majority of the admissions were through road traffic accident at about 231 (50.3%) and 208 (46.6%) before and after enforcement of the referral guidelines. The Non-trauma

orthopaedic admissions doubled from 55 (12.0%) to 100 (22.4%) before and after enforcement of the referral guidelines respectively and this was statistically significant ( $p=0.0001$ ) (Table 4.1.1.9).

Table 4.1.1 9: Orthopaedic admissions to KNH by mechanism of injury before and after enforcement of referral guidelines, 2021.

	Before	After	Total	<i>p</i> -value
Road Traffic Accident	231 (50.3%)	208 (46.6%)	439 (48.5%)	0.267
Fall	110 (24.0%)	79 (17.7%)	189 (20.9%)	0.021
Assault	17 (3.7%)	14 (3.1%)	31 (3.4%)	0.641
Gunshot	3 (0.7%)	3 (0.7%)	6 (0.7%)	0.972
Others	41 (8.9%)	40 (9.0%)	81 (9.0%)	0.984
Non-trauma	55 (12.0%)	100 (22.4%)	155 (17.1%)	0.0001
Missing System	2 (0.4%)	2 (0.4%)	4 (0.4%)	-
Total	459 (100.0%)	446 (100.0%)	905 (100.0%)	

The study sought to ascertain the patterns of mechanism of injury with the age categorisation. The results revealed majority of RTA about 164 (54.3%) and 143 (48.5%) involved those aged between 25 – 64 years of age both before and after enforcement of the referral guidelines. Falls were the commonest mechanism of injury amongst children and the those above 65 years of age. The non-trauma causes of orthopaedic admissions doubled from 55 (12.0%) to 100 (22.5%) after enforcement of the referral guidelines (Table 4.1.1.10).

Table 4.1.1 10: Distribution of mechanism of Injury against the age group before and after the enforcement of the referral guidelines, 2021.

	Age categories	Assault	Fall	Gunshot	Non-Trauma	Others	RTA
Before	0 -14 years	1 (1.7%)	32 (55.2%)	0 (0.0%)	9 (15.5%)	8 (13.8%)	8 (13.8%)
	15 – 24 years	4 (4.8%)	8 (9.6%)	2 (2.4%)	4 (4.8%)	11 (13.3%)	54 (65.1%)
	25 – 64years	12 (4.0%)	64 (21.2%)	1 (0.3%)	39 (12.9%)	22 (7.3%)	164 (54.3%)
	Above 65 years	0 (0.0%)	6 (42.9%)	0 (0.0%)	3 (21.4%)	0 (0.0%)	5 (35.7%)
	Total	17 (3.7%)	110 (24.1%)	3 (0.7%)	55 (12.0%)	41 (9.0%)	231 (50.5%)
After	0 -14 years	0 (0.0%)	12 (30.0%)	0 (0.0%)	9 (22.5%)	7 (17.5%)	12 (30.0%)
	15 – 24 years	2 (2.4%)	14 (14.9%)	0 (0.0%)	12 (14.5%)	5 (6.0%)	50 (60.2%)
	25 – 64years	12 (4.1%)	44 (14.9%)	3 (1.0%)	69 (23.4%)	24 (8.1%)	143 (48.5%)
	Above 65 years	0 (0.0%)	9 (34.6%)	0 (0.0%)	10 (38.5%)	4 (15.4%)	3 (11.5%)
	Total	14 (3.2%)	79 (17.8%)	3 (0.7%)	100 (22.5%)	40 (9.0%)	208 (46.8%)

The study sought to reveal the patterns of distribution of orthopedic and trauma admissions by sub-county of origin. Most of the orthopedic admissions were from Nairobi County at 64.1% and

56.9% before and after enforcement of the referral guidelines, respectively. These are followed by Kiambu County, Kajiado County and Eastern Counties namely Machakos and Kitui Counties (Table 4.1.1.11).

Table 4.1.1 11: Shows the distribution of orthopedic and trauma admissions by their sub-county of origin before and after enforcement of referral guidelines, 2021.

Country	County	Before	After
Burundi	Burundi	0 (0.0%)	1 (0.2%)
Kenya	Nairobi	293 (64.1%)	253 (56.9%)
	Kiambu	56 (12.3%)	59 (13.3%)
	Kajiado	40 (8.8%)	41 (9.2%)
	Others – Eastern (Machakos, Mwingi counties)	32 (7.0%)	33 (7.4%)
	Others - Central	10 (2.2%)	18 (4.0%)
	Muranga	6 (1.3%)	13 (2.9%)
	Nakuru	5 (1.1%)	5 (1.1%)
	Others - Western	4 (0.9%)	4 (0.9%)
	Others – North Eastern	3 (0.7%)	2 (0.4%)
	Others - Rift	3 (0.7%)	3 (0.7%)
	Others - Coast	2 (0.4%)	9 (2.0%)
	Others - Nyanza	1 (0.2%)	4 (0.9%)
	Missing	2 (0.4%)	0 (0.0%)
	Total	457 (100.0%)	455 (100.0%)

Global Information System (GIS) coordinates were generated from the areas of residence of orthopedic and trauma admissions reported at KNH and density plots generated using QGIS software and stratified as before and after the enforcement of the referral guidelines. Sub-county was used as reference unit to calculate the total number of cases reported and these were expressed in a graduated map. The residence of orthopedic cases reported at KNH were spread across the country with majority being from Nairobi County and its environs (Figure 4.2).

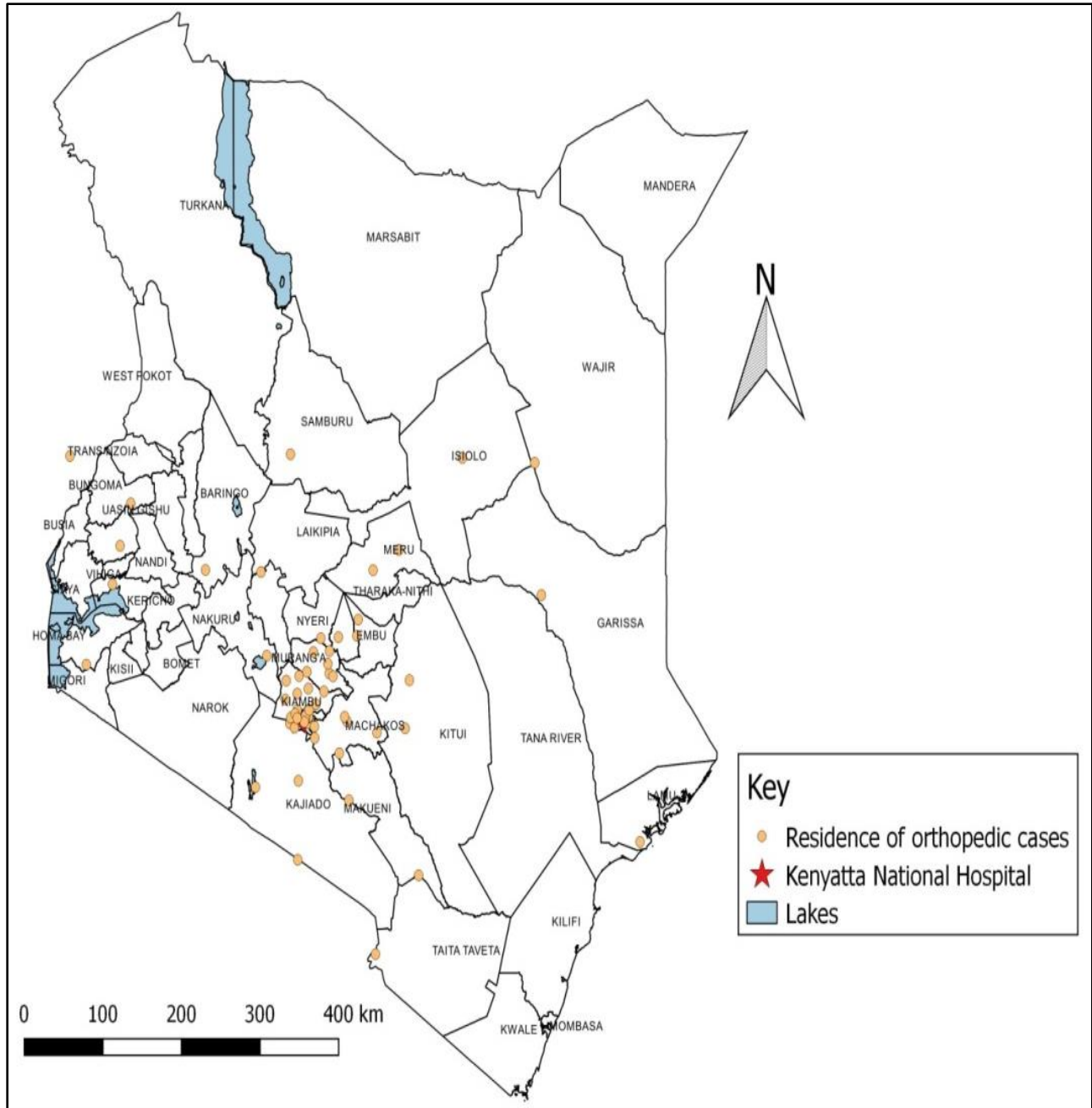


Figure 4 2: Residence orthopedic and trauma admissions reported at Kenyatta National Hospital before enforcement of referral regulations

Density plots for orthopedic and trauma admissions to KNH based on their current residence as at the time of seeking care at KNH after enforcement of referral guidelines. The residence of orthopedic cases reported at KNH were spread across the country with majority being from Nairobi County and its environs (Figure 4.3).

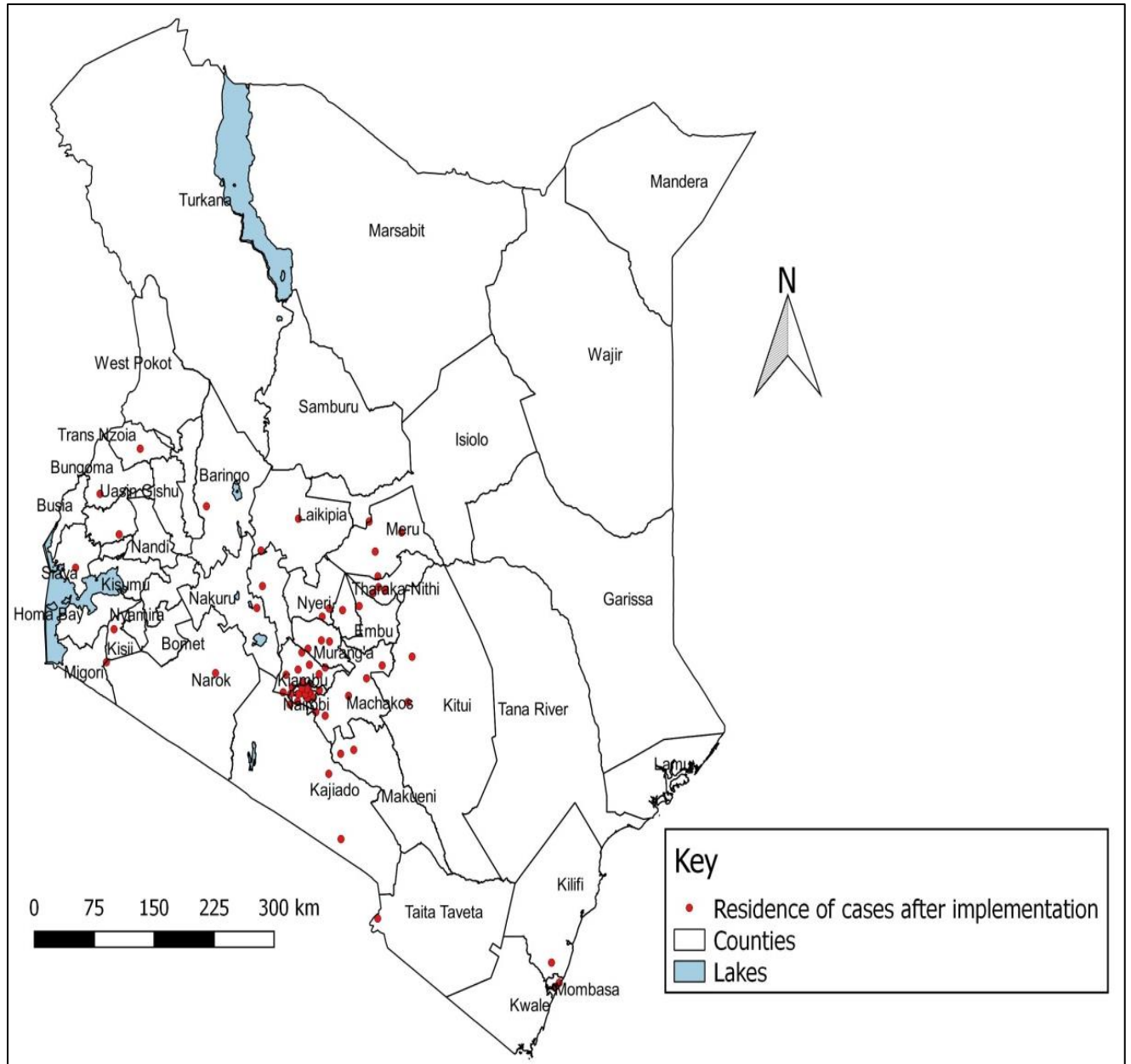


Figure 4 3: Residence orthopedic and trauma admissions reported at Kenyatta national referral hospital after enforcement of referral regulations

The distribution of orthopedic and trauma admissions reported at KNH were spread across the country with majority being from Nairobi County and its environs. When the number of cases were plotted in sub county of residence and compared before and after the enforcement of referral guidelines, a general reduction was also observed after enforcement of regulations however, Kajiado North, Dagoreti North, Embakasi South and Kasarani sub-counties had increase in number of cases referred to KNH after the enforcement of referral guidelines (Figure 4.4)

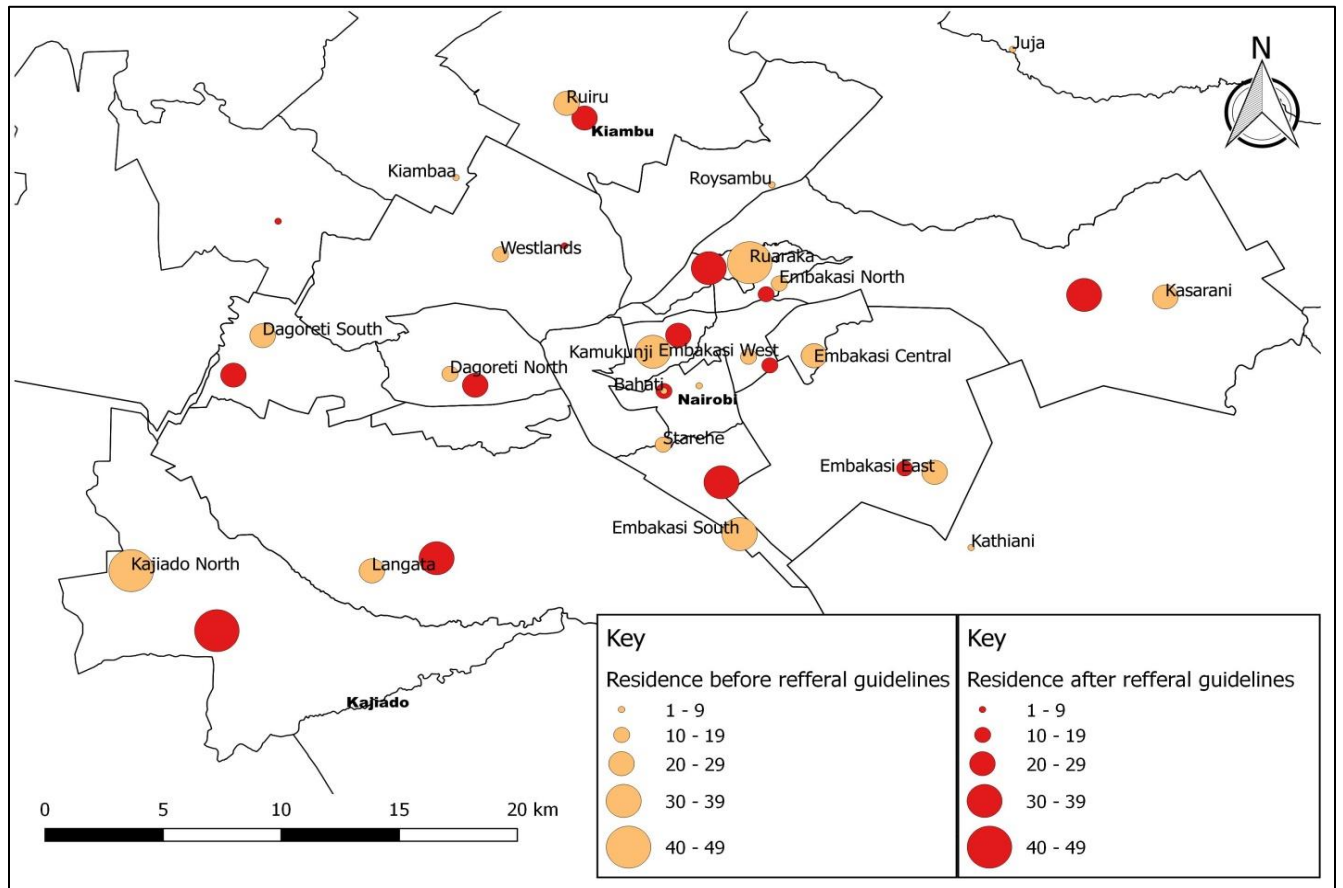


Figure 4 4: Distribution by sub-county of residence among orthopedic and trauma admissions reported at Kenyatta National Hospital before and after enforcement of referral regulations

#### 4.1.2 Types of Orthopaedic and Trauma Admissions Before and After Enforcement of Referral Guidelines

The study sought to determine the type of orthopaedic and trauma admissions to KNH before and after the enforcement of KNH referral guidelines in 2021. Overall, the majority of the orthopaedic and trauma admissions in 2021 were due to lower limb fractures at 38.8% followed by upper limb injuries at 13.5% while the least admissions were due to acetabular fractures at 1.5% (Table 4.2.0). The results also indicate there were no statistical differences for all the type of injuries for before and after with the exception of acetabular injury (Table 4.1.2.1).

Table 4.1.2.1: Types of Orthopaedic and trauma admissions to KNH (n=905)

Types of orthopaedic cases	Before (n= 459)	After (n=446)	Overall	p-value
Lower Limb Injury	186 (40.5%)	165 (37.0%)	351 (38.8%)	0.276
Upper Limb Injury	54 (11.8%)	68 (15.2%)	122 (13.5%)	0.125
Spine Injury	29 (6.3%)	38 (8.5%)	67 (7.4%)	0.206
Pelvic Injury	24 (5.3%)	20 (4.5%)	44 (4.9%)	0.603
Acetabular Injury	12 (2.6%)	2 (0.4%)	14 (1.5%)	<b>0.008</b>

The study also reviewed the type of orthopaedic and trauma injuries and revealed majority 232 (50.5%) and 197 (44.2%) were closed fractures before and after enforcement of the referral guidelines respectively. This translates to 60.1% (232/386) and 61.0% (197/323) of total fracture injuries before and after enforcement of referral guidelines. Non-trauma orthopaedic cases were 73 (15.950 and 123 (27.6%) before and after enforcement of referral guidelines. Of open fractures, majority 60 (39.0%) and 36 (28.6%) were Anderson-Gustillo type II fractures. Anderson-Gustillo type IIIc were the least common type of open fractures (Table 4.1.2.2).

Table 4.1.2.2: Type of orthopaedic and trauma injury before and after enforcement of referral guidelines, 2021

	Type	Frequency	Gustillo Type	Frequency
Before	Closed	232 (50.5%)	-	-
	Open	154 (33.6%)	I	22 (14.3%)
			II	60 (39.0%)
			IIIa	11 (7.1%)
			IIIb	8 (5.2%)
			IIIc	2 (1.3%)
			Not classified	51 (33.1%)
Non-trauma	73 (15.9%)	-	-	
After	Closed	197 (44.2%)	-	-
	Open	126 (28.3%)	I	20 (15.9%)
			II	36 (28.6%)
			IIIa	13 (10.3%)
			IIIb	3 (2.4%)
			IIIc	0 (0.0%)
			Not classified	54 (42.9%)
Non-trauma	123 (27.6%)	-	-	

A bivariable analysis was done to assess the association between the Lower limb injuries and other orthopaedic injuries admitted to KNH during 2021 period. The results revealed a statistically significant association between lower limbs injuries and Upper limb injuries as well as spine injuries (Table 4.1.2.3).

Table 4.1.2.3: Bivariable analysis on association between Lower Limb injuries and other orthopaedic injuries before and after enforcement of referral guidelines, 2021.

			Lower Limb Injury	No Lower Limb Injury	$\chi^2$ ; $p$ -value
Upper Limb Injury	Before	Yes	9 (16.7%)	45 (83.3%)	<b>14.451;</b> <b><math>p=0.0001</math></b>
		No	177 (43.7%)	228 (56.3%)	
	After	Yes	7 (10.3%)	61 (89.7%)	<b>24.541;</b> <b><math>p=0.0001</math></b>
		No	158 (41.8%)	220 (58.2%)	
Pelvic Injury	Before	Yes	7 (29.2%)	17 (70.8%)	1.355; $p=0.244$
		No	179 (41.1%)	256 (58.9%)	
	After	Yes	7 (35.0%)	13 (65.0%)	0.036; $p=0.850$
		No	158 (37.1%)	268 (62.9%)	
Acetabular Injury	Before	Yes	5 (41.7%)	7 (58.3%)	0.007; $p=0.935$
		No	181 (40.5%)	266 (59.5%)	
	After	Yes	1 (50.0%)	1 (50.0%)	0.146; $p=0.703$
		No	164 (36.9%)	280 (63.1%)	
Spine Injury	Before	Yes	0 (0.0%)	29 (100.0%)	<b>21.091;</b> <b><math>p=0.0001</math></b>
		No	186 (43.3%)	244 (56.7%)	
	After	Yes	3 (7.9%)	35 (92.1%)	<b>15.092;</b> <b><math>p=0.0001</math></b>
		No	162 (39.7%)	246 (60.3%)	

Binary logistic regression was used to determine the likelihood of lower limb injuries co-existing with upper limb and spine injuries. The study revealed that having Upper limb injuries were 3.882 (1.848 – 8.153) more likely to be associated with no lower limb injuries before the enforcement of the referral guidelines and 6.258 (2.789 – 14.046) more likely to be associated with no Lower limb injuries after the enforcement of the referral guidelines (Table 4.1.2.4). This means having lower limb fractures are less likely to have upper limb fractures.

In addition, orthopaedic admissions due to spinal injuries were 7.683(2.324 – 25.397) more likely to be associated with no Lower limb injuries after the enforcement of the referral guidelines and this was statistically significant (Table 4.1.2.4).



Table 4.1.2.4: Multivariable analysis on association between Lower Limb and other orthopaedic injuries before and after enforcement of referral guidelines, 2021.

			Lower Limb Injury	No Lower Limb Injury	$\chi^2$ ; $p$ -value	Logistic regression OR (95% CI)
Upper Limb Injury	Before	Yes	9 (16.7%)	45 (83.3%)	14.451; $p=0.0001$	1.0
		No	177 (43.7%)	228 (56.3%)		3.882(1.848 – 8.153)
	After	Yes	7 (10.3%)	61 (89.7%)	24.541; $p=0.0001$	1.0
		No	158 (41.8%)	220 (58.2%)		6.258(2.789– 4.046)
Spine Injury	Before	Yes	0 (0.0%)	29 (100.0%)	21.091; $p=0.0001$	-
		No	186 (43.3%)	244 (56.7%)		
	After	Yes	3 (7.9%)	35 (92.1%)	15.092; $p=0.0001$	1.0
		No	162 (39.7%)	246 (60.3%)		7.683(2.324 – 25.397)

The study reviewed the major types of orthopaedic and trauma admissions to KNH in 2021. Overall femur shaft fractures (13.6%), Tibia-Fibula fractures (12.2%), spine fractures (8.1%), femur proximal fractures (7.5%), hand fractures (4.9%) and pelvic fractures (4.8%) were the most frequently admitted orthopaedic fractures both through facility referrals and walk-ins (Table 4.2.4). On the other hand, radial fractures (2.6%), Foot wound (2.6%) and humerus shaft fractures (1.1%) were the least orthopaedic admissions. No facility referrals were made for Humerus shaft fractures while 2.0% and 3.8% of Humeral Shaft fractures were walk-ins before and after enforcement of referral guidelines (Table 4.1.2.5).

Table 4.1.2. 5: Types of Orthopaedic admissions to Kenyatta National Hospital before and after enforcement of referral guidelines through Facility referrals and Walk-ins, 2021.

Type of Orthopaedic Admission	Facility referrals		Walk-ins		Total
	Before	After	Before	After	Total
Femur Shaft Fracture	38 (14.1%)	43 (14.8%)	33 (13.0%)	19 (11.9%)	133 (13.6%)
Tibia - Fibula Shaft Fracture	28 (10.4%)	38 (13.1%)	39 (15.4%)	14 (8.8%)	119 (12.2%)
Spine Fracture	27 (10.0%)	33 (11.3%)	9 (3.5%)	10 (6.2%)	79 (8.1%)
Femur Proximal Fracture	19 (7.1%)	19 (6.5%)	22(8.7%)	13 (8.2%)	73 (7.5%)
Hand Fracture	15 (5.6%)	13 (4.5%)	8 (3.1%)	12 (7.5%)	48 (4.9%)
Pelvic Fracture	12 (4.5%)	16 (5.5%)	9 (3.5%)	10 (6.2%)	47 (4.8%)
Tibia - Fibular Proximal Fracture	9 (3.3%)	8 (2.7%)	12 (4.7%)	8 (5.0%)	37 (3.8%)
Ankle Fracture	10 (3.7%)	8 (2.7%)	13 (5.1%)	5 (3.1%)	36 (3.7%)
Femur Distal Fracture	10 (3.7%)	13 (4.5%)	8 (3.1%)	3 (1.9%)	34 (3.5%)
Foot Fracture & Dislocation	8 (3.0%)	5 (1.7%)	13 (5.1%)	8 (5.0%)	34 (3.5%)
Tibia - Fibular Distal Fracture	11 (4.1%)	8 (2.7%)	12 (4.7%)	2 (1.3%)	33 (3.4%)
Hand Soft Tissue Injury	8 (3.0%)	8 (2.7%)	7 (2.8%)	9 (5.7%)	32 (3.3%)
Distal Humerus Fracture	15 (5.6%)	4 (1.4%)	9 (3.5%)	2 (1.3%)	30 (3.1%)
Radial Fracture	3 (1.1%)	13 (4.5%)	5 (2.0%)	4 (2.5%)	25 (2.6%)
Foot Wound	5 (1.9%)	8 (2.7%)	8 (3.1%)	4 (2.5%)	25 (2.6%)
Shaft Humerus Fracture	0 (0.0%)	0 (0.0%)	5 (2.0%)	6 (3.8%)	11 (1.1%)
	269	291	254	159	973

#### 4.2 Factors associated with Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines

The study sought to determine the factors associated with orthopaedic and trauma referrals before and after the enforcement of the referral guidelines. The factors included human resource capacity and availability, health facility infrastructure, Orthopaedic and trauma equipment's and implants availability, patient's preference, unaccompanied patients and financial constraints and proximity to KNH. The major factors are as shown in Table 4.2.0.1.

Table 4.2.0 1: Table showing the frequency distribution of the major factors associated with orthopaedic and trauma referrals before and after the enforcement of the referral guidelines at KNH.

	Human resource capacity and availability	Health facility Infrastructure	Orthopaedic equipment's and Implant availability	Patients' preference	Financial constraints'
Before (n=459)	190 (41.4%)	30 (6.5%)	89 (19.4%)	89 (19.4%)	125 (27.2%)
After (n=446)	196 (43.9%)	27 (6.1%)	92 (20.6%)	123 (27.6%)	86 (19.3%)

#### 4.2.1 Human Resource Capacity and Availability

The qualitative study showed that most orthopaedic and trauma admissions to KNH were due to perceived or real inadequate human resource capacity and availability from the peripheral health facilities, both public and private health facilities. This was the most frequently cited reasons for bypassing the nearby health facilities at 41.4% and 43.9% before and after enforcement of referral guidelines respectively. KNH was believed to have highly specialized personnel to manage diverse orthopaedic/trauma and associated conditions like plastic surgeons, neurosurgeons and cardiovascular surgeons. Some health facilities with orthopaedic surgeons still refer polytrauma orthopaedic cases due to lack of other specialist personnel/care like neurosurgeons, ICU or HDU care.<sup>1</sup>

*“... patient was taken to Kangundo hospital but there were not enough human resource personnel to attend to the patient....” Walk-in patient from Machakos county.*

*“.... went to Thika level 5 hospital then they were transferred to KNH since Thika Level 5 lacked a spine specialist....” Facility referral from Thika Level 5 Hospital*

According to some patients, they brought themselves and some referred to KNH after trying many other hospitals without satisfactory outcomes.

*“.... came to see a specialized doctor after several failed attempts at Murang'a peripheral facilities....” Walk-in from Kilome*

<sup>1</sup> Ngong Sub-County Hospital KII, KNH KII, Mama Lucy Kibaki Hospital KII, Mwingi County Referral Hospital KII, Arthi River Shallow Hospital KII, St Francis Community Hospital KII

*“...after trying many hospitals in Kisii, patient finally decided to come to KNH” Walk-in from Kisii.*

Some orthopaedic and trauma admissions were polytrauma patients with very critical neurosurgical complications that the referring facilities could not manage, thus they had to refer the patients to KNH for specialized care.

*“.....patients’ injuries were too severe and required a specialized doctor/depressed skull fracture with inner table compressing the brain's neurosurgeon not available at the facility....”* Facility referral from Thika Level 5 Hospital

There are those patients who were referred from the health facility due to the fact that there was no orthopaedic surgeon at the time of emergency at the referring health facility.

*“.....there was no orthopaedic surgeon at that particular night so they decided to refer the patient to KNH to get assistance....”* Facility referral from Mama Lucy Kibaki Hospital

*“...he needed an orthopaedic doctor for treatment of his condition, and Machakos did not have one at that moment....”* Facility Referral from Machakos Level 5 Hospital

*“...I would say maybe especially at night, we refer Kenyatta because of the visiting consultants are not available at night...”* St Francis Community Hospital KII

#### **4.2.2 Financial constraints**

According to significant number of orthopaedic and trauma admissions, the referral was done because of financial constraints since they could ill afford the private health facilities, they were in. This was the second and third most frequently cited reasons for bypassing the nearby health facilities at 27.2% and 19.3% before and after enforcement of referral guidelines respectively. Most of the private health facilities were not accepting NHIF insurance cover for orthopaedic admissions. A number of private orthopaedic and trauma patients were advised by their doctors to seek care at KNH because of their relative affordability and ability to make use of the NHIF cover to pay their medical bills. This was triangulated with KII findings that revealed the most common reason for referral from private health facilities to KNH was financial constraints. Majority of orthopaedic and trauma admissions to KNH are from low socio-economic status with no insurance cover and therefore could not afford to meet the cost of private health facilities.<sup>2</sup>

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<sup>2</sup> KNH KII, Mbagathi DH KII, Mwingi County Referral KII, Arthi River Shallom Hospital KII

*“...she couldn’t afford to pay at Nairobi South Hospital so her doctor requested for the surgery to be done at KNH since the doctor was also from KNH...”* Facility Referral from Nairobi South Hospital

*“...Parkland Avenue was too expensive the dad could not afford so they opted for KNH...”* Facility Referral from Parklands Avenue Hospital

*“...metropolitan hospital was too expensive for the patient thus opting for KNH....”* Facility Referral from Metropolitan Hospital

*“...we mainly refer due to cost....”* St Peters Orthopaedic KII

### **4.2.3 Patients’ preference**

The study revealed that some patients, their families, relatives and friends opted to go to KNH or be referred to KNH from other health facilities due to personal reasons, preferences and perceived high-quality services and availability of advanced equipment’s and orthopaedic implants as compared to the peripheral health facilities. This was the third and the second most frequently cited reasons for bypassing the nearby health facilities at 19.4% and 27.6% before and after enforcement of referral guidelines respectively. For some patients, either themselves or their relatives have been treated at KNH before and had good experience and outcome and ended by encouraging their loved ones and friends to seek services at KNH. This was triangulated with KII findings that revealed orthopaedic patients ask for referrals or decide on their own volition to present themselves to KNH for treatment based on their previous experience and perception of better quality of care at affordable terms.<sup>3</sup>

*“...Patient prefers KNH since family members have been treated there and fully recovered”,* Walk-in from Westlands

*“...after being advised by the people around, the patient decided to come to KNH...”* Walk-in from Embakasi South

*“...one friend of his suggested KNH as one of the best hospitals so they requested for a referral from Kakamega to KNH...”* Facility Referral from Kakamega PGH

### **4.2.4 Orthopaedic and trauma equipment and implants availability**

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<sup>3</sup> Mwingi County Referral Hospital KII, Mama Lucy Kibaki Hospital KII, Mbagathi DH KII

The study revealed that most health facilities and patients believed KNH had better orthopaedic and trauma equipment's and implants availability to manage diverse and complicated orthopaedic and trauma conditions. This was the fourth most frequently cited reasons for bypassing the nearby health facilities at 19.4% and 20.6% before and after enforcement of referral guidelines respectively. KNH was believed to have advanced imaging equipment's like CT scans, MRI and X-rays for diagnosis and patient management compared to the peripheral health facilities. These were triangulated with findings from KIIs done with the main referring public health facilities that revealed most of these public hospitals lack imaging equipment's like X-rays, CT scan and MRI and for those who have, the machines are sometimes faulty and in a sorry state. Patients then end up being referred to KNH for imaging studies.<sup>4</sup>

*"...Kenya is better equipped..."* Walk-in patient

*"...Sinai Hospital lacked machines to do X-rays..."* Facility Referral from Sinai Hospital, Rongai

*"Mama Lucy lacked the metals that were supposed to be put on the leg so they were forced to come to KNH..."* Facility Referral from Mama Lucy Kibaki Hospital

*"...the patient needed head and cervical vertebrae scanning which could not be done in Kitui hospital and they were specifically referred to KNH"* Walk-in from Kitui County

In addition, some health facilities had non-functioning imaging machines and so they referred them to KNH where they believed machines were available and in good working condition.

*".... machines were not working at Mama Lucy"* Facility Referral from Mama Lucy Kibaki Hospital

*"...Mbagathi's reason for referral always is the machine is not working every day"* KNH KII

Orthopaedic implants and sets are not available in most of these public and private peripheral health facilities. Most of these implants are outsourced and this requires that have to pay for them in advance before they implant can be procured. Those patients with no insurance cover, low socio-economic status and therefore cannot afford to pay for the implants, end up being referred to KNH.<sup>5</sup>

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<sup>4</sup> KNH KII, Mama Lucy Kibaki KII, Mbagathi DH KII, Mwingi County Referral Hospital KII, St Francis Community Hospital KII, Athi River Shallom Hospital KII

<sup>5</sup> Thika Level 5 Hospital KII, Machakos County Referral Hospital KII

*“..... either cash or NHIF, patients usually buy orthopaedic implant”* Machakos County Referral Hospital KII

#### **4.2.5 Health Facility Infrastructure**

The study demonstrated a number of patients were referred to KNH because of the unavailability of infrastructure and better facilities to handle and perform orthopaedic and trauma operations. This was one of the less frequently cited reasons for bypassing the nearby health facilities at 6.5% and 6.1% before and after enforcement of referral guidelines respectively. KNH was considered to have superior and capacious infrastructure to handle complex orthopaedic complications.

*“...there was no bed space in Mama Lucy...”* Facility Referral from Mama Lucy Kibaki Hospital

*“...KNH had better facilities and services...”* Facility Referral from Sinai Hospital, Rongai

This was triangulated with KII findings that revealed there was no enough infrastructure in some public hospitals with some lacking operation rooms while others health facilities have to share the theatre space making it hard for orthopaedic procedures to be done when required. Some public hospitals have no ICU or have few ICU beds. Some health facilities simply have inadequate bed capacity for orthopaedic admissions and have to refer to KNH when their capacity gets exceeded.<sup>6</sup>

*“...because we have two theatres, but there is one specifically for maternity. This other one we use for Obs and gynae, general surgery, ENT. So, we have one day each for each department...”*

Mwingi County Referral Hospital KII

#### **4.2.6 Quality of Health Services**

Quality of health services also came up as one of the factors affecting orthopaedic and trauma admissions to KNH. Some patients preferred to be referred to KNH because of the poor health care and services they got from other peripheral health facilities like the nurses being rude, unprofessional conduct. Some of these patients had received unfavourable commendations about peripheral health facilities with regard to the poor quality of health care provision.

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<sup>6</sup> KNH KII, Machakos County Referral Hospital KII, Mbagathi DH KII, Ngong Sub-County Hospital KII, Mwingi County Referral Hospital KII

*“...it was the patient decision to take a referral from Kiambu to KNH for further management due to poor services in Kiambu Hospital...”* Facility referral from Kiambu Level 5 Hospital

#### **4.2.7 Proximity to KNH**

Proximity to KNH was another factor mentioned that was associated with orthopaedic and trauma referrals. Some patients were either brought or came to KNH because it was the nearest facility from their residence or from the scene of the accident; the paramedics decided to rush them to KNH being the nearest hospital. Triangulated findings from KII revealed that referrals to KNH was convenient for orthopaedic and trauma patients because it is near. The patients also prefer being referred to KNH for convenience’s sake.<sup>7</sup>

*“...he was rushed by an ambulance to KNH as it was the nearest from the scene”* Walk-in from Mavoko

*“Nearer to KNH and the vehicle accident owner decided to bring him to KNH”,* Walk-in from Githunguri, Kiambu county

#### **4.2.8 Unaccompanied**

The study also revealed that some orthopaedic and trauma admissions were unconscious and just found themselves at KNH when they woke up not knowing how they got there. For others, it was the ambulance, good Samaritans or police officers that brought them direct to KNH from the accident scene. Some paramedics thought it wise to bring them to KNH given the severity of their injuries.

*“...he was unconscious and was picked by an ambulance and decided to bring to KNH...”* Walk-in from Embakasi Central

*“... since the patient was unconscious, he was involuntarily brought to KNH....”* Walk-in from Kasarani

*“...the patient was brought in to KNH by police....”* Walk-in from Starehe

*“...rushed to hospital by the owner of the vehicle who hit him....”* Walk-in from Kajiado North

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<sup>7</sup> KNH KII, Ngong Sub- County Hospital KII



## **5.0 DISCUSSIONS**

### **5.1.1 Patterns of Orthopaedic and Trauma admissions to Kenyatta National Hospital before and after enforcement of referral guidelines.**

There was a statistically significant reduction in the number and proportions of walk-in patients that ended up being admitted to KNH after the enforcement of the KNH referral guidelines. This is because patients were encouraged to seek services to lower-level health facilities and that they should come with a formal referral letter from a lower-level health facility to KNH.

The fact that most of the referrals were verbal over the telephone and once a verbal consensus has been reached the referring health facilities did not see the need of writing an official referral letter explains why the enforcement of the referral guidelines had no effect on proportion of admissions with formal referral letters.

The enforcement of the referral guidelines reduced the proportion of emergency admissions that were admitted through Accident and Emergency Department and these were mostly trauma – related injuries. Patients who normally would end up being admitted at KNH were being managed at the lower-level health facilities. This also resulted in a relative increase in the proportion of elective admissions that were admitted through the Orthopaedic Clinic and Corporate Outpatient Clinic.

The study also demonstrated that the majority of the admissions were through road traffic accident (RTA), falls and assaults. This compares favourably with other studies done in Tanzania, Ethiopia, Botswana, Middle East, Nepal that depicted a high proportion of Orthopaedic and Trauma admissions were due to RTA, falls and assaults (36, 51, 64-67). In addition, there was doubling of non-trauma Orthopaedic admissions after enforcement of the referral guidelines and this was reinforcing the fact that elective Orthopaedic admissions increased while emergency Orthopaedic and Trauma admissions reduced after the enforcement of the referral guidelines.

Moreover, when the patterns of mechanism of injury was disaggregated by age, it revealed majority of RTA orthopaedic and trauma admissions aged 25 – 64 years both before and after enforcement of the referral guidelines. Falls were the commonest mechanism of injury amongst

admissions in children and those above 65 years of age. This compares favourably with similar studies done in Middle East region and Botswana that showed RTA was the major cause of admissions at for younger populations while falls commonest cause of admissions for the extremes of age – children and the elderly (36, 67). This also compares with a multicenter observation study done on distribution of orthopedic fractures in low and middle-income countries that revealed falls was the main mechanism of injury for those 60 years and above (68). Elderly patients who are more prone to fragility fractures and children are more prone to falls.

The study demonstrated Orthopaedic and Trauma admissions were male before and after enforcement of referral guidelines. This compares favourably with studies done in Ethiopia, India, Nepal, Middle East and Botswana that showed male predominates Orthopaedic and Trauma admissions (24, 36, 52, 64-67, 69). While male admissions predominated and peaked at 25 – 64 years and these admissions declined steadily to 65years of age and thereafter admissions were comparable across gender for those above 65 years of age. This compares with a retrospective study done in a tertiary Hospital in Nepal that showed similar admission rates from 60 years of age (69). However, the study revealed an overall increase in female admissions as compared to males after the enforcement of referral guidelines. This can be attributed to reduction in the number of emergency admissions through Accident and Emergency department and also reduced number of admissions resulting from the road traffic accident due to the enforcement of the referral guidelines since majority of these emergency admissions were male.

The Orthopaedic and Trauma admissions was young and this compares with studies done in tertiary hospitals in Nepal, Middle East, Botswana that showed young adults as the common age group for Orthopaedic and Trauma admissions (36, 65, 67, 69). However, while the mean age remained relatively the same for men before and after enforcement of the referral guidelines, for females the mean age increased significantly from 32.157 years to 37.987 years after enforcement of the referral guidelines. This compares favourably with studies done in Moshi, Northern Tanzania that showed in Orthopaedic and Trauma admissions were young males tended to be younger (37.8years) than females (43.9years) (51, 66). This is because the enforcement of the referral guidelines was accompanied by a corresponding increase in female elective admissions

during the study period and these were largely non-trauma admissions that came with degenerative musculoskeletal disorders.

Based on age groups, children and those above 65 years represented the least Orthopaedic and Trauma admissions during the study period before and after enforcement of the referral guidelines while majority of the admissions were observed among age group 25 – 64 years. This compares with a retrospective study on Orthopaedic admissions done in Warangal, India that showed the average age was 41.14 years. There was bimodal distribution with high rates of admissions for the young adults up to the age of 35 years old as well as for those above 45 years old (24). Similar studies also depicted low paediatric orthopaedic admissions (26). However, this contrasts with a study done in PCEA Kikuyu Mission Hospital, Kenya that showed 18.84% orthopaedic admissions were of paediatric age group (52). This could be due to the fact that PCEA Kikuyu Mission Hospital is a private mission hospital and is an established and highly reputable orthopaedic and trauma rehabilitation centre in Kenya.

Casual labourers comprised significant majority of orthopaedic admissions before and after enforcement of referral guidelines when compared with other forms of occupation. This compares favourably with study done in Taiwan that revealed fractures were associated with patients of low socio-economic status (26). However, it contrasted with studies done on orthopedic and trauma admissions in Kilimanjaro Christian Medical Centre (KCMC) in Northern Tanzania which showed the three most common occupations were farmers, businessman, professional drivers, students (51, 66). This could be because KCMC is a private facility as opposed to KNH which is a public referral health facility.

The study reviewed the mode of payment for Orthopedic and Trauma admissions. A small proportion of the Orthopedic and Trauma admissions had an active insurance cover at 24.7% and 37.8% before and after the enforcement of the referral guidelines. The increase in the proportion with insurance cover after the enforcement of the referral guidelines could be due to an increase in the number and proportion of female Orthopedic and Trauma admissions. More female admissions had insurance cover after enforcement of referral guidelines and this could be due to the fact that there were more elective admissions after enforcement of the referral guidelines and

these were mostly women with non-trauma Orthopedic conditions that were age-related. That also supports the earlier finding that the mean age of women increased after enforcement of the referral guidelines. This contrasts with a multicenter observation study done on distribution of orthopedic fractures in low and middle-income countries that revealed about 18% of Orthopedic admissions in Africa had health insurance cover (68). It also contrasts with a retrospective study done in PCEA Kikuyu Mission Hospital in Kenya showed about 60.82% of orthopedic patients have insurance cover (52). This could be explained by the fact that PCEA Kikuyu Mission Hospital is a private health facility that admits patients with higher socio-economic status compared to KNH which is a public referral health facility.

The study revealed that while orthopedic and trauma admissions were spread across the country, most of the admissions were from Nairobi County before and after enforcement of the referral guidelines. This compares with a review of Orthopedic and Trauma admissions in KCMC in Northern Tanzania that showed 65.7% of the patients came from state of Kilimanjaro where the hospital is located, 12.7% from Arusha, 6.4% from Tanga, 5.9% from Manyara and 1.5% from Singida (66). A similar study done in Muhimbili National Hospital in Tanzania showed only 0.8% of admissions were from outside Dar Es Salaam (41). A similar study done in Blantyre in Malawi also revealed majority of referrals come from within the Tertiary facility (70)

### **5.1.2 Types of Orthopaedic and Trauma admissions to Kenyatta National Hospital before and after enforcement of referral guidelines;**

The study sought to determine the type of orthopaedic admissions to KNH before and after the enforcement of KNH referral guidelines. Overall, the majority of the admissions were due to lower limb fractures followed by upper limb injuries while the least admissions were due to acetabular fractures. This compares with studies done on orthopaedic admissions in India and Nepal that revealed majority of admissions were lower limb fractures, upper limb fractures and spine injuries (24, 26, 65, 69). This could be explained by the fact that majority of the admissions were male and lower limb injuries are associated with male gender. However, this contrasts with a cross-sectional study done at a Teaching Hospital in Bharatpur in Nepal in 2020 that showed Spine injury was the least common injury at 1.1% (65).

The study showed that orthopaedic and trauma admissions due to lower limb injuries were less likely to be associated with upper limb and spinal injuries. This contrasts studies done on spinal injuries that revealed spinal injuries admissions, the most commonly involved orthopaedic injury was lower extremity, upper extremity and pelvis (71-74).

The study reviewed the major types of Orthopaedic and Trauma admissions to KNH in 2021. Overall femur fractures, Tibia-Fibula fractures and spine fractures were the most frequently admitted orthopaedic fractures through both facility referrals and walk-ins before and after enforcement of referral guidelines. This compares favourably with studies on orthopaedic admissions done in Nepal, Botswana, Tanzania that showed long bone fractures and spine fractures are common orthopaedic admissions (36, 51, 65, 66).

In about two-thirds of admissions were closed fractures before and after enforcement of the referral guidelines. Of open fractures, Anderson-Gustillo type II fractures were the most frequent while Anderson-Gustillo type IIIc were the least common. This compares with a prospective study on orthopedic and trauma caseload in a referral facility in Moshi, Tanzania in 2022 that showed of those patients diagnosed with a fracture, 34.5% had at least one open fracture while 65.5% had only closed fractures (51). Similarly a study done at a Teaching Hospital in Bharatpur in Nepal in 2020 to review pattern of injury revealed of all injuries closed injuries was 74.1% while open injuries were 24.1% and 1.8% were both closed and open injuries (65).

## **5.2 To determine the factors associated with Orthopaedic and Trauma admissions to KNH before and after enforcement of referral guidelines**

The factors associated with Orthopaedic and Trauma admissions to KNH before and after enforcement of the referral guidelines were largely similar and hence these factors will be discussed as one. However, is important to note that before the enforcement of the referral guidelines most of the referrals were initiated and handled by the junior staff at the referring health facility. After the enforcement of the referral guidelines Medical Officers and Orthopaedic Consultants were more involved in decision making on whether to refer or not. This compares with a descriptive study done on inter-facility transfer in developing countries that showed about 93% of the referrals were initiated and handled by the junior medical staff (75).

The factors associated with the Orthopaedic and Trauma admissions have been grouped into: a) human resource capacity and availability, b) patient's preference, c) financial constraints, d) Orthopaedic equipment's and implants availability, e) health facility infrastructure, f) proximity to KNH and d) unaccompanied.

### **5.2.1 Human Resource Capacity and Availability**

Human resource for health is a critical pillar in World Health Organization (WHO) health system strengthening and a key component in access to health care. Quantity and quality of human resource for health determines the quality of care received. Most of the Orthopaedic and Trauma admissions to KNH were due to need for specialized Orthopaedic and Trauma surgeons to handle orthopaedic injuries including polytrauma patients with head injuries, patients with pelvic and spine injuries. This compares with studies done on reasons for inter-hospital transfer of trauma patients that revealed that severely injured trauma patients and those with pelvic injuries are likely to be transferred to advanced trauma centres for management and for better outcomes (30, 76-78). The advanced centres are presumed to have well trained personnel with relevant experience to handle complicated cases. The referring health facilities either lacked orthopaedic surgeons and/or allied specialities like plastic surgeons and neurosurgeons required for polytrauma management or the resident orthopaedic surgeons were not available at the time of the patient was presenting to the health facility. This compares with studies that revealed limited staff capacity at the peripheral facilities necessitates surgical referrals in low- and middle-income countries (40, 79-83).

### **5.2.2 Patients' preferences**

Patients' preferences refer to patients' values, beliefs, expectations and health goals that influences their health choices and health facility choices as well. This study did reveal the role of family, friends and the society at large in health seeking behaviour for orthopaedic and trauma patients.

A significant proportion of patients opted to go to KNH or be referred to KNH from other health facilities due to recommendation from either family members, relatives or friends. This compares favourably with a study done in Israel indicated that about 33% of patients seek second opinion on recommendation of a relative and/or friend (40, 84). However, this contradicts a review done in Northern Tanzania that showed patients preference accounts for about 1% of surgical patient's referral to a Tertiary health facility (40). In addition, a systematic review of factors patients

consider in choice of a surgeon reveal that hospital reputation, rather than surgeon's reputation, was of primary importance and most patients relied on word-on-mouth and physician preference to decide the hospital of choice (85).

### **5.2.3 Financial constraints**

Personal finance is key factor in the choice of a hospital with patients of high socio-economic status and with insurance cover opting for high-end private health facilities while patients of low-socio-economic status and mostly with no insurance cover opting to seek services in government health facilities.

In this study for a significant number of orthopaedic and trauma admissions, the referral was done because of financial constraints since they could ill afford the private health facilities. KNH was more affordable than the private health facilities. In addition, most of the private health facilities would require additional financial top-ups in addition to the NHIF insurance cover while others would outrightly reject the NHIF cover due to its low financial allocations for orthopaedic and trauma procedures.

### **5.2.4 Orthopaedic and Trauma Equipment and implants availability**

Equipments, supplies are another WHO building block for effective health service delivery. Orthopaedic equipment's, sets and implants are generally costly and require significant capital outlays. Availability of Orthopaedic equipment's, sets and implants are key to management of orthopaedic patients. Given the level and the nature of health care financing in Kenya, most health facilities - both government and private are not able to acquire and maintain these equipment's.

KNH being a premier referral facility in the country was believed to be well resourced and therefore best equipped in this regard to manage diverse and complicated orthopaedic and trauma conditions. From the patient and health care workers perspective, KNH was believed to have advanced imaging equipment's like Computer Tomography (CT) scans, Magnetic Resonance Imaging (MRI) and X-rays for diagnosis and patient management compared to the peripheral health facilities. Some high-volume health facilities with resident orthopaedic surgeon(s) were noted to have had non-functioning imaging machines. This compares with a qualitative study done in Uganda to review challenges in provision of surgical services that revealed unavailability, non-functional or intermittent functioning of imaging facilities like CT scan, MRI that hindered

surgical service provision (40, 80). A study in Muhimbili National Hospital in Tanzania revealed lack of equipment as the main reason for referral to the Tertiary facility (41). Similar surveys done in Kenya, Uganda, Tanzania, Rwanda and Ghana revealed infrastructure gap at the peripheral health facilities necessitated referrals to Tertiary health facilities (86).

### **5.2.5 Health Facility Infrastructure**

Health Infrastructure is one of the WHO pillars of health system strengthening and provides the structural framework for provision of health care. It refers to availability of health amenities, adequate ward, theatre rooms, physiotherapy, occupational therapy spaces for Orthopaedic and Trauma and Rehabilitation service provisions. Poor infrastructure means compromised health service delivery.

Orthopaedic and trauma patients were also referred or self-referred to KNH because of the unavailability of bed space and poor facilities to handle and perform orthopaedic and trauma operations. This compares with a prospective study done in Aga Khan University Hospital in Kenya that revealed bed availability was one of the commonest reasons cited for referral (87). Similar studies in Uganda, Rwanda have shown inadequate health infrastructure with limited ward and theatre capacity hinders provision and access to surgical services (40, 80-82). The operating rooms are shared by other surgical specialities and most often overburdened by urgent obstetric cases that often lead to planned orthopaedic operations delayed or postponed due to the urgent obstetric procedures. This effectively means reduced operative capacity for orthopaedic procedures. This would necessitate referrals or patient seeking self-referral to KNH due to the expected delays. KNH being a premier public referral facility in the country is considered to have superior and capacious infrastructure to handle huge number of orthopaedic and trauma cases. Some of these public health facilities in addition to limited operative capacities also lacked Intensive Care Unit (ICU) or High Dependency Unit (HDU) capacities to handle polytrauma patients with neurosurgical complications.

### **5.2.6 Quality of Health Services**

Quality of health service delivery is one of the WHO pillars of health care strengthening and it requires provision of quality health care. This study did show that some patients preferred to be referred or self-referred to KNH because of the poor health care services they got from other



peripheral health facilities. The unfavourable commendations about peripheral health facilities from relatives and friends with regard to the poor quality of health care provision influenced their decision to seek services at KNH. This compares favourably with a number of studies have shown that quality of service influences the choice of a health facility with hospitals with high quality of care being hospitals of choice (88, 89).

### **5.2.7 Proximity to KNH**

Geographical distance is a key consideration for choice of a hospital. Long distance travel has financial implications but also it is not convenient for friends, relatives and family of the patients who seek to visit and take care of the sick. That's why in reviewing the patterns of orthopaedic and trauma admissions, over 90% of orthopaedic admissions to KNH comes from Nairobi County and its environs.

A number of orthopaedic and trauma admissions were either brought or came to KNH because it was the nearest facility from their residence or from the scene of the accident; the paramedics decided to rush them to KNH being the nearest government hospital that's is affordable. This compares favourably with a systematic review of factors patients consider in choice of health provider that revealed hospital distance was of primary importance in choosing the facility of choice (85). Another study done on the influence of quality of service on choice of a health facility showed that the greater distance the less likely the hospital will be chosen (88).

### **5.2.8 Unaccompanied patients**

Unaccompanied patients means that these are admissions that were brought in by good Samaritans or police officers and not relatives and therefore in most cases not much was known about them at the time of admission. These patients were brought in unconscious from the scene of accidents. They were victims of road traffic accidents, assaults or mentally ill patients that sustained orthopaedic/trauma related injuries. The polices officers, the good Samaritans are normally the first responders at the scene of accident and most of them make the decision to refer the patients to KNH either due to financial considerations given KNH is a government facility or due to proximity to KNH given that majority of the RTAs occur within Nairobi County. The unaccompanied and unconscious patients at the scene of accident are deemed to have serious injuries. This compares favourably with studies that showed Police officers are usually the first

responders at the scene of accident (90, 91). Similarly a study done on post-crash emergency care in India showed good Samaritans and police officers referred about 90% post-crash victims to government hospitals as the first contact health facility (92).

## **6.0 CONCLUSIONS AND RECOMMENDATIONS**

### **6.1 SUMMARY AND CONCLUSIONS**

#### **6.1.1.1 Patterns of orthopaedic injuries**

From the foregoing we can conclude that there was a significant decline in proportion of walk-ins after enforcement of the referral guidelines. There was also a notable increase in orthopaedic admissions through orthopaedic clinic and COC and reduction in A&E admissions after enforcement of the referral guidelines.

The Non-trauma orthopaedic admissions doubled which reflected an increase in elective admissions after enforcement of the referral guidelines. There was also a significant increase in proportion of female admissions after the enforcement of the referral guidelines with mean age rising among females from 32.2 (SD 19.9) to 38.0 (SD 20.4) after the enforcement of the referral guidelines. The enforcement of the referral guidelines was associated with a statistically significant increase in the number of orthopaedic and trauma admissions with active insurance cover.

Most of the orthopedic and trauma admissions were from Nairobi County and its environ before and after enforcement of the referral guidelines.

#### **6.1.1.2 Types of orthopedic injuries**

Overall, the majority of the orthopaedic admissions in 2021 were due to lower limb fractures followed by upper limb injuries while the least admissions were due to acetabular fractures before and after enforcement of the referral guidelines. Majority of fractures were closed fractures before and after enforcement of the referral guidelines. Of open fractures, majority were Anderson-Gustillo type II fractures before and after enforcement of the referral guidelines.

The study revealed that having Upper limb injuries were less likely to be associated with lower limb injuries before and after the enforcement of the referral guidelines. Overall femur shaft fractures, Tibia-Fibula fractures, spine fractures, femur proximal fractures, hand fractures and pelvic fractures were the most frequently admitted orthopaedic fractures both through facility referrals and walk-ins. On the other hand, radial fractures and humerus shaft fractures were the least admissions.

### **6.1.2. Factors associated with Orthopaedic and trauma admissions to KNH before and after enforcement of referral guidelines**

There was no notable difference in the factors associated with orthopaedic and admissions before and after the enforcement of the referral guidelines. The major factors associated with orthopaedic and trauma admissions included inadequate human resource capacity and availability, inadequate Orthopaedic equipment's and implants availability, patient's preference, financial constraints and inadequate health facility infrastructure.

## **6.2 RECOMMENDATIONS**

### **6.2.1 Recommendations to Policy Makers/ County Government**

1. Allocate more resources to human resource for health for recruitment of more orthopaedic and trauma surgeons and also fund training for more specialized orthopaedic speciality including pelvic and spine specialities;
2. Improve the health facility infrastructure and operative capacity of major health facilities within Nairobi Metropolitan Area;
3. The high cost of Orthopaedic sets and implants is an impediment to orthopaedic care since majority of the patients are of low socio-economic status with no insurance cover and therefore it would be prudent for the policy makers and the government to consider subsidizing the cost of orthopaedic equipment's, sets and implants to make it more affordable and accessible;

### **6.2.2 Recommendations to KNH**

1. Educate and sensitize the public, the police force as to the role of KNH as a premier National Teaching and Referral facility that is mandated to manage complex referrals and should not be the first point of contact for patients seeking orthopaedic care;
2. Have a written referral standard operating procedure to KNH. This referral guideline should be reviewed and updated annually;
3. Consider providing outreaches/mentorship to main public health facilities within Nairobi Metropolitan Area on a regular basis in operative management of pelvic and spine injuries as part of mentorship and capacity building;

### **6.2.3 Recommendations to Health Facilities**

1. Human resource capacity building for Orthopaedic surgeons and fund subspecialty trainings in orthopaedics to handle complex orthopaedic cases like spine, pelvic and hand injuries;
2. Need to address the culture of MoH staff with regards to unavailability/ absenteeism at work to avoid unnecessary referrals of patients;
3. Improvement in health infrastructure and this includes increasing the operative capacity of the major health facilities bed capacity, imaging equipment's like CT scan, MTRI, X-rays to reduce on unnecessary referrals;
4. Strengthen the maintenance department to ensure that facilities with imaging equipment's, theatre equipment's are serviced on a timely manner to minimize on frequent breakages and non-functioning equipment's that impede effective and timely service provision;
5. Fund the procurement of basic Orthopaedic equipment's, sets and implants for basic orthopaedic procedures that can be handles by qualified resident orthopaedic surgeons;
6. High volume private health facilities should endeavour to fund the procurement of basic orthopaedic equipments, sets and implants and also recruit resident orthopaedic surgeons or visiting surgeons to be able to manage orthopaedic patients on a timely manner without the need for referral.

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## 8.0 APPENDICES

### 8.1 Appendix 1a: Adult Participant Information and Consent form: English

#### PARTICIPANT INFORMATION AND CONSENT FORM

#### FOR ENROLLMENT IN THE STUDY

**TITLE OF STUDY:** A DESCRIPTIVE COMPARATIVE ANALYSIS OF PATTERNS AND TYPES OF ORTHOPAEDIC ADMISSIONS TO KENYATTA NATIONAL HOSPITAL AND THE ASSOCIATED FACTORS: BEFORE AND AFTER ENFORCEMENT OF REFERRAL GUIDELINES.

**Principal Investigator and institutional affiliation:** Maxwell Philip Omondi, Department of Orthopedics, College of Health Sciences, UoN.

**Co-Investigators and institutional affiliation:** Dr. JC Mwangi (UoN), Dr. Fredrick Sitati (UoN) & Dr. Herbert Ong'ang'o (UoN).

#### INTRODUCTION:

The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in this study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a respondent, and anything else about the research or this form that is not clear. When we have answered all your questions to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent. Once you understand and agree to be in the study, I will request you to sign your name on this form.

The general ethical principles apply to this study, namely: i) Your decision to participate is entirely voluntary ii) You may withdraw from the study at any time without necessarily giving a reason for your withdrawal iii) Refusal to participate in the research will not affect the services you are entitled to in this health facility or other facilities. We will give you a copy of this form for your records.

May I continue? YES / NO

This study has approval by The Kenyatta National Hospital-University of Nairobi Ethics and Research Committee protocol No. \_\_\_\_\_

#### WHAT IS THIS STUDY ABOUT?

The researchers listed above are conducting a study on inpatient orthopaedic admissions in KNH before and after the enforcement of the referral guidelines. The referral guidelines were enforced on 1<sup>st</sup> July 2021. This will cover the 1<sup>st</sup> February to 30<sup>th</sup> June 2021 and 1<sup>st</sup> August to 31<sup>st</sup> December 2021 periods. The purpose of the interview is to find out the patterns, types of orthopaedic admissions, and their associated factors during these two periods before and after the enforcement

of the referral guidelines. Participants in this research study will be asked questions about socio-demographic characteristics, types of injuries, and circumstances/reasons for seeking services at KNH.

There will be approximately 900 participants in this study. We are asking for your consent to consider participating in this study.

### **WHAT WILL HAPPEN IF YOU DECIDE TO BE IN THIS RESEARCH STUDY?**

If you agree to participate in this study, the following things will happen:

You will be interviewed by a trained interviewer in a private area where you feel comfortable answering questions. The interview will last approximately 30 – 45 minutes. The interview will cover topics such as patterns of admission, type of illness, and the reasons for seeking services at KNH.

We will ask for a telephone number where we can contact you if necessary. If you agree to provide your contact information, it will be used only by people conducting this study and will never be shared with others. The reasons why we may need to contact you include missing information, seeking clarifications once the initial interview is over.

### **ARE THERE ANY RISKS, HARMS, DISCOMFORTS ASSOCIATED WITH THIS STUDY?**

There is no harm in participating in this study but there is a risk of loss of privacy. We will keep everything you tell us as confidential as possible. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet. However, no system of protecting your confidentiality can be secure, so it is still possible that someone could find out you were in this study and could find out information about you.

Also, answering questions in the interview may be uncomfortable for you. If there are any questions you do not want to answer, you can skip them. You have the right to refuse the interview or any questions asked during the interview.

It may be embarrassing for you to have details of your health conditions. We will do everything we can to ensure that this is done in private. Furthermore, all study staff and interviewers are professionals with special training in these examinations/interviews. Also, event recalls may be stressful (e.g event recalls).

You may feel some discomfort when being interviewed. In case of an injury, illness, or complications related to this study, contact the study staff right away at the number provided at the end of this document. The study staff will treat you for minor conditions or refer you when necessary.

### **ARE THERE ANY BENEFITS BEING IN THIS STUDY?**

We will refer you to a hospital for care and support where necessary. Also, the information you provide will help us better understand the types of admissions and the reasons behind seeking

services at KNH. This information is a contribution to science and planning for orthopaedic and trauma admissions in KNH.

**WILL BEING IN THIS STUDY COST YOU ANYTHING?**

It will not cost you anything other than the time you will spend during the interview process.

**WILL YOU GET A REFUND FOR ANY MONEY SPENT AS PART OF THIS STUDY?**

You will not spend any cash to participate in the study.

**WHAT IF YOU HAVE QUESTIONS IN THE FUTURE?**

If you have further questions or concerns about participating in this study, please call or send a text message or send an email to the study staff at the number and email address provided at the bottom of this page.

For more information about your rights as a research participant, you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke).

The study staff will pay you back for your charges to these numbers if the call is for study-related communication.

**WHAT ARE YOUR OTHER CHOICES?**

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits.

**CONSENT FORM (STATEMENT OF CONSENT)**

**Participant's statement**

I have read this consent form or had the information read to me. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I understand that my participation in this study is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study.

I understand that all efforts will be made to keep information regarding my identity confidential.

By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

<b>I agree to participate in this research study:</b>	<b>Yes</b>	<b>No</b>
I agree to provide contact information for follow-up:	Yes	No

**Participant printed name:** \_\_\_\_\_

**Participant signature / Thumb stamp** \_\_\_\_\_ **Date** \_\_\_\_\_

**Researcher's statement**



I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

**Researcher 's Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Signature** \_\_\_\_\_

**Role in the study:** \_\_\_\_\_

For more information contact

1. Maxwell Philip Omondi on 0721208732 or email address: [maxwellomondi@students.uonbi.ac.ke](mailto:maxwellomondi@students.uonbi.ac.ke) at Department of Orthopaedics, College of Health Sciences, University of Nairobi;
2. JC Mwangi, Lecturer, Department of Orthopaedics, College of Health Sciences, the University of Nairobi on 0724230604 or email address: [j\\_cmwangi@yahoo.com](mailto:j_cmwangi@yahoo.com);
3. Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke).

Witness Printed Name (*If a witness is necessary, A witness is a person mutually acceptable to both the researcher and participant*)

**Name** \_\_\_\_\_ **Contact information** \_\_\_\_\_

**Signature /Thumb stamp:** \_\_\_\_\_ **Date;** \_\_\_\_\_

## **8.1 Appendix 1b: Adult Participant Information and Consent form: Kiswahili**

FOMU YA TAARIFA NA RIDHAA YA MSHIRIKI

KWA KUJIANDIKISHA KATIKA MAFUNZO

**KICHWA CHA MAFUNZO:** UCHAMBUZI UNAOELEZA WA ULINGANISHI WA MIFUMO NA AINA ZA ULABITI WA Mifupa KATIKA HOSPITALI YA TAIFA YA KENYATTA NA MAMBO HUSIKA: KABLA NA BAADA YA UTEKELEZAJI WA MIONGOZO YA RUFAA.

**Mpelelezi Mkuu na uhusiano wa kitaasisi:** Maxwell Philip Omondi, Idara ya Mifupa, Chuo cha Sayansi ya Afya, UoN.

**Wachunguzi-wenza na uhusiano wa kitaasisi:** Dkt. JC Mwangi (UoN), Dk. Fred Chuma Sitati (UoN) & Dk. Herbert Ong'ang'o (UoN).

### **UTANGULIZI:**

Madhumuni ya fomu hii ya idhini ni kukupa taarifa utakayohitaji ili kukusaidia kuamua kama kuwa mshiriki au la katika utafiti huu. Jisikie huru kuuliza maswali yoyote kuhusu madhumuni ya utafiti, nini kitatokea ikiwa utashiriki katika utafiti, hatari na manufaa yanayoweza kutokea, haki zako kama mhojiwa, na jambo lingine lolote kuhusu utafiti au fomu hii ambalo haliko wazi. Wakati tumejibu maswali yako yote kwa kuridhika kwako, unaweza kuamua kuwa katika utafiti au la. Utaratibu huu unaitwa 'ridhaa iliyoarifiwa. Ukishaelewa na kukubali kuwa katika utafiti, nitakuomba utie sahihi jina lako kwenye fomu hii.

Kanuni za jumla za kimaadili zinatumiwa katika utafiti huu, ambazo ni: i) Uamuzi wako wa kushiriki ni wa hiari kabisa ii) Unaweza kujiondoa kwenye utafiti wakati wowote bila ya kueleza sababu ya kujiondoa iii) Kukataa kushiriki katika utafiti hakutaathiri. huduma unazostahili kupata katika kituo hiki cha afya au vituo vingine. Tutakupa nakala ya fomu hii kwa rekodi zako.

Naweza kuendelea? NDIO/LA

Utafiti huu umeidhinishwa na Itifaki ya Kamati ya Maadili na Utafiti ya Hospitali ya Kitaifa ya Kenyatta-Chuo Kikuu cha Nairobi Namba.

### **SOMO HILI LINAHUSU NINI?**

Watafiti walioorodheshwa hapo juu wanafanya utafiti kuhusu kulazwa kwa wagonjwa waliolazwa ndani ya mifupa katika KNH kabla na baada ya kutekelezwa kwa miongozo ya rufaa. Miongozo ya rufaa ilitokeleza tarehe 1 Julai 2021. Hii itajumuisha vipindi vya tarehe 1 Februari hadi 30 Juni 2021 na 1 Agosti hadi 31 Desemba 2021. Madhumuni ya mahojiano ni kujua mifumo, aina za kulazwa kwa mifupa, na mambo yanayohusiana nayo katika vipindi hivi viwili kabla na baada ya utekelezaji wa miongozo ya rufaa. Washiriki katika utafiti huu wataulizwa maswali kuhusu sifa za kijamii na idadi ya watu, aina za majeraha, na hali/sababu za kutafuta huduma katika KNH.

Kutakuwa na takriban washiriki 900 katika utafiti huu. Tunaomba idhini yako ili kuzingatia kushiriki katika utafiti huu.

### **NINI KITAENDELEA UKIAMUA KUWA KATIKA UTAFITI HUU?**

Ukikubali kushiriki katika utafiti huu, mambo yafuatayo yatafanyika:

Utahojiwa na mhojiwa aliyefunzwa katika eneo la faragha ambapo unahisi vizuri kujibu maswali. Mahojiano yataidumu takriban dakika 30 - 45. Mahojiano hayo yatashughulikia mada kama vile njia za kulazwa, aina ya ugonjwa, na sababu za kutafuta huduma katika KNH.

Tutaomba nambari ya simu ambapo tunaweza kuwasiliana nawe ikibidi. Ikiwa unakubali kutoa maelezo yako ya mawasiliano, yatatumiwa na watu wanaofanya utafiti huu pekee na kamwe hayatashirikiwa na wengine. Sababu ambazo tunaweza kuhitaji kuwasiliana nawe ni pamoja na kukosa maelezo, kutafuta ufafanuzi punde tu mahojiano ya kwanza yanapokamilika.

### **JE, KUNA HATARI, MADHARA, FURAHA ZINAZOHUSIANA NA UTAFITI HUU?**

Hakuna ubaya katika kushiriki katika utafiti huu lakini kuna hatari ya kupoteza faragha. Tutaweka kila kitu unachotuambia kama siri iwezekanavyo. Tutatumia nambari ya msimbo kukutambua katika hifadhidata ya kompyuta iliyolindwa na nenosiri na tutaweka rekodi zetu zote za karatasi kwenye kabati ya faili iliyofungwa. Hata hivyo, hakuna mfumo wa kulinda usiri wako unaoweza kuwa salama, kwa hivyo bado kuna uwezekano kwamba mtu anaweza kujua ulikuwa kwenye utafiti huu na kupata taarifa kukuhusu.

Pia, kujibu maswali katika mahojiano kunaweza kuwa na wasiwasi kwako. Ikiwa kuna maswali yoyote ambayo hutaki kujibu, unaweza kuyaruka. Una haki ya kukataa mahojiano au maswali yoyote yaliyolizwa wakati wa mahojiano.

Inaweza kuwa aibu kwako kuwa na maelezo ya hali yako ya afya. Tutafanya kila tuwezalo kuhakikisha kuwa hili linafanyika kwa faragha. Zaidi ya hayo, wafanyakazi wote wa utafiti na wahojaji ni wataalamu walio na mafunzo maalum katika mitihani/mahojiano haya. Pia, kumbukumbu za matukio zinaweza kuwa zenye mkazo (k.m kumbukumbu za tukio).

Unaweza kuhisi usumbufu wakati unahojiwa. Iwapo kuna jeraha, ugonjwa, au matatizo yanayohusiana na utafiti huu, wasiliana na wafanyakazi wa utafiti mara moja kwa nambari iliyotolewa mwishoni mwa waraka huu. Wafanyakazi wa utafiti watakushughulikia kwa hali ndogo au kukuelekeza inapohitajika.

### **JE, KUNA FAIDA YOYOTE KUWA KATIKA UTAFITI HUU?**

Tutakuelekeza kwa hospitali kwa huduma na usaidizi inapobidi. Pia, maelezo utakayotoa yatatusaidia kuelewa vyema aina za uandikishaji na sababu za kutafuta huduma katika KNH. Maelezo haya ni mchango kwa sayansi na upangaji wa mizigo ya mifupa nchini KNH.

## **JE, KUWA KATIKA SOMO HILI ITAKUGHARIMU CHOCHOTE?**

Haitakugarimu chochote zaidi ya muda utakaotumia wakati wa mchakato wa usaili.

## **JE, UTAPATA REJESHA KWA FEDHA ZUZOTE ULIZOTUMIA SEHEMU YA UTAFITI HUU?**

Hutatumia pesa taslimu kushiriki katika utafiti.

## **VIPI IKIWA UNA MASWALI BAADAYE?**

Ikiwa una maswali zaidi au wasiwasi kuhusu kushiriki katika utafiti huu, tafadhali piga simu au tuma ujumbe mfupi wa maandishi au tuma barua pepe kwa wafanyikazi wa utafiti kwa nambari na anwani ya barua pepe iliyotolewa chini ya ukurasa huu.

Kwa maelezo zaidi kuhusu haki zako kama mshiriki wa utafiti, unaweza kuwasiliana na Katibu/Mwenyekiti, Hospitali ya Kitaifa ya Kenyatta-Kamati ya Maadili na Utafiti ya Chuo Kikuu cha Nairobi Nambari 2726300 Ext. 44102 barua pepe [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke).

Wafanyikazi wa utafiti watakurudishia malipo yako kwa nambari hizi ikiwa simu ni ya mawasiliano yanayohusiana na masomo.

## **WHAT ARE YOUR OTHER CHOICES?**

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits.

## **FOMU YA RIDHAA (TAARIFA YA RIDHAA)**

### **Kauli ya mshiriki**

Nimesoma fomu hii ya idhini au nimesomewa maelezo. Nimejibiwa maswali yangu kwa lugha ninayoielewa. Hatari na faida zimeelezewa kwangu. Ninaelewa kuwa ushiriki wangu katika utafiti huu ni wa hiari na kwamba ninaweza kuchagua kujiondoa wakati wowote. Ninakubali kwa uhuru kushiriki katika utafiti huu.

Ninaelewa kuwa juhudi zote zitafanywa ili kuweka taarifa kuhusu utambulisho wangu kuwa siri.

Kwa kutia saini fomu hii ya idhini, sijaacha haki zozote za kisheria nilizo nazo kama mshiriki katika utafiti wa utafiti.

**Ninakubali kushiriki katika utafiti huu:**

Ninakubali kutoa maelezo ya mawasiliano kwa ufuatiliaji:

**Ndiyo**

Ndiyo

**Hapana**

Hapana

**Jina lililochapishwa la mshiriki:** \_\_\_\_\_

**Sahihi ya mshiriki / Muhuri wa kidole gumba \_\_\_\_\_ Tarehe \_\_\_\_\_**

**Kauli ya mtafiti**

Mimi, aliyetia sahihi hapa chini, nimeeleza kikamilifu maelezo muhimu ya utafiti huu kwa mshiriki aliyetajwa hapo juu na ninaamini kuwa mshiriki ameelewa na ametoa ridhaa yake kwa hiari na kwa uhuru.

**Jina la Mtafiti:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Sahihi** \_\_\_\_\_

**Jukumu katika utafiti:** \_\_\_\_\_

Kwa maelezo zaidi wasiliana

1. Maxwell Philip Omondi kwa 0721208732 au barua pepe: [maxwellomondi@students.uonbi.ac.ke](mailto:maxwellomondi@students.uonbi.ac.ke) katika Idara ya Tiba ya Mifupa, Chuo cha Sayansi ya Afya, Chuo Kikuu cha Nairobi;
2. JC Mwangi, Mhadhiri, Idara ya Tiba ya Mifupa, Chuo cha Sayansi ya Afya, Chuo Kikuu cha Nairobi kwa nambari 0724230604 au barua pepe: [j\\_cmwangi@yahoo.com](mailto:j_cmwangi@yahoo.com);
3. Katibu/Mwenyekiti, Hospitali ya Kitaifa ya Kenyatta-Kamati ya Maadili na Utafiti ya Chuo Kikuu cha Nairobi Nambari 2726300 Ext. 44102 barua pepe [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke).

Jina Lililochapishwa na Shahidi (*Ikiwa shahidi ni muhimu, Shahidi ni mtu anayekubalika kwa pande zote mbili kwa mtafiti na mshiriki*)

**Jina** \_\_\_\_\_ **Maelezo ya mawasiliano** \_\_\_\_\_

**Sahihi /Muhuri wa kidole gumba:** \_\_\_\_\_ **Tarehe**

\_\_\_\_\_

## 8.2 Appendix 2a: Assent Form: English

### STUDIES INVOLVING CHILDREN

#### Child Assent Form

**Title of Study:** A DESCRIPTIVE COMPARATIVE ANALYSIS OF PATTERNS'AND TYPES OF ORTHOPAEDIC ADMISSIONS TO KENYATTA NATIONAL HOSPITAL AND THE ASSOCIATED FACTORS: BEFORE AND AFTER ENFORCEMENT OF REFERRAL GUIDELINES

**Investigators and institutional affiliation:**

Maxwell Philip Omondi (UoN), Mwangi J.C UoN), Fred Chuma Sitati (UoN), Herbert Ong'ang'o (KNH)

We are doing a research study about patterns and types of orthopaedic admissions to Kenyatta National Hospital and the associated factors before and after the enforcement of the referral guidelines.

Permission has been granted to undertake this study by the Kenyatta National Hospital-University of Nairobi Ethics and Research Committee (KNH-UoN ERC Protocol No. \_\_\_\_\_)

This research study is a way to learn more about people. At least 80 children will be participating in this research study with you.

If you decide that you want to be part of this study, you will be asked to permit to participate at the time of admission.

There are some things about this study you should know. These are interview-guided questionnaires on your profile, type of admission, and the reasons for seeking services at KNH.

Not everyone who takes part in this study will benefit. A benefit means that something good happens to you. We think these benefits might be advocacy for services to be decentralized to the nearest health facility.

When we are finished with this study, we will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too. Your parents know about the study too.

For more information contact

1. Maxwell Philip Omondi on 0721208732 or email address: [maxwellomondi@students.uonbi.ac.ke](mailto:maxwellomondi@students.uonbi.ac.ke) at Department of Orthopaedics, College of Health Sciences, University of Nairobi;
2. JC Mwangi, Lecturer, Department of Orthopaedics, College of Health Sciences, the University of Nairobi on 0724230604 or email address: [j\\_cmwangi@yahoo.com](mailto:j_cmwangi@yahoo.com);
3. Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke).

If you decide you want to be in this study, please sign your name.

I, \_\_\_\_\_, want to be in this research study.

\_\_\_\_\_

(Signature/Thumb stamp)

\_\_\_\_\_

(Date)

## 8.2 Appendix 2b: Assent Form: Kiswahili

### MASOMO YANAYOHUSISHA WATOTO

Fomu ya Kuidhinishwa kwa Mtoto

Kichwa cha Utafiti: UCHAMBUZI UNAOELEZA WA ULINGANISHI WA PATTERNS'NA AINA ZA ULABITI WA Mifupa KATIKA HOSPITALI YA TAIFA YA KENYATTA NA MAMBO HUSIKA: KABLA NA BAADA YA UTEKELEZAJI WA MIONGOZO YA RUFAA.

#### Wachunguzi na uhusiano wa kitaasisi:

Maxwell Philip Omondi (UoN), Mwangi J.C UoN), Frederic Sitati (UoN), Herbert Ong'ang'o (KNH)

Tunafanya utafiti kuhusu mwelekeo na aina za kulazwa kwa matibabu ya mifupa katika Hospitali ya Kitaifa ya Kenyatta na mambo yanayohusiana kabla na baada ya kutekelezwa kwa miongozo ya rufaa.

Ruhusa imetolewa kufanya utafiti huu na Hospitali ya Kitaifa ya Kenyatta-Kamati ya Maadili na Utafiti ya Chuo Kikuu cha Nairobi (KNH-UoN Itifaki ya ERC Na. \_\_\_\_\_)

Utafiti huu ni njia ya kujifunza zaidi kuhusu watu. Angalau watoto 80 watashiriki nawe katika utafiti huu.

Ukiamua kuwa ungependa kuwa sehemu ya utafiti huu, utaombwa kuruhusu kushiriki wakati wa kuandikishwa.

Kuna baadhi ya mambo kuhusu utafiti huu unapaswa kujua. Hizi ni hojaji zinazoongozwa na mahojiano kwenye wasifu wako, aina ya kiingilio, na sababu za kutafuta huduma katika KNH.

Si kila mtu atakayeshiriki katika utafiti huu atafaidika. Faida inamaanisha kuwa kitu kizuri kinatokea kwako. Tunafikiri manufaa haya yanaweza kuwa utetezi wa huduma kugatuliwa kwa kituo cha afya kilicho karibu nawe.

Tukimaliza na somo hili tutaandika ripoti kuhusu kile tulichojifunza. Ripoti hii haitajumuisha jina lako au kwamba ulikuwa kwenye utafiti.

Si lazima uwe katika utafiti huu ikiwa hutaki kuwa. Ukiamua kuacha baada ya sisi kuanza, hiyo ni sawa pia. Wazazi wako wanajua kuhusu utafiti pia.

Kwa maelezo zaidi wasiliana

1. Maxwell Philip Omondi kwa 0721208732 au barua pepe: [maxwellomondi@students.uonbi.ac.ke](mailto:maxwellomondi@students.uonbi.ac.ke) katika Idara ya Tiba ya Mifupa, Chuo cha Sayansi ya Afya, Chuo Kikuu cha Nairobi;
2. JC Mwangi, Mhadhiri, Idara ya Tiba ya Mifupa, Chuo cha Sayansi ya Afya, Chuo Kikuu cha Nairobi kwa nambari 0724230604 au barua pepe: [j\\_cmwangi@yahoo.com](mailto:j_cmwangi@yahoo.com);
3. Katibu/Mwenyekiti, Hospitali ya Kitaifa ya Kenyatta-Kamati ya Maadili na Utafiti ya Chuo Kikuu cha Nairobi Nambari 2726300 Ext. 44102 barua pepe [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke).

Jina Lililochapishwa na Shahidi (*Ikiwa shahidi ni muhimu, Shahidi ni mtu anayekubalika kwa pande zote mbili kwa mtafiti na mshiriki*)

Ukiamua ungependa kuwa katika utafiti huu, tafadhali saina jina lako.

Mimi, \_\_\_\_\_, nataka kuwa katika utafiti huu.

\_\_\_\_\_  
(Sahihi/Muhuri wa kidole gumba)

\_\_\_\_\_  
(Tarehe)



### 8.3 Appendix 3: Key Informant Guide

Participants: Nine (9) Key Informant Interviews will be conducted by the Principal Investigator using a KII guide formulated for this purpose. The Key informants will be i) the KNH A&E Senior Chief Nurse (1) ii) KNH A&E Medical officer-in-charge (1), iii) Matron for the KNH Orthopaedic Wards (2) iv) Mbagathi Hospital A&E Medical Officer-in-charge, (v) Mama Lucy Hospital A&E Medical officer-in-charge, (vi) Thika Level V Hospital A&E Medical Officer-in-charge, (vii) Kenyatta University Teaching and Referral Hospital Medical Officer A&E Officer-in-charge, (viii) Nairobi Metropolitan Services, Director of Health Services (1) ix) Ministry of Health, Director of Curative Services (1).

1. Where do you refer your orthopedic cases? In order of most frequently referred facility at least in the last 6-12 months?
2. What are the referral guidelines for orthopedic cases to KNH? (Ask for a copy if available – soft or hard copy)
  - a. Any difference before and after the guidelines?
3. What is the profile of patients you refer/admit to KNH?
  - a. What is their distribution in your catchment area?
  - b. What are their characteristics?
4. What are the common orthopedic trauma cases you refer to KNH? -
  - c. Amongst pediatrics? Male vs Female
  - d. Amongst adult? Male vs Female
5. What are the factors associated with the referral/admission of orthopedic patients to KNH?
  - e. Human resource
  - f. Infrastructure
  - g. Equipment and implants availability
  - h. Patients factors & preference
6. What are the key programmatic and management recommendations would you suggest?
7. Any other comments

**END**

**8.4 Appendix 4: Data Abstraction Tool**

Serial No.....	Area of accident.....N/A.....
Admission ward.....	Time of accident.....N/A.....
Date of admission .....	Time of accident.....N/A.....
Day of the week.....	Date of accident/injury.....N/A.....
Month.....	The month of accident .....
Year.....	Year of accident.....N/A.....

**EVENTS SURROUNDING ADMISSION (Applicable for accident/injury victims)**

1. Nature of admission a) Walk-ins b) facility referral
2. Previous admission for current orthopedic condition Yes [ ] No [ ]
3. If yes, which facility? Private [ ] Public [ ]
4. You have a referral letter ..... Yes [ ] No [ ]
5. If yes, from which health facility.....
6. Point of admission ..... A&E [ ] Clinic [ ]
7. Mechanism of injury
  - a. RTA b. Assault c. Fall d. Gunshot e. Stab wounds f. Others
  - Explain.....
  - .....
  - .....

**REASONS FOR SEEKING SERVICES TO KNH**

1. A) Which facility is a major health facility closest to you (closest to the area of accident)?.....
- B) Why did you bypass the facility? a) Walk-in b) self-referral c) facility referral
  - Human resource
    - .....
    - .....
    - .....
  - Infrastructure.....
    - .....
    - .....
  - Equipment and implants availability.....
    - .....
    - .....
    - .....
  - Patients factors & preference.....

- Financial.....
- Not well defined.....
- Others.....

**SOCIODEMOGRAPHIC**

8. a) Country of Residence .....b) County of Residence.....
9. a) Sub-county of Residence.....b) Area/Estate of residence.....
10. Type of admission a) emergency b) elective
11. Mode of payment
- a. Insurance (specify - NHIF, CFC, Britam, NEMIS, CIC, etc).....
  - b. Cash payment
12. Age (in years) .....
13. Sex..... Male [ ] Female [ ]
14. Marital status...
- Married [ ] Divorced [ ] Separated [ ] Widowed [ ] Widower [ ] Single [ ]
15. Religion...Protestant [ ] Pentecostal [ ] Catholic [ ] Muslim [ ] Hindu [ ]  
Atheist [ ]
16. Occupation.....
- Farmer [ ] Businessman/woman [ ] Casual [ ] Unemployed [ ] Employed [ ]
  - Student [ ] Motorbike rider [ ] Driver [ ] N/A [ ]
17. Education level... Tertiary [ ] Secondary [ ] Primary [ ] Nursery [ ]  
Kindergarten [ ] pre-school [ ] None [ ]

**TYPES**

18. Type of Orthopaedic injury
- a. Open [ ] closed [ ]
  - b. If Open – Gustillo-Anderson classification Gustilo I [ ] Gustilo II [ ]  
Gustilo IIIa [ ] Gustilo IIIb [ ] Gustilo IIIc [ ]
  - c. Trauma Orthopaedic Injuries – AO/OTA classification & ICD version 10
    - i. Humerus [ ] v. Tibia/Fibula [ ]
    - ii. Radius/Ulnar [ ] vi. Foot [ ]
    - iii. Hand [ ] vii. Pelvic Fractures [ ]
    - iv. Femur fractures [ ] viii. Acetabular [ ]

- ix. Spine [                    ]
- x. Ankle dislocation [                    ]
- xi. Knee dislocation [                    ]
- xii. Elbow dislocation[                    ]
- xiii. Shoulder dislocation[                    ]

d. Other Trauma Associated injuries (Non-orthopaedic) (ICD version 10)

.....

19. Do you have any co-morbidities? Yes [    ] No    [    ]

a. If yes, which ones? (ICD version 10) .....

20. Are you currently on medications.....

**END**

**8.5 Appendix 5: Logbook**

Serial number	Name of patient	Ward	Date of Admission	Eligible	Enrolled	Comments

## 8.6 Appendix 6: MAP

