PROFILE OF UNILATERAL ACUTE HAND INJURIES SEEN AT A REFERRAL HOSPITAL IN KENYA.

A PROSPECTIVE STUDY.

A DISSERTATION SUBMITTED IN PART FULFILMENT FOR THE REQUIREMENTS OF THE DEGREE OF MASTER OF MEDICINE IN SURGERY, UNIVERSITY OF NAIROBI.

By

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DECLARATION

This dissertation is my original work, and has not been presented for a degree in any other university.

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This dissertation has been submitted for consideration with my approval as the University supervisor.

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DEDICATION

To my family Alvin and Jackie, the reason we exist.

ACKNOWLEDGEMENT

I wish to acknowledge the role played in the generation, conduct and finalization of this project by my supervisor Dr Stanley Khainga.

This dissertation would not have been successful without the co-operation of casualty, orthopaedic ward and clinic 5 officers who selflessly informed me of patient availability. Finally I would like to appreciate all the patients who availed themselves for follow up and even reminded me of their appointments.

LIST OF TABLES

LIST OF ABBREVIATIONS

KNH	Kenyatta National Hospital.
A&E	Accident and Emergency
HISS	Hand injury severity score
HOSS	Hand outcome survey sheet
ED	Emergency Department
USA	United States of America
OR	Odds ratio
SD	Standard deviation
P1	Proximal phalanx
P2	Middle phalanx
P3	Distal phalanx

1. SUMMARY

This study was designed to assess the pattern and outcome of unilateral acute hand injuries managed at the Kenyatta National Hospital. A prospective analysis of consecutive patients who had hand injuries and followed up at the KNH between May 2006 and September 30th, 2006 was performed.

Data on Causes, pattern, complications and outcome was collected using a questionnaire administered to the patients who met the inclusion criteria at the A&E department and later followed up for outcome after an average of a 3-month period in the orthopaedic outpatient clinic. The data collected was entered and analysed using SPSS 11.5.

A total of 99 patients with hand injuries were recruited with 75 being evaluated for outcome. The mean age was 28.2 years with the modal age group being 21-30 year group. More males were injured than females. The left hand was affected more than the right hand (difference not statistically significant). Hand use preference had no influence on likelihood of injury. Work-related/ occupational and assaults were the leading causes of hand injury.

The majority of injuries included lacerations, fractures and tendon injuries. The distal phalanges of the ring and long fingers were commonest site of injury on the digits.
Skeletal pain and deformity were the commonest complications followed by cold sensitivity. A significant group of patients were assessed to have a poor outcome.

2. INTRODUCTION

The hand is one of the most important parts of the human body. Combined with the brain, the two have made man the most superior species on earth. The hand's role in this is due to its abilities at prehensile movement and tactile acuity. It is a super tool, an organ of communication, used for gestures and expression of a range of emotions from anxiety and fear to submission and helplessness, scorn and hatred, determination and control, or love and tenderness[1].

The hand can be rugged and its palmar corniferous skin durable, yet its vulnerability to diverse intrinsic or acquired disorders often requires the highest and most ingenious surgical skill for correction. Hand injuries are common and account for 5-10% of emergency department (ED) visits in the USA[2]. The worst disasters occur when injuries are missed on initial assessment and the patient is not referred to a surgeon. Hand injuries should therefore be looked for and treated aggressively. Specialty attention is important.

Given the prime importance of the hand and its vulnerability to injury it is necessary for health care providers to be able to predict the outcome of injury. Outcome is more meaningful to the patient and surgeon if it correlates to the final achievable function. The measure of functional outcome must incorporate the evaluation and severity of the initial injury and the subsequent reconstructive surgeries[3].

In a study conducted in Denmark, hand injuries were observed to be a real burden to society and worthwhile to be prevented [4]. The authors recommended that data recording on the backgrounds of accidents and their long-term consequences should be improved. These are important for documentation, assessing society burden, prevention and managing long-term consequences. In his dissertation, Marangu noted that the outcome of tendon and hand injuries at KNH was poor and recommended a controlled prospective study to find out the exact cause of the poor results[5].

This study addresses various aspects of the injuries of the hand. In particular it documents the causes, patterns, risk factors (for occupational injuries) and describes the outcome of treatment of hand injuries in patients seen at the Kenyatta National Hospital.

3. LITERATURE REVIEW

3.1 Functional Anatomy of the Hand

The skin, fingers, and the small muscles are the primary structures responsible for the functions of the hand. Carpal, metacarpal bones and phalanges comprise the skeleton of the hand. Long and short muscles act to provide unique movement of the fingers and hand[6]. It has rich vascular and neural supply that enables it achieve its various unique functions.

Bones of the hand consist of three main groups i.e. carpal, metacarpal and the phalanges. There are 8 Carpal bones made up of 2 rows of 4 bones each. The proximal row consists of the scaphoid, lunate, triquetrum, and pisiform bones. The distal row consists of the trapezium, trapezoid, capitate, and hamate bones. The anterolateral margins of the scaphoid and trapezium make an attachment site for the flexor retinaculum. The hamate has a bony hook volarly, and the pisiform stands on the triquetrum, these 2 then form medial attachment for the flexor retinaculum[6]. There are 5 metacarpal bones, each with a base, a shaft, and a head. Each finger contains 3 phalanges, but the thumb has 2.

The skin of the dorsum of the hand is thin and has numerous transverse creases. The palm of the hand has thick and glabrous skin, which is richly supplied with sweat glands but contains no sebaceous glands. A moderate amount of fat enhances its pliability. It has flexion creases at the sites of skin movement that contribute to the effectiveness of the hand as a prehensile or grasping organ.

The deep fascia of the dorsum of the hand forms the extensor retinaculum over the carpal bones on the back of the wrist. On the volar aspect, it is thickened to form the flexor retinaculum in the wrist and palmar aponeurosis in the palm. The palmar aponeurosis provides firm attachment to the overlying skin, improves grip strength, and protects the underlying structures in the palm. Flexor retinaculum, stretches volarly across the front of the carpal bones, converts the concave anterior surface of the carpus into the carpal tunnel[6].

The hand contains intrinsic and extrinsic groups of muscles. Tendons of long muscles arising in the arm and forearm form the extrinsic group while the intrinsic group contains the short muscles of the hand. Palmar side contains of 8 tendons of the flexor digitorum superficialis and profundus, the tendons of the flexor pollicis longus, and the flexor carpi radialis. These pass through the carpal tunnel, reach the carpal bones or fingers, and insert onto related bones. Dorsal side contains the tendons abductor pollicis longus, extensor pollicis brevis, extensor carpi radialis longus and brevis, extensor pollicis longus, extensor digitorum, extensor indicis, extensor digiti minimi, extensor carpi ulnaris.

The extensor tendons join the extensor expansion, on the back of the proximal phalanx, which splits into 3 parts: a central part, which is inserted into the base of the middle phalanx, and 2 lateral parts that converge to insert into the base of the distal phalanx[6].

Intrinsic muscles of the hand consist of 4 groups of muscles; the lumbricals, interossei, thenar (of the thumb), and hypothenar (of the little finger). . The thenar and hypothenar compartments contain an abductor, an opponens, and a flexor muscle.

The hand contains some complex joints, from proximal to distal; the radiocarpal, intercarpal, carpometacarpal, metacarpal phalangeal , and interphalangeal joints. Radiocarpal joint is synovial spheroid, intercarpal joints are a synovial and plane-type. Metacarpophalangeal joints are synovial condyloid. Interphalangeal joints are between the phalanges and are synovial hinge joints.

Arteries of the hand form a rich vascular network with radial and ulnar arteries providing the main feeder arteries that supply blood to the hand[7]. Nerves of the hand consist of the radial nerve, which provides sensory feedback from the dorsum of the hand, thumb, index, middle and radial side of the ring finger. Median nerve which is motor to the 3 thenar muscles and 2 radial lumbrical muscles. Its sensory fibers supply the palmar surfaces and sides of the thumb, index finger, and middle and radial half of the ring finger. The ulnar nerve has a superficial branch that provides the cutaneous innervation of the volar and dorsal aspect of the small finger and of the ulnar half of the ring finger. Its deep branch innervates the hypothenar muscles, the ulnar 2 lumbrical muscles, adductor pollicis and interosseous muscles[6].

3.2 Incidence and prevalence

The magnitude and severity of hand injuries in Kenya has not been quantified. The incidence and prevalence varies worldwide. In the USA they account for 5-10% of ED admissions[2]. In Northern Ireland an audit revealed the hand and wrist were injured in 6.6% of patients seen at the A&E department[8]. Schaller and Geldmacher[9] in a cross-sectional study observed that incidence of hand injuries in multiple trauma is not well investigated. They noted that in 20% of the multiply traumatized patients, additional hand injuries were seen, of which 75% were closed fractures of hand and wrist. They observed and concluded that the severity of multiple trauma had no influence on the incidence of hand injury. Further they observed that young people between twenty and forty years of age were mostly affected in multiple trauma, with increased incidence of hand injuries especially after motorcycle accidents. Hassan [10] in a study on road traffic accidents listed the regional anatomical areas injured. He noted that that hand formed 2.7% of the regional injury distribution among road traffic accident victims.

Most incidence studies have focused on occupational injuries, most of which are self-reported. In Denmark with a better trauma registry, occupational hand injuries had an estimated incidence rate of 17.1 per 1,000-person years[4]. The incidence was found to be higher among men than women in all age groups below 60 years. The incidence for minor injuries declines with increasing age, but the rates for significant injuries are independent of age[4]. It was also noted about 2% of employees attend a casualty department appointment with an occupational hand injury[4].

The largest study done in Norway, involving all open hand, wrist, and forearm injuries that were treated during a 10-year period, at hospitals and emergency wards in three Norwegian cities with 225,000 inhabitants, were registered. For moderate injuries overall incidence was 59 (56-62), incidence among males 92 (86-98), and among females 28 (25-31) per 100,000 person-years. For severe injuries overall incidence was 7.5 (6.3-8.6), incidence among males 11.1 (9.1-13.1), and among females 4.0 (2.8-5.2) per 100,000-person years[11].

3.3 Causes

The causes of traumatic hand injuries vary from one population to another. In industrialized set-up most injuries are occupational. In the Far East country of Quatar (an oil based industrial country) industrial hand injuries represent 59%, the domestic and sport hand injuries represent 39% and RTA 2% of all hand injuries[12].

In a study in Ireland, Hill classified causes of hand injuries using the Derby Hand codes and noted that falls ranked highest among causes followed by sports, domestic and industrial causes respectively[8].

Age is an important factor as a determinant of cause of injury. For example in children between the age 12-16, sports injuries are the most common cause of hand fractures, usually occurring outdoors and tend to present late[13]. For those below 12 years most injuries are domestic and are caused by doors[13]. In adult athletes problematic injuries may

result such as scaphoid and hook of hamate fractures, as well as ligament injuries to the wrist that may affect eventual return to athletic competition[14]. Given their relative high incidence therefore falls and sports injuries are an important cause of hand injury[15].

Some causes are not as common but may produce severe injuries. Such include blast injury, which causes severe and devastating trauma to the hand. Blasts occur more commonly in military settings, those seen in public institutions resulting from the manipulation of hand-made explosives. The blast usually causes most damage in the first web[16]. High-pressure injection injuries also occur but are rare. The most commonly injected materials include paint, automotive grease, solvents and diesel oil[17].

3.4 Anatomic areas injured

Injuries to the hand may produce certain characteristic patterns that may be predicted by the mechanism of injury. These may be seen as characteristic pattern of fractures on radiography[15]. The cause of injury will also have great bearing to the anatomic areas injured. Particular areas in the hand are more susceptible by their anatomic position.

The surgical audit done in Ireland (with mainly falls and domestic accidents as leading causes of injury) the thumb, the index and the little finger were the most injured structures respectively[8]. In Quatar, with predominantly industrial injuries, the long followed by the index and then the thumb were the most frequent fingers affected[12]. For each finger the distal phalanx was the most injured structure. Similar results were

observed in occupational injuries among workers seen in occupational clinics in New England (US)[18].

In the paediatric population in whom the injuries occur mostly at home, the fingertips are the most affected sites especially on the thumb[13]. There was an exception to this in Sweden where injuries of the long finger were more than those of the thumb among chidren[19]. In combination more injuries occur on the fingers compared to the palm and dorsum of the hand.

3.5 Outcome Assessment

Clinicians, therapists and researchers need an outcome measure that is simple, valid and robust to assess patients with a hand ailment[20]. Many outcome measures are available, some of which have not been validated and different versions are often used[20].There are a number of objective assessments described for the hand, but most of them are time-consuming and they are rarely used in routine clinical practice. The most common assessments are grip strength, range of motion (ROM) and two-point discrimination (2PD). Specific function tests such as the Purdue peg board test, total active and total passive motion (TAM and TPM) assessment and the Moberg's pickup test are only used occasionally[20]. The Jebsen test, which has been extensively validated, is commonly used by American hand Therapists[20].

A comprehensive functional assessment is considered incomplete without a subjective assessment that includes patient satisfaction and assesses simple aspects of psychological reactions[20]. Appearance, influence on work and other identifiable distress factors associated with a hand problem also cannot be ignored. An ideal outcome measure should identify and possibly measure the impairment and disability. It needs to be sensitive specific, relevant, robust, simple, comparable and reproducible[20].

Objective assessment of hand injuries is a complex subject. However, an objective assessment, leading to a score, can help in predicting outcome and can be used as a research tool. Campbell and Kay [21] came up with an objective scoring method (Hand injury severity score...HISS) in which injuries to the hand, distal to the carpals are considered. Each ray of the hand is assessed separately. Each ray's score is then multiplied by a weighting factor for that ray and added to the scores of the other rays to obtain a total score for the injury. The hand outcome survey sheet (HOSS) is a doctor-administered form and combines both subjective and objective measures[20]. The HISS[21] measures the injury in four tissues: integument, skeletal, motor and neural. These four tissues and their degree of impairment form the basis for measuring the outcome in the HOSS[20]. For each tissue a few cardinal outcomes are listed which are then assessed on a scale ranging from ``a'' to ``d''. (As a: Normal, b: Mild: Not affecting function, c: Moderate: Some functional defect OR interferes with work d: Severe: marked function defect, unable to use). For example a flexor tendon injury will have an outcome that is assessed for the integument, the motor and the joint function categories.

An appropriate distress level is marked for the particular outcome category depending on the skin healing, tendon glide and the associated joint function. The only objective assessment on this form is grip strength. This is measured by using a calibrated Jamar analogue dynamometer and is recorded for both the hands (the normal and the affected). Grip strength of the affected hand provides an indication of the state of the hand at any given time and therefore could be considered as an overall outcome measure for hand disorders. Expressing the grip strength as a percentage of the opposite hand would theoretically counter variations in the equipment, mood of the patient, state of the hand and other effects such as the time of day[20].

3.6 Prevention

Modifiable risk factors in patients with hand injuries are likely to be found in those with occupational hand injuries. Identifying these factors would go along way in prevention of hand injuries. The hand is the leading body part injured at work and treated in hospital emergency departments, affecting an estimated 1 080 000 workers annually in the United States[22]. Hand injuries exceed 20% of all occupational injuries [22]. When cuts and lacerations of the fingers and hands are combined, the number of days away from work (approximately 110 000 annually), are second only to back strain and sprain frequency according to US Bureau of Labor Statistics data[23].

The hand is frequently exposed to professional risks. It is often the target of accident during non-protected work and many complex and grave lesions can be caused. Several

transient factors have been identified that increase/decrease risk for occupational hand injuries. These are: using a machine, tool, or work material that performed differently than usual; wearing gloves; performing an unusual task; doing a task using an unusual work method; being distracted or rushed; and feeling ill. Unusual performing equipment/materials included a jammed machine, malfunctioning hand tool, a recently sharpened knife, or a work piece that was easier or harder to cut than usual[24].

Occupational category, job experience and safety training were found to alter the risk[24]. Peng , in a study on industrial hand injuries identified duration of employment as a leading influencing factor for the risk of hand injury by punch machines[25]. Skov[26], found that age and gender are independent risk factors for the occupational hand injuries. The highest at risk are the youngest and men. He calculated the lifetime risk to be 93% for men and 73% for women.

4. 1 STUDY JUSTIFICATION

Clinicians need to be able to predict outcome of the disease or the condition they are attending to. Given the importance of the hand and how catastrophic poor outcome of a hand injury can be, it is prudent to be able to predict the likely outcome of a patient's injury. This is of great interest to the patient and the surgeon. To the patient, to be able to weigh their expectations and plan their participation in treatment. For surgeons, to be able to evaluate their interventions versus the earlier predicted outcome. That is to appropriately carry out a surgical audit.

This study is therefore designed to address the various characteristics hand-injured patients seen at KNH. Specifically; the causes, anatomic site of injury, risk factors for occupational injuries and certain aspects of treatment and how these influence eventual outcome. It is then presumed that the findings of this study will then form a basis upon which preventive measures can be build especially in the occupational related hand injuries.

4.2 PROBLEM STATEMENT

That the causes of hand injury in KNH remain undocumented. The pattern and sites of injury are unknown. We believe that hand injured patients in KNH are likely to have modifiable work place temporal factors which if documented may lead to prevention of occupational hand injuries. The outcome of treatment of hand injuries at KNH is unknown and needs documentation.

5. STUDY OBJECTIVES

Main objective

To determine pattern and outcome of treatment of acutely hand-injured patients seen at KNH.

Specific objectives

1. Document the causes of hand injuries in patients seen at KNH.
2. Document pattern and anatomic characteristics of hand injured patients at KNH.
3. Determine what modifiable risk factors are present in patients with occupational hand injuries.
4. Determine the outcome of treatment of hand-injured patients at KNH.

6. MATERIALS AND METHODS

6.1 Study area

The setting of this study was at KNH. KNH is the largest hospital in the country being about a 1400 bed in-patient public health facility. It is the main referral hospital in East and Central Africa and also acts as a teaching hospital for the University of Nairobi. It has a large accident and emergency unit (A&E), which receives most of emergency cases in the greater Nairobi region. This unit is run mainly by Medical Officers who are first-degree holders. They filter and provide the initial care to all patients. After evaluation the patients are treated and discharged for follow-up if need be in various outpatient clinics. With various indications some are admitted for further care. In the case of hand injured patients, the flow may be to the orthopaedic outpatient clinic, admission to orthopaedic ward where further care is by senior house officer's in surgery with involvement of orthopaedic surgery consultant.

6.2 Study population

This study was conducted among all patients with unilateral hand injuries who presented at KNH A&E and satisfied the inclusion criteria below.

6.3 Study design

The study was a prospective descriptive cross-sectional survey that encompassed follow up for outcome.

6.4 Eligibility Criteria

The study was among all trauma hand-injured patients seen at KNH A&E unit who were either referred to the outpatient clinic or admitted to the orthopaedic ward. To be eligible for the study, subjects must have had either a laceration, crush, avulsion, puncture, fracture, contusion or dislocation involving any part of the hand. (Hand being considered to be any part distal to the distal wrist crease).

6.5 Exclusion criteria

The following sets of patients were excluded from the study:

a) Burn injuries

b) Referred patients who have received prior surgical intervention

c) Injuries beyond 72 hours

d) Injection injuries

e) Previous hand injury.

f) Bilateral injury

6.6 Ethical Issues

The study was approved by University of Nairobi & the KNH Research and Ethics Committee. Informed consent was sought from the participants of this study.

6.7 Study end-point

The study took the assumption that the appropriate hand-healing period is less than six months since injury[27]. Patients were therefore followed up and assessed at three months

period for outcome. Three months was selected to capture most patients for follow up. If some were considered to have healed earlier, then time of treatment discontinuation was used to assess outcome.

6.8 Study Instruments and personnel

A questionnaire (see appendix) was used to extract data at admission and a subsequent questionnaire (HOSS), was used at the end to assess outcome.

The data was collected by the principal investigator alone.

6.9 The Data

The data sought included:

a) Patient demographics (age, sex, occupation)

b) Cause of injury

c) Injury type (laceration, fracture, contusion, mutilation)

d) Anatomic structure (integument, tendons, nerve, bone)

e) Exact anatomic sites (fingers, palm, dorsum).

f) If occupational injury (work related risk factors.... distraction, duration at work, handedness, period of employment)

g) HOSS details for outcome after average three month time period.

6.10 Sample Size

The sample size required was calculated as follows:

$$N = \frac{Z^2 \, P(1-P)}{d^2}$$

Where N..... Sample size

Z^2..... Standard deviation of 95th percentile (1.96)

P ..... expected proportion of hand-injured patients among patients seen at A&E department (0.066).

d^2..... confidence interval (0.05)

The expected sample size was 95.

6.11 Data Analysis

Data was collected using pre- coded entry sheets to ease the process of analysis with SPSS 11.5. SPSS 11.5 software was used for data entry and analysis. The data was summarized using frequency tables and graphs.

Associations were investigated using the student's t-test for continuous variables and the chi-square test (Epi-info 3.2.2) for discrete variables with level of significance taken as 0.05. Yates correction was used where expected cell value was less than 5.

7. Study limitations

Several factors impeded the smooth implementation of this study. Among them a lack of protocol for the treatment and referral system for hand injured patients. This led to some patients who should have been acutely admitted being sent to the clinic without urgent intervention.

The lack of an electronic register of patients and their dates for clinic attendance made it difficult to follow up patients. There is also a problem in the coding of injuries in A&E department which does not include hand injury as an entity.

Other patients were lost to follow up for unexplained reasons.

8. RESULTS

Patient characteristics

A total of 99 patients who met the inclusion criteria consented and were recruited to the study. About 75 were available to be assessed for outcome, having satisfied the study protocol. 16 were lost to follow up, 8 were excluded because either they underwent a second operation at another institution or could not be assessed for outcome because they were scheduled for another surgical intervention.

The Age range was 2 years to 59 years with a modal age set of 21-30 years followed closely by 31-40 year group. The extremes of ages formed were the least group of patients in this study (Table 8.1). The sample population had a mean age of 28.2 years, a median age of 26 years with SD of 9.5. The male group had a mean age of 27 while female had mean age of 30. However this difference was not statistically significant (p=0.33).

There were 78 (78.9%) male patients and 21(21.2%) female patients giving a male to female ratio of 3.7: 1. Most patients had a primary level of education 52(52.5%) followed closely by those with secondary level education 34 (34.3%). 9.1% (n=9) had tertiary education while 3 (3%) had no formal education (Table 8.1).

Of the 99 patients, 94(94.9 %) were right handed while 3(3%) were left handed with ambidextrous group forming 2% (n =2) (Table 8.1).

Table 8.1: Social Demographic characteristic of the Study population

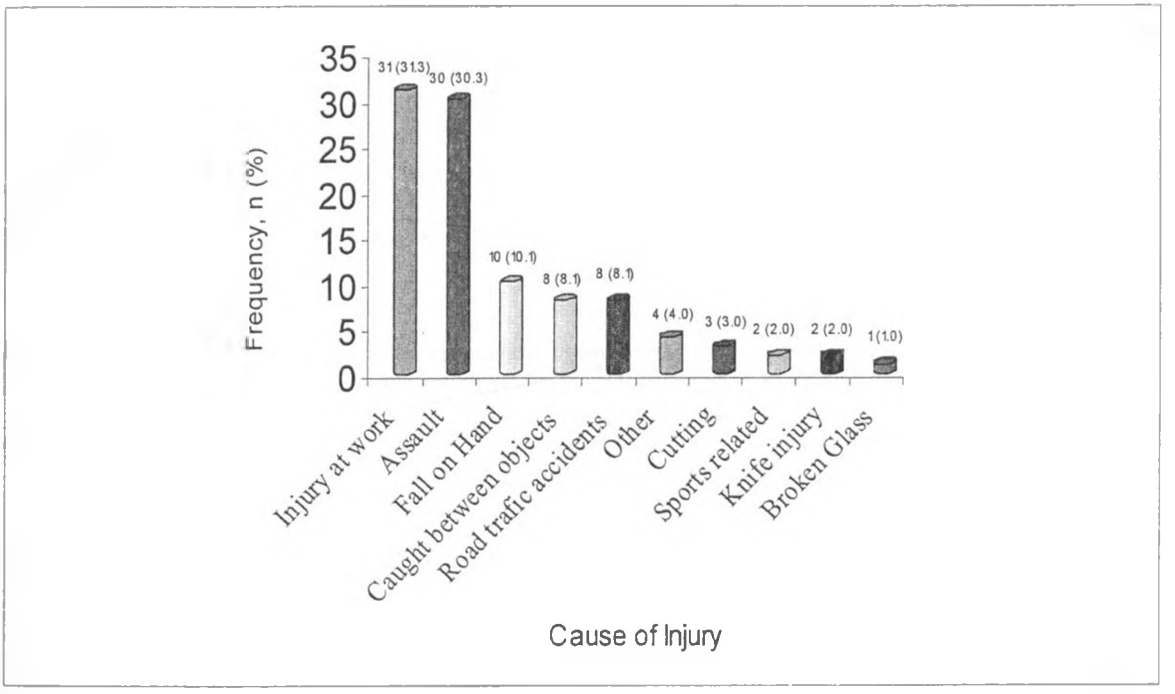
Characteristic	*Frequency*	*Percentage*
Age Distribution (n = 99)		
0 – 10	2	2.0
11 – 20	14	14.1
21 – 30	45	45.5
31 – 40	27	27.3
41 – 50	9	9.1
51 – 60	2	2.0
Sex (n = 99)		
Male	78	78.8
Female	21	21.2
Level of Education (n = 99)		
None	4	4.0
Primary	52	52.5
Secondary	34	34.3
College	9	9.1
Handedness		
Right	94	94.9
Left	3	3.0
Either	2	2.0

Injury characteristics

Cause of injury

The commonest cause of injury was work or machine related (occupational). This represented 31.3 % (n=31) patients followed closely by assaults affecting 30 patients (30.3%). Falls caused injury in 10 patients (10.1%) and hand being caught in objects affecting 8 (8.1%) patients which was similar in prevalence to road traffic accidents. The remaining causes together accounted for 10 (10%) of the cases. These are sports related, knife injury (self inflicted/ accidental), piercing and broken glass. (Figure 8.1)

Figure 8.1: Cause of the Injury



Handedness and usual hand for working

Each of the hands was injured in almost equal proportion, with the left 54(54.5%) being slightly more than the right 45(45.5%). (Table 8.2). Comparing the individual's usual hand for working and the hand injured, those who were right handed had the right hand injured in 44 cases (46.8%) while the left hand was injured in 50 cases (53.2%). Those who were left handed had only their left hands injured. There was no difference between the likelihood of the dominant hand (usual hand for working) and the non-dominant hand being injured. P= 0.27 (Table 8.3)

Table 8.2: Injured and the usual hand of working

Variable	*Hand (n = 99)*		
	Right, n (%)	***Left, n (%)***	***Either, n (%)***
Usual hand for working	94 (94.9)	3 (3.0)	2 (2.0)
Injured hand	45 (45.5)	54 (54.5)	-*

**The value is not applicable*

Table 8.3: Relationship between the injured hands and the usage of the same

Injured	*Usual hand for working*			
	Right, n (%)	***Left, n (%)***	X^2	***P-value***
Right	44 (44.4)	Nil		
Left	50 (50.5)	3 (3.0)	2.6	0.27
Either	1 (1.0)	1 (1.0)		

Site of injury

The carpus represented the site most injured with 24.2% of injuries occurring at this site. The distal phalanges of long and ring were each injured at a frequency of 9.8% while that of index at 9.1%. The proximal phalanx of thumb was affected 7.6 % of the times. The proximal phalanx of long finger (2.2%), middle phalanges of index (2.3%) and little finger (1.5%), distal phalanx of little finger (2.3%) were the least injured. (Table 8.4)

Table 8.4: Site of injury

Figure	*Position*		
	Proximal, n (%)	***Middle, n (%)***	***Distal, n (%)***
Thumb	10 (7.6)	-*	6 (4.5)
Index	8 (6.1)	3 (2.3)	12 (9.1)
Long	3 (2.3)	6 (4.5)	13 (9.8)
Ring	7 (5.3)	6 (4.5)	13 (9.8)
Little	8 (6.1)	2 (1.5)	3 (2.3)
Carpus	32(24.2)*		

* No middle for thumb

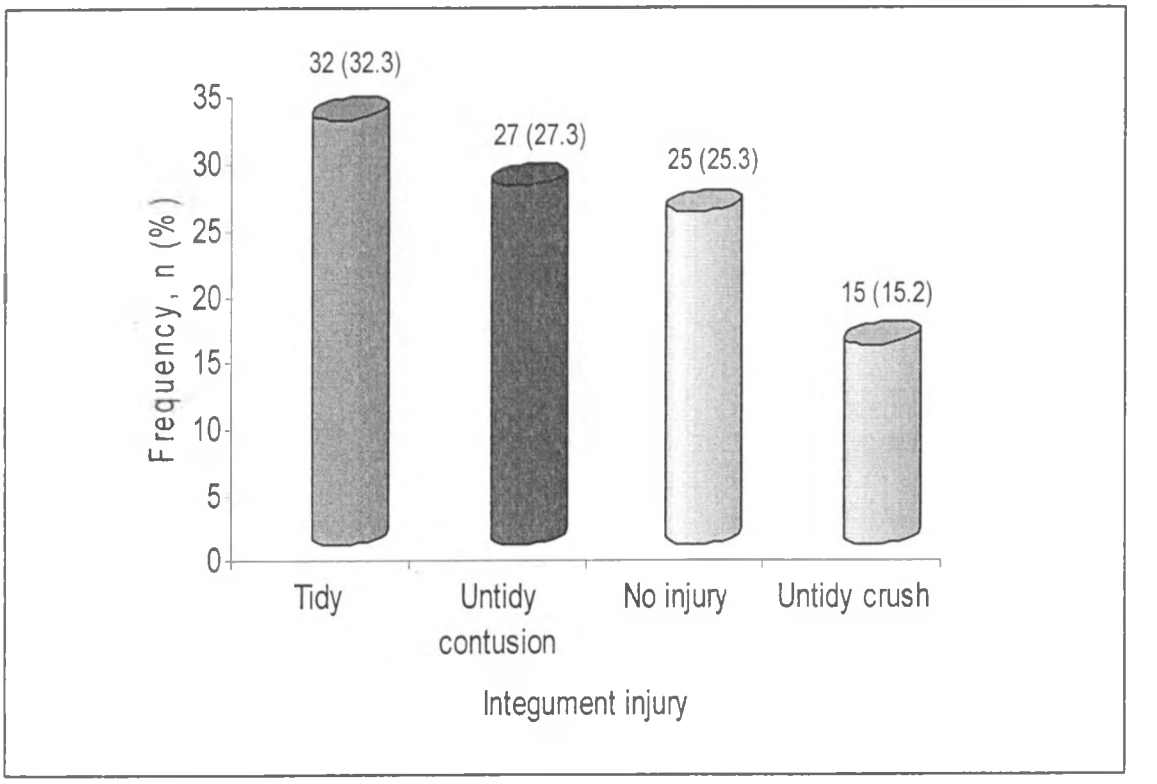
* No divisions for carpus.

Pattern of injury

The Skin was injured in 74.75% of the cases of which 32.3% were tidy and 42.5% untidy.

In 25.3% of the cases the skin was intact. (Figure 8.2)

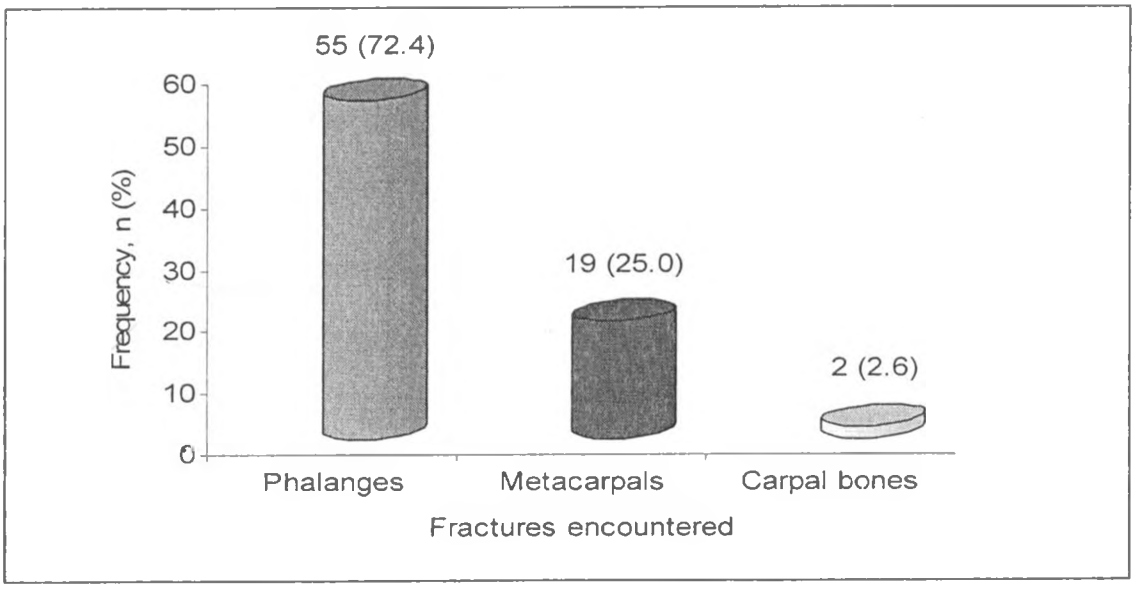
Figure 8.2: Pattern of Injury



Distribution of fractures

Of the 76 fractures seen, 55 (72.4%) were located on phalanges, while 19 (25.0%) involved metacarpals. In only 2 (2.6%) instances were carpals affected. (Figure 8.3)

Figure 8.3: Fractures Encountered



Phalangeal fractures

Of the phalangeal fractures, the distal phalanx of the long finger was most fractured bone 11(20%), followed closely by distal phalanx of ring 8(14.5%) and proximal phalanx of index finger 7(12.7%). Distal and middle phalanx of little finger, middle phalanx of index were the least fractured n=1(1.8%) each. (Table 8.5)

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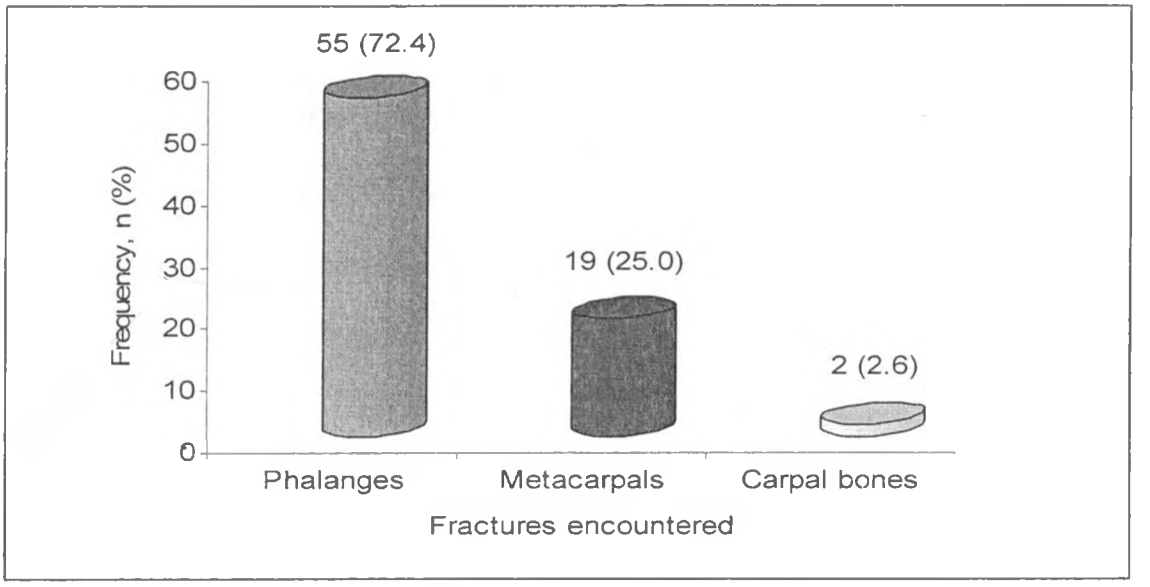
Of the 76 fractures seen, 55 (72.4%) were located on phalanges, while 19 (25.0%) involved metacarpals. In only 2 (2.6%) instances were carpals affected. (Figure 8.3)

Figure 8.3: Fractures Encountered



Phalangeal fractures

Of the phalangeal fractures, the distal phalanx of the long finger was most fractured bone 11(20%), followed closely by distal phalanx of ring 8(14.5%) and proximal phalanx of index finger 7(12.7%). Distal and middle phalanx of little finger, middle phalanx of index were the least fractured n=1(1.8%) each. (Table 8.5)

Table 8.5: Distribution of phalangeal fractures

Finger	*phalanges fractured*		
	P1, n (%)	*P2, n (%)*	*P3, n (%)*
Thumb	5 (9.1)	2 (3.6)	-
Index	7 (12.7)	1 (1.8)	6 (10.9)
Long	3 (5.5)	2 (3.6)	11(20.0)
Ring	3 (5.5)	2 (3.6)	8 (14.5)
Little	3 (5.5)	1 (1.8)	1 (1.8)

Carpal and metacarpal fractures

Of metacarpal and carpal bones, the second metacarpal was the most fractured 7(33.3%), followed by fifth metacarpal 4 (19%), the fourth 3(14.3%), the first 3(14.3%) with the third being least injured 2 (9.5%). The scaphoid and hamate were the only carpal bones fractured. (Table 8.6)

Table 8.6: Carpal and Metacarpal Fracture

Distribution of Carpal and Metacarpal	*Findings*
Metacarpal	n
1st	3 (14.3)
2nd	7 (33.3)
3rd	2 (9.5)
4th	3 (14.3)
5th	4 (19.0)
Scaphoid bone	1 (4.8)
Hamate bone	1 (4.8)

Nerve injuries

There were very few instances of nerve injuries reported in this study with overall prevalence of 2% with median and ulnar nerve being the only ones reported as outlined below. (Table 8.7).

Table 8.7: Nerve injuries

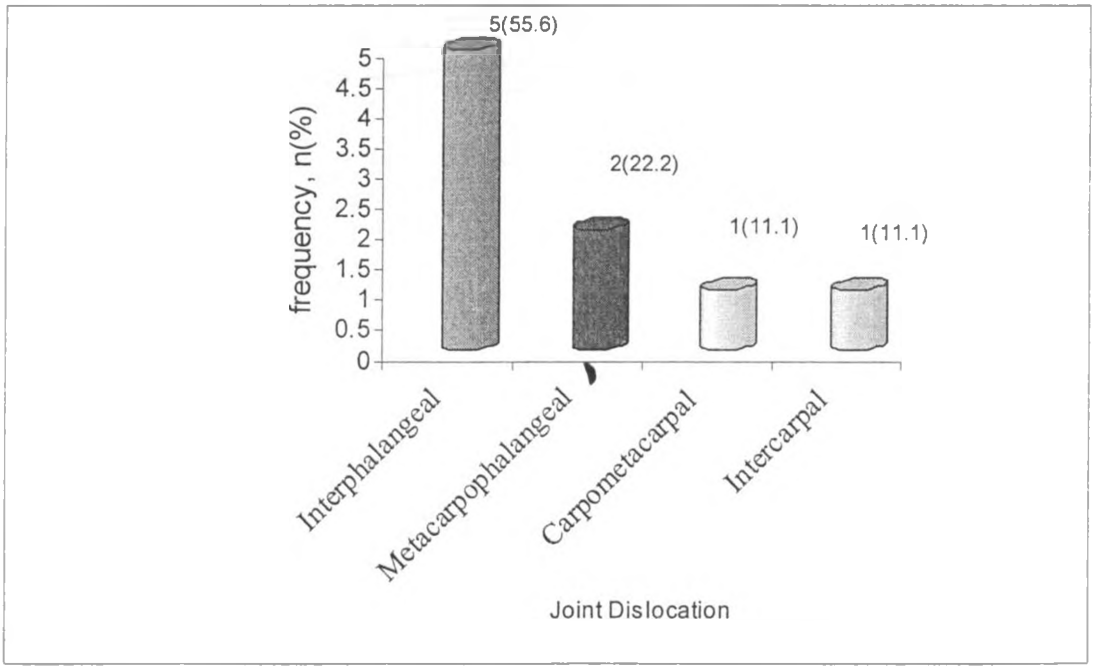
Distribution of nerve injuries	*Findings n(%)*
Median	1 (1.0)
Ulnar	1 (1.0)
Radial	-

Joint injury (Dislocation)

Of the 99 (100%) patients, 9 (10.0%) had a joint dislocation with interphalangeal joint being the most injured 5 (5.1%). The metacarpo-phalangeal joint was involved in 2 (2.0%) and the carpometacarpal, intercarpal joint 1 (1%) respectively.

The distribution of the 9 is as illustrated in the figure 8.4 below;

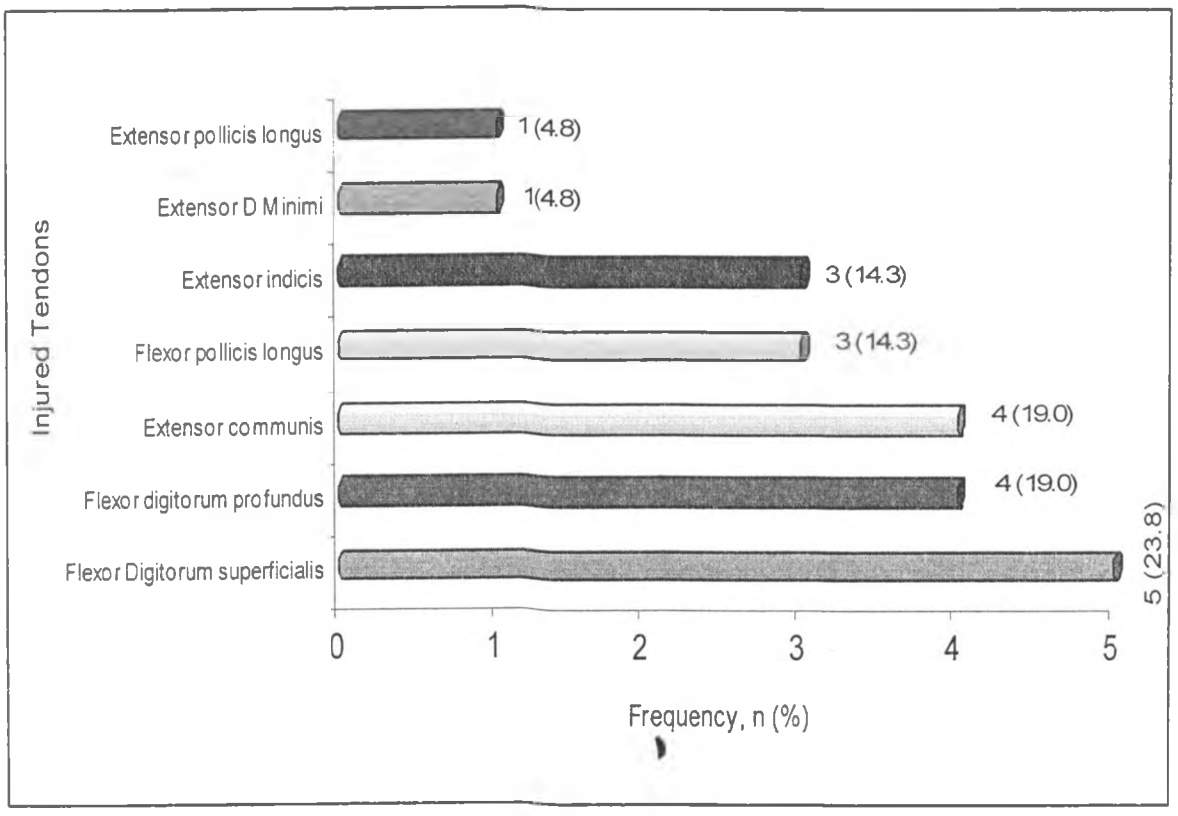
Figure 8.4: Joint Dislocation



Injured tendons

Seventeen patients had tendon injuries, with 21 individual tendon injuries being reported. The flexor tendons were injured more than the extensors with flexor digitorum superficialis being the commonest, followed by flexor digitorum profundus and extensor digitorum communis. (Figure 8.5)

Figure 8.5: Distribution of Injured Tendons



Temporal factors for occupational injuries

Most of those injured had been at work (45.2%) for a period between 1-5 years, while those working less than 1 year were 9 (29), while 8 (25.8) had worked for greater than 5 years. (Table 8.8) Most of the patients were injured in the early hours on duty, with 48.4% percent being injured in the first 4 hours of work. 13(41.9%) were injured in the period 4-8 hours, while 2 (6.5%) were injured in the period 9-12 hours. Only one patient was injured while on duty for more than 12 hours. (Table 8.8)

Twenty six (83.9%) were injured during the day shift while only 5(16.1) during the night shift. (Table 8.8)

Table 8.8: Temporal factor for occupational injuries

Characteristics	*Frequency*	*Percentage*
Duration of Employment in Years (n = 31)		
< 1	9	29.0
1 – 5	14	45.2
> 5	8	25.8
Hours on Duty for the Employed (n = 31)		
< 4	15	48.4
4 – 8	13	41.9
9 – 12	2	6.5
> 1	1	3.2
Shifts (n = 31)		
Day	26	83.9
Night	5	16.1

Transient risk factors at time of injury

Lack of protective equipment was the main risk factor occurring in 28(90.3) of the 31 with occupational hand injuries. Lack of safety training was present in 10(32.3) of the cases, followed by equipment failure in 6(19.4), being rushed 3(9.7%), performing unusual task 2(4.3%). Being distracted and work piece being different from usual were the least likely risk factor representing only 3.2% each (n=1). (Table 8.9)

Table 8.9: Transient risk factors for occupational injury

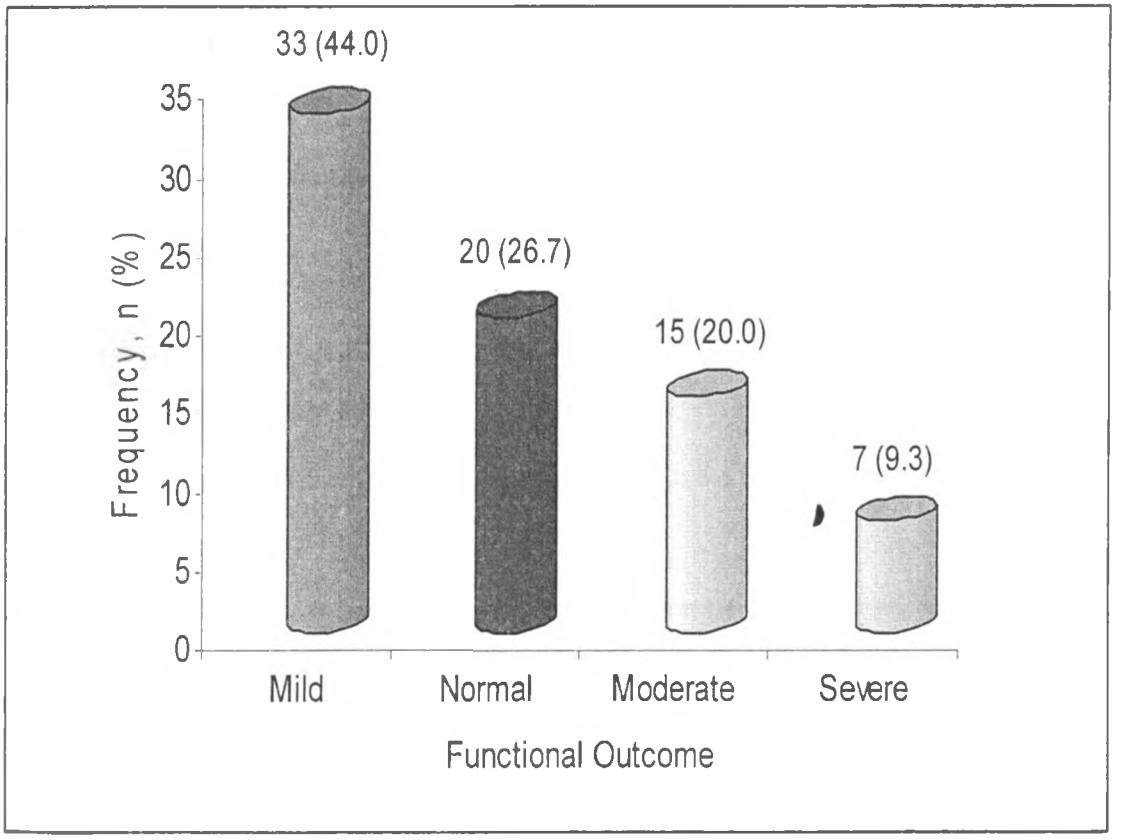
Characteristics	*Frequency*	*Percentage*
Hand protective equipments	28	90.3
No safety training	10	32.3
Equipment failure	6	19.4
Being rushed	3	9.7
Performing unusual task	2	6.5
Unusual work methods	1	3.2.
Being distracted	1	3.2
Work piece harder/easier to cut	1	3.2

Outcome

Subjective functional outcome

This represents the patient's assessment of their ability to use the injured hand. Twenty six percent (n=20) were very satisfied with their outcome and reported a normal hand (Back to pre-injury state). Forty four percent (n=33) reported their hands not being normal but the deficit did not affect ability to use their hand. In twenty percent (n=15), the functional defect interfered with work while 7(9.3) patients were unable to use the hand and therefore a severe functional defect. (Figure 8.6)

Figure 8.6: Patient's Subjective view of the Functional Out come



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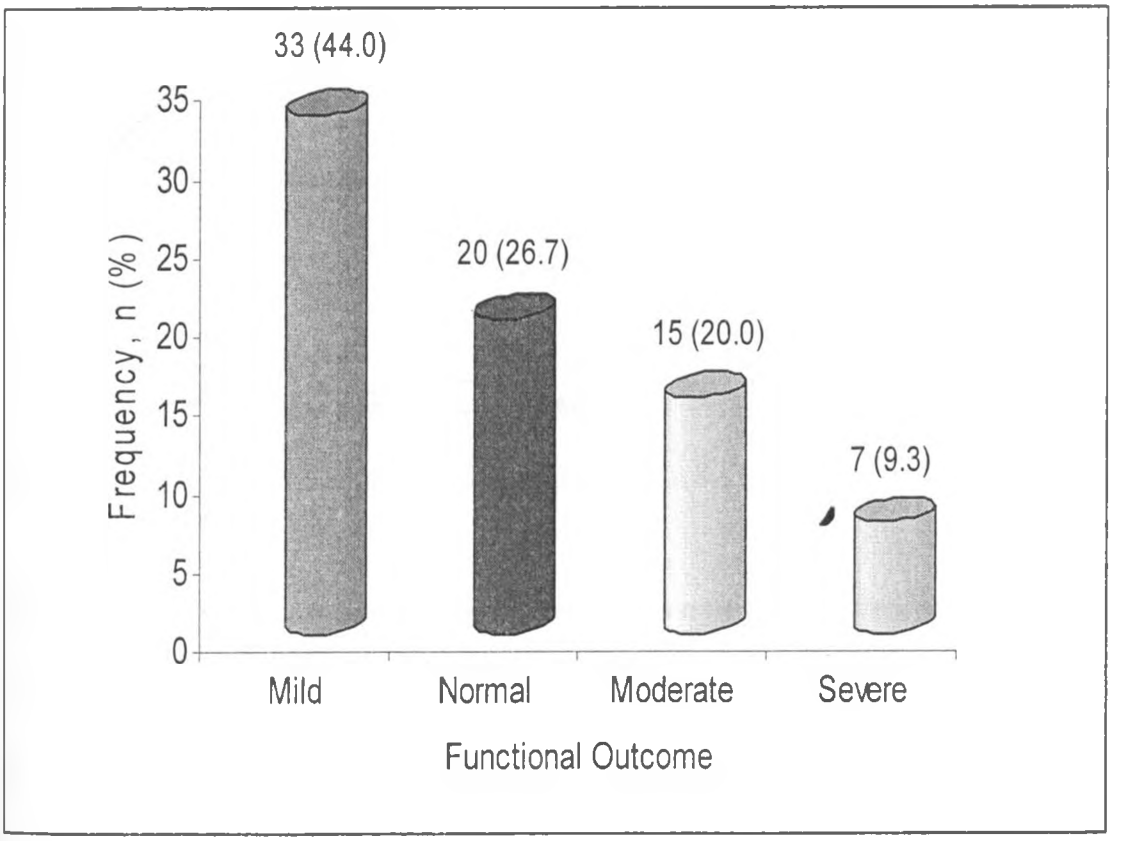

Complications

The most common complication reported was skeletal pain (25.5%), with skeletal deformity (18.2 %) and cold sensitivity being next in-line (16.4%). Joint stiffness and integument pain were the other significant complications. (Table 8.10)

Table 8.10: Complications affecting the injured hand

Characteristics	*Frequency*	*Percentage*
Complications		
Skeletal pain	15	27.3
Skeletal deformity	11	20.0
Cold sensitivity	9	16.4
Joint Stiffness	8	14.5
Integument pain	6	10.9
Tendon lag	3	5.5
Tendon pain	2	3.6
Tendon disruption	1	1.8

Objective outcome

This is by grip strength assessment. Seventy percent (53) had adequate grip strength while 29.3% (22) had inadequate grip strength. (Table 8.11).

Table 8.11: Grip strength (n=75)

Adequate	53	70.7
Inadequate	22	29.3

Association between demographics, pattern of injury and outcome

Age and sex of the individual were not independent predictors of outcome (p=0.78, 0.12) respectively. However the likelihood of males having a worse outcome was higher than that for females, with an OR (odds ratio of 3.3). An individuals' level of education(Table 8.1, table 8.12) had no influence on the outcome (p = 0.51).

The left hand was marginally more injured than the right hand. Injury to the right hand conferred likelihood of worse outcome compared to the left (OR = 1.6). However this did not reach statistical significance (p =0.33).

Status of integument (untidy, tidy) was not independently predictive for outcome. (P = 0.56). However the prescence of untidy wound had a higher odds of worse outcome (OR = 1.48).

Type of fracture (phalangeal, metacarpal and carpal) did not independently affect outcome. As illustrated in table 8.12 below.

Table 8.12: Association between demographics, pattern of injury and outcome

	Complication		*OR (95% CI)*	X^2	*P-value*
Variable	*Yes, n ()*	*No, n (%)*			
Age Distribution					
≤30	13 (13.1)	48 (48.5)	0.8 (0.30, 2.56)	0.08	0.78
>30	9 (9.1)	29 (29.3)			
Sex					
Male	20 (20.2)	58 (58.6)	3.3 (0.70, 15.3)	2.5	0.12
Female	2 (2.0)	19 (19.2)			
Injured hand					
Right	12(12.1)	33(33.3)	1.6(0.62, 4.1)	0.94	0.33
Left	10(10.1)	44(44.4)			
Education level					
Pre-primary	11(11.1)	44(44.4)	0.73(0.25,2.08)	0.43	0.51
Post primary	11(11.1)	32(32.3)			
Intugument status					
Untidy	11(11.10)	31(31.3)	1.48(0.52, 4.26)	0.33	0.56
Tidy	11(11.1)	46(46.5)			
Phalangeal Fracture					
P1	5(9.1)	16(29.1)	-	2.44	0.30
P2	4(7.3)	4(7.3)			
P3	6(10.9)	20(36.4)			
Carpal/metacarpal					
Metacarpal	10(47.6)	9(42.9)	1.11(0.0, 49.10	0.45	0.5
Carpal	1(4.8)	1(4.8)			
Tendon injury					
Flexor	5(23.8)	7(33.3)	1.4(0.17, 12.5)	0.00	0.95
Extensor	3(14.3)	6(28.6)			

9. DISCUSSION

Age

Nearly all the age sets were affected by hand injury. However the modal age-set was in the 21-30 year group who consisted 45.5 % of the patients. This group is the most exposed to injury as it forms the majority of people at the work place and are also very prone to violence. These findings compare well with other studies. Wanjohi[28] in his dissertation noted a similar modal group who formed 39.9% of patients with hand fractures. These results are also consistent with others in Northern Ireland[8] and in Qatar[12]. However Larsen[29] in a study in The Netherlands and Denmark, described the peak of injury to be in teenagers. These were largely due to recreational causes.

However the distribution across age groups differs with Shaheen[12] reporting a higher figure of 12% in the 1-10 year group while Hill[8] had about 10%. In this study only 2% belonged to this group. This may be explained by differences in the definition and case selection of patients. Hills study had loose selection criteria for hand injury.

Sex

Males formed a disproportionately high group of patients in this study. This gave a male to female ratio of 3.7 to 1. This figure compares well with Eastern European country of Poland[30] where male-female ratio was 4:1. This is higher than figures in Northern Ireland[8] of (2.2: 1) and Denmark[31] (1.6:1). This may be explained by the fact that women are more involved in the economies of western European countries. However this ratio is quite low compared with Qatar[12] figures of (10.1: 1), which may be due to cultural issues that hinder women's participation in society.

Education level

Most of the patients had primary level education and these tended to be the ones with occupational and assault injuries as they were mostly manual workers with little safety education.

Handedness and Injured hand

Most of the patients as expected were right handed (94%), with a few being left handed (3%) or ambidextrous (2%). This distribution is similar to that described by Mink[32]. The dominant and non-dominant hands were injured in almost equal proportions for the right handed. While for the left handed, the dominant hand was exclusively injured. In the ambidextrous group either hand was injured equally. Therefore handedness is not predictive of the likelihood of one hand being injured. This compares well with the study by Shaheen[12] in Qatar, that of Hill[8] in Ireland, Trybus in Poland[30] and Mink in the USA[32]. However this finding is at variance with that of Porac[33] in Canada, who found that individuals with consistent hand preference, regardless of side, were more likely to injure their preferred hand (dominant) when compared to mixed preference types.

Causes of injury

The aetiology of injuries was varied with work-related (31%) causes and assault (30%) being the two twin leading causes. While falls and hand being caught in objects being next in line. This aetiology reflects the socioeconomic state of the victims and the country's level of development. Compared with industrialized country like Qatar[12], this differs greatly as industrial causes accounted for 59% with domestic and recreational

(sports injury) being next (30%). In Ireland[8], falls (15%) and sports (15%) were the leading causes. This may be due to developed nature of this country with less industrial manual workers. Pietrobon[34], in South Africa observed that assaults were the leading cause. He attributed this to be due to the period 1992 to 1994 when the country was in transition characterized by violence, social upheaval and uncertainty about the future. In Netherlands and Denmark[29] however, home and leisure accidents caused by objects and falls were the leading cause.

The predominance of work-related injuries suggests that preventive measures focused at this group would lead to significant reduction of hand injuries which usually tend to be more severe. These injuries occur in young members of society who work in directly productive sectors of society.

Site of injury

The carpus was the most commonly injured site because of its large area. Distal phalanges of the index and long fingers were next in-line and this is explainable by the fact that these are the leading parts of the body especially in those with occupational injuries.

However, taken together the digits were more affected by injury than the carpus. This compares well with the study by Hill in Ireland[8] in terms of ratios although the Irish study had significantly less injuries on the carpus.

Among the digits, the ring and the index fingers were the most injured followed closely by the long finger. This differs from Shaheen's[12] study in which the long finger was the most injured with index and thumb next in predominance.

Pattern of injury

Most of the injuries were open with more than 42% being untidy. This reflects the severity of the force and cause at the time of injury. Machine related and assaults involving sharp objects are likely to cause lacerations/ penetrating injuries.

The phalangeal bones (72.9%) were the most predominant bones fractured followed by the metacarpals (25%). This is in keeping with site of injury distribution and reflects the fact that the phalanges are the leading part of the hand. Of the metacarpals injured, second and fifth were most affected. These metacarpals are on the open side of the hand, therefore exposed to violence of assaults and machine injuries.

The findings of this study are at variance with those of Wanjohi[28] in which metacarpals were the most fractured bones (50%). However these figures compare well with those of Onsellen[35] in Netherlands. He found phalangeal fracture prevalence to be 59% while that of metacarpals to be 33%. Hove[36] in Belgium observed that p`halanges, metacarpals, and carpal bones account for, 46%, 36% and 18% of the fractures, respectively. Fractures of the scaphoid made up 10.6% of the total.

In Finland Nieminen[37] found a pattern in which lacerations constituted 45% of the injuries while fractures 26%.

Nerve injuries

The prevalence of nerve injuries was very low at about 2%. Though comparable with the findings of Nieminen[37] in Finland who reported a prevalence of 2%, it is possible that there was under reporting of nerve injuries. Nieminen's[37] study also had a similar prevalence of tendon injuries. This study has a tendon injury prevalence of 17% which is in keeping with the violent sharp nature of injuries due to assaults and machine lacerations. Probably the nerve injuries were discordant because many of the tendon injuries were zone 1 and 2 where tendons and nerve are not as closely related as compared to zone 3 and 4 of the hand. The assessment of nerve injury in acutely injured is not very easy and is subjective.

Joint

There was a 10% rate of joint dislocation with the interphalangeal joints being the most affected joint. This is in keeping with the sites injured and the corresponding fractured bones.

Temporal factors for occupational injuries

Those who had worked for 1-5 years, were the most affected, followed by those who had worked for less than a year. Though one would expect the less experienced to be more injured, probably there could be more of these workers in industries or complacency could be a factor. These findings compare well with those of Sorrock[24] who found these two groups to be most vulnerable.

Most patients were injured in the initial hours of duty <4 hours. Expectation would have been that these injuries would occur in later part of working hours when the workers are expected to be exhausted and inattentive. Lombardi[38] found similarly in the USA that

workers were injured in early hours of the day. 83.3% were injured during the day shift, this is most likely to be due to increased number of people working during the day and not due to daytime being a risk factor on its own.

Transient risk factors at workplace at time of injury

Multiple factors were identified whose presence increased risk of injury at work. Of significance were lack of protective equipment, lack of safety training and equipment failure. These are modifiable factors whose manipulation can reduce incidence of occupational hand injuries. In their study Sorrock et al[24] found that equipment failure, doing unusual task and being rushed/ distracted were the most significant factors at work. They also calculated that wearing gloves reduced the risk and severity of hand injury.

Subjective outcome

The patients' perception of the ability to use their hand was varied. Fifty three (70%) were able to use their hand after an average 3 month period without functional defect. They reported their hand to be normal in terms of their ability to use it (back to pre-injury state) or had a mild deficit not affecting function. Approximately same number had adequate grip strength. The rest (30%) were unhappy with the outcome. Either had moderate deficit (affecting function) or were unable to use the hand altogether. They also had inadequate grip strength. Patients' perception (which is subjective) had a great agreement with the grip strength which is an objective measure of outcome.

A study in Poland by Trybus[39] had 90.9% of their patients return to their previous work, 4.89% had to change work and 4.50% had permanent disability. The average treatment period was 76.95 +/- 67.81 days.

Complications

Skeletal pain and deformity were the most prevalent morbid conditions that limited patients' ability to use their hand. This was followed by cold sensitivity and joint stiffness. This implied that possession of a skeletal injury was likely to lead to adverse outcome. This correlates with the fact that skeletal injury is likely to be associated with a high energy severe injury.

10. CONCLUSIONS

The most common causes of hand injury in this set up is occupational/ work related and assaults. Hand injury involves the young age group with the modal group being 21-30 year group followed by 31-40 year group. They tend to be male with primary level education.

As expected the society is largely right handed with a very small group of left handed people. However hand dominance does not influence the likelihood of the hand being injured. This conclusion can only be drawn on right handed people. The left handed were too few to have any conclusions drawn.

Collectively the digits are the commonest sites of injury compared to the carpus. Of the digits the middle three represent the predominant sites of injury.When fractures occur, the phalanges are the likeliest to be involved, with P3 being the most predominant. When joint dislocation occurs, the inter-phalangeal joints are the most likely to be affected.

Flexor digitorum superficialis and profundus together with extensor digitorum communis are the leading tendons injured.

Lack of equipment and safety training are the most important risk factors for occupational/ work-related injuries.

Most of the patients were marginally satisfied with the outcome of treatment of the hand injuries. Skeletal pain and deformity are the commonest complications of hand injuries.

A large number of patients (30%) had unsatisfactory grip strength at 3 months.

11. RECOMMENDATIONS

1. There is need to mainstream the care of patients with hand injuries. This should involve creation of a clear cut policy of management and flow of hand injured patients. A team of dedicated specialists could also be created who should provide leadership in this important area.
2. Dedicated efforts at prevention of hand injuries at work place should be made. This should include work-place safety education and provision of necessary hand protective equipment.
3. There is need at automation of the health records at KNH. This will enable easier information retrieval. It should also include proper coding of anatomical areas injured and could take into account coding when there are multiple injuries.
4. Recommendations on further study arising from this study:
    a) Case control study on occupational hand injuries
    b) Influence of time of intervention, training of surgeon, physiotherapy on outcome of treatment.
    c) The burden of care of patients with hand injuries.

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13. A: APPENDICES 1(QUESTIONAIRRE)

Patient Demographics

a) Study No. ☐

b) Name: ☐

c) Age (years) 1) 1-10

2) 11-20

3) 21-30

4) 30-40 ☐

5) 41-50

6) 51-60

7)>65

d) Sex Male (1) ☐

Female (2)

e) Education level

1) Illiterate

2) Primary ☐

3) Secondary

4) Tertiary

f) Telephone contact

☐

g) Usual hand for working

1) Right
2) Left
3) Either

☐

Cause of injury (Derby hand codes)

1) Fall on hand
2) Sports related
3) Caught in door/window
4) Cutting/piercing
5) Knife injury
6) Injury at work/machinery
7) Broken glass
8) Hand caught between objects
9) Assault
10) Animal bite
11) Other

☐

Injury characteristics

Side

1) Right
2) Left
3) Both

☐

Anatomical Site (P-proximal, M-middle, D-distal phalanx)

Thumb			Index			Long			Ring			Little			Palm	Dorsum	Wrist

Nature

a) Integument

1) Tidy

2) Untidy

a) Contusion

b) Contortion (crush)

b) Bone fracture (Specify)

1) Yes

2) No

c) Nerve

1) Median

2) Ulnar

3) Radial

d) Joint dislocation

1) Yes (specify)

2) No

e) Tendon

1) Yes (specify)

2) No

If occupational injury

Duration of employment (in years)

1) < 1 ☐

2) 1-5

3)>5

Hours on duty during day of injury

1) <4

2) 4-8 ☐

3) 8-12

4)>12

Day (1)/night shift (2) ☐

Wearing gloves/hand protective equipment

1) Yes ☐

2) No

Performing an unusual task

1) Yes ☐

2) No

Doing a task using an unusual work method

1) Yes

2) No

Being distracted

1) Yes

2) No

Being rushed

1) Yes

2) No

Feeling ill.

1) Yes

2) No

Safety Training

1) Yes

2) No

Unusual performing equipment/materials included a jammed machine

1) Yes

2) No

Work piece that was easier or harder to cut than usual

1) Yes

2) No

Outcome

THE HOSS

THUMB	INDEX	LONG	RING	SMALL	PALM	DORSUM	WRIST

Diagnosis:

R	L

Definations

a: Normal:

b: Mild: Not affecting function

c: Moderate: Some functional defect OR interferes with work

d :Severe: Marked function defect. Unable to use

MRCS: Medical Research council Sensory(S0..No sensibility, S1..Deep cutaneous pain, S2…superficial pain, S3…pain and touch, S4…complete recovery)

MRCM: Medical research council Motor (0..No activity, 1..Flicker, 2… no gravity, 3…gravity, no resistance, 4…. Moderate resistance, 5.. Normal power)

A. INTEGUMENT

		Defect	Cold sens	Stiff	Swelling	Pain
HAND	Dorsum					
	Palm					
DIGIT	Dorsum					
	Palm					

B. SKELETON

	Healing	Deformity	Nonunion	Swelling	Pain
BREAK					

	Lax	Subluxation	Dislocation	Stiff	Swelling	Pain
JOINT						

C. MOTOR

	Trigger	Lag	Disrupted	Adherent	Swelling	Pain
Extensor						
Flexor						

D. NERVE

MRCS (0-4)	MRCM (0-5)	Tingling	Swelling	Pain

F. GRIP STRENGTH

Normal Hand	Injured Hand

Form filled by:

13. B: APPENDIX II: CONSENT BY THE PARTICIPATING PATIENT

Study number.....
Hospital Number.....

Purpose of the study

The purpose of this study is to document the causes, pattern of injuries, risk factors for occupational injuries and the outcome of management of the hand-injured patients at the Kenyatta National hospital. The information gathered will be used in improving management of hand injuries and recommend prevention of these injuries.

Risks and benefits

The benefits are for future better care and prevention of hand injuries. However during the study if the researcher identifies complications on you he will recommend/ refer you appropriately. There is no harm or risk anticipated for participating in this study. No additional tests outside the usual ones for treatment will be carried out and no extra cost to you will occur for participating in this study.

Voluntary participation

Participation in this study is out of your own free will. You may terminate participation at any time with no consequences whatsoever.

Confidentiality

All information will be treated with confidentiality. Your identity will not be published whatsoever.

I the undersigned has been explained to and understood the above and voluntarily accept to participate in the study.

Signature/Thumbprint:
(Patient/guardian)

Dr. Wyckliffe Kaisha Otsianyi,
H58/7859/03, 0722-217632

13. C: Appendix IIB: Ruhusa kutoka kwa mhusika

Nambari ya uchunguzi:

Nambari ya hospitali:

Sababu ya uchunguzi

Sababu ya uchunguzi huu ni kurekodi, kufafanua sababu, hali ya majeraha, hatari ya majeraha kazini na matokeo ya matibabu kwa wale walio na majeraha ya mikono wanao pata matibabu katika hospitali kuu ya Kenyatta. Habari hii itatumiwa kuboresha utunzi kwa walioumia mikono na kupendekeza kinga ya haya majeraha.

Hatari na manufaa

Manufaa itakuwa kwa huduma bora na kinga kutokana na majeraha siku za usoni. Hata hivyo, iwapo wakati wa uchunguzi, mtafiti atapata kuna shida katika matibabu yako atapendekeza au kukutuma kwa matibabu yanayo faa. Uchuguzi huu hautakugharimu fedha zaidi. Hakuna hatari yoyote kwako kwa kuhusika kwa huu uchunguzi.

Uhusika wa hiari

Kuhusika kwako katika uchunguzi huu ni kwa hiari yako mwenyewe na hauwezi kushurutishwa. Waweza kukatiza kuhusika wakati wowote bila madhara yoyote ile.

Usiri

Habari zote unazotoa zitawekwa kwa siri na jina lako halitachapishwa kwa vyovyote vile.

Nadhibitisha nimeyafahamu yale nimeelezwa na mtafiti na nimekubali kwa hiari yangu mwenyewe kuhusika katika uchunguzi huu.

Sahihi/ Kidole cha gumba:

Dr. Wyckliffe Kaisha Otsianyi,
H58/7859/03, 0722-217632.

KENYATTA NATIONAL HOSPITAL
Hospital Rd. along, Ngong Rd.
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Fax: 725272
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Email: **KNHplan@Ken.Healthnet.org**

Ref: KNH-ERC/ 01/ 3532

Date: 22nd May 2006

Dr. W. K. Otsianyi
Dept. of Surgery
Faculty of Medicine
University of Nairobi

Dear Dr. Otsianyi

RESEARCH PROPOSAL: "PROFILE OF ACUTE HAND INJURIES AS SEEN AT THE KENYATTA NATIONAL HOSPITAL " (P209/12/2005)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** revised version of your above cited research proposal for the period 22nd May 2006 – 21st May 2007.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF A N GUANTAI
SECRETARY, KNH-ERC

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC
The Deputy Director CS, KNH
The Dean, Faculty of Medicine, UON
The HOD, Medical Records, KNH
The Chairman, Dept. of Surgery, UON
Supervisor: Dr. Khainga Stanley, Dept. of Surgery, UON