

Distribution of skeletal trauma in children treated at Muhimbili Orthopaedic Institute

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**DISTRIBUTION OF SKELETAL TRAUMA IN CHILDREN TREATED
AT MUHIMBILI ORTHOPAEDIC INSTITUTE**

By

Musa Omar Kawambwa

**A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree
of Master of Medicine (Orthopaedics and Traumatology) of**

**Muhimbili University of Health and Allied Sciences
October, 2019**

CERTIFICATION

The undersigned certifies that, he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; **“Distribution of skeletal trauma in children treated at Muhimbili Orthopedic Institute”** in (partial) fulfillment of requirement for degree of Master of Medicine (Orthopaedics and Trauma) of Muhimbili University of Health and Allied Sciences

Dr. Cuthbert Mcharo

Supervisor

Date

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I, **Dr. Musa Omar Kawambwa**, declare that, this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for similar or any other degree award.

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Finally, I would like to appreciate the support and encouragement from my beloved wife who have always stood by me and dealt with all of my absence from many family occasions.

DEDICATIONS

This dissertation is dedicated to my mother and my wife

ABSTRACT

Background: Children are vulnerable to trauma because they are unable to recognize and avoid many Potential risks on their own. Paediatric trauma has become a major public health problem and common cause of morbidity and mortality worldwide(4)(5)(6).

Objectives: To explore the distribution of skeletal trauma in children treated at MOI.

Methodology: A prospective descriptive study done on patients aged from 0 to 17 years. This study was conducted at MOI from July 2017 to April 2018. Three hundred and fifty four patients met the inclusion criteria and were recruited after signing the informed consent. Data was collected using guided structured questionnaire. The obtained data were analyzed by SPSS version 23.

Results: During this study a total of 354 children with skeletal trauma were enrolled. Of these 354, male were 245(69.2%) and female 109(30.8%), with approximated male to female ratio of 2:1. The majority were in the school age group of 7-12 years,(35.9%), followed by preschool age group of 3-5 years (31.1%), adolescent age group of 13-17years and the minority were in the infant and toddler age group of 0-2 years(11.4%). Majority 286(80.8%) of the victims came from Dar es salaam city and 68(19.2%) from other regions.

Falls 226(63.8%) were the commonest cause of the trauma, followed by road traffic crashes 96(27.1%) of which motorcycle crashes were 45(46.9%), automobile crashes were 45(46.9%) and bicycle crashes were 6(6.3%). Pedestrians 51(52.0%) and passengers 38(38.8%) were the commonest victims of road traffic crashes. Home environments 219(61.9%) were the commonest place of the injury, followed by Roads 94(26.6%). Others, were play grounds 31(8.8%) and school 10(2.8%). The most injured site were the thigh 110(31.1%) that involved the femur, followed by arm that involved the humerus 80(22.6%) forearm 72(20.3%) and the leg that involved the two bones T/F 39(11.0%) . Joints were 11(3.1%) and it was found that large joint outnumbered the small joints. The least site was the spine (0.8%). Fracture was the

most form of skeletal trauma encountered 351(95.9%) followed by dislocation 8(2.2%) and fracture-dislocation 7(1.9%)

Conclusion: Skeletal trauma in children is a major public health problem and age group of 7 – 12 years was the main group affected. Fracture appeared the most form of skeletal trauma in children, mostly caused by falls in domestic environment, and motor traffic crashes. Pedestrians and passengers are the commonest victims of road traffic crashes

Recommendation: Since most causes of skeletal trauma in children are falls (mostly domestic) and traffic crashes, awareness and communication on the magnitude of the problem and education on the risk factors have to be conveyed to community. Preventive measures to motor traffic crashes require the participation of people both at community and national level.

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ABBREVIATIONS

EMD	Emergency Medical Department
MMED	Masters of Medicine
MOI	Muhimbili Orthopaedic Institute
MTC	Motor Traffic Crash
MUHAS	Muhimbili University of Health and Allied Sciences
R/U	Radius and ulna
T/F	Tibia and fibula
FIG	Figure
SPSS	Statistical Program for Social Sciences

DEFINITION OF KEY TERMS

- Skeleton is the internal structural framework of the body, which is composed of bones, cartilage and joints, that gives shape, support, movement and protection of the body(9)(10)
- A trauma is an injury to the body from an external stimulus, as from physical violence or an accident(32)
- A child is
 1. a person who has not attained maturity or the age of legal majority(32)
 2. a person of either sex between the time of birth and adolescent(33)
 3. a person below the age of 18, unless the laws of a particular country set the legal age for adulthood younger((34)
- A fracture is a breach in the continuity of bone(1)(2) (3)
- A dislocation is a loss of congruency of the articulating surfaces of a joint(1)(2) (3)
- A fracture-dislocation is a fracture occurring in or near a joint that results in a subluxation or dislocation of the joint(1)(2) (3).

CHAPTER ONE

1.0 INTRODUCTION

Skeletal trauma is common in children. It is divided into three major groups of injuries to the musculoskeletal system: these are fractures, dislocations, and fracture-dislocations.

A fracture is defined as breach in the continuity of bone. A dislocation is defined as loss of congruency of articulating surfaces of a joint. Dislocations can be either a complete loss of congruency of the articulating surfaces or a partial dislocation, termed as subluxation.

A fracture-dislocation is a fracture occurring in or near a joint that results in a subluxation or dislocation of the joint(1)(2) (3). Children are vulnerable to skeletal trauma because they are unable to recognize and avoid many Potential risks on their own, and the causes can either be due to accident or physical child abuse. Pediatric trauma is often distressing for parents and clinician, a major public health problem and common cause of morbidity and mortality worldwide(4)(5)(6). Trauma accounts for nearly 50% of deaths after the first year of life in children in the USA and other developed countries (6). In developing countries, it is the third most common cause of death in children after infectious diseases and diarrhea, particularly in the first 5 years of life(6)(7)(8). It is projected that by 2020, pediatric trauma will be the leading disease globally(8)

Overview of skeletal system anatomy

The human skeleton is the internal structural framework of the body. It is composed of around 300 bones at birth, this total decreases to 206 bones by adulthood after some bones have fused together. The bone mass in the skeleton reaches maximum density around age 20(9) The skeletal system is arranged into Axial skeleton that runs along the body's midline and is made up of 80 bones in the following regions: Skull, Hyoid, Auditory ossicles, Ribs, Sternum, and Vertebral column. And Apendicular skeleton which is made up of 126 bones in the following regions: upper limbs, lower limbs, Pelvic girdle and Pectoral (shoulder) girdle.

An articulation, or joint, is a point of contact between bones, between a bone and cartilage.(10).

The human skeleton performs six major functions; support, movement, protection, production of blood cells, storage of minerals, and endocrine regulation.(9). The major anatomic differences between the adult and pediatric skeletal system include the presence of the preosseous cartilage, physis and a stronger osteogenic periosteum. Additional differences between pediatric and adult orthopedic injuries can be attributed to the mineral content of bone and the strength of ligaments. This difference in mineral content allows the absorption of more energy prior to fracture and deformation. In addition, ligaments of children are stronger than the immature bones in which they are attached. As a result, injury patterns are the opposite of the adult population; with pediatric fractures occurring more commonly than ligamentous injuries(11)

Distribution of skeletal trauma

The distribution of skeletal trauma is influenced by the anatomical and biomechanical differences in the skeletal system. Anatomic differences in the paediatric are multiple, varies with age and maturity. These differences include the presence of preosseous cartilage physis and thicker and strong periosteum, hence children sustain a different complex of injuries than adult in similar traumatic situation(12). Material properties or composition of bone in children is quite different from those of adult bone. Children possess the physes, the thick and strong periosteum and the ligaments insert into the epiphyses. As a consequence, traumatic forces applied to an extremity may be transmitted to the physis. This phenomenon has led ligaments injury and dislocation being rare in children. But they do occur and become frequent in adolescence as the transition to skeletal maturity occur(13).

Age and sex also have influences on distribution of skeletal trauma. There is bimodal age distribution of skeletal trauma in children, the first, being in the first year of life and the second being an increase through the adolescent years. The incidence increases as the child begins to interact with the adult world, especially with motor vehicles(14). The prevalence of skeletal trauma differs between boys and girls, these injuries occur more in boys than girls (6)(15)(16)(22)(24).

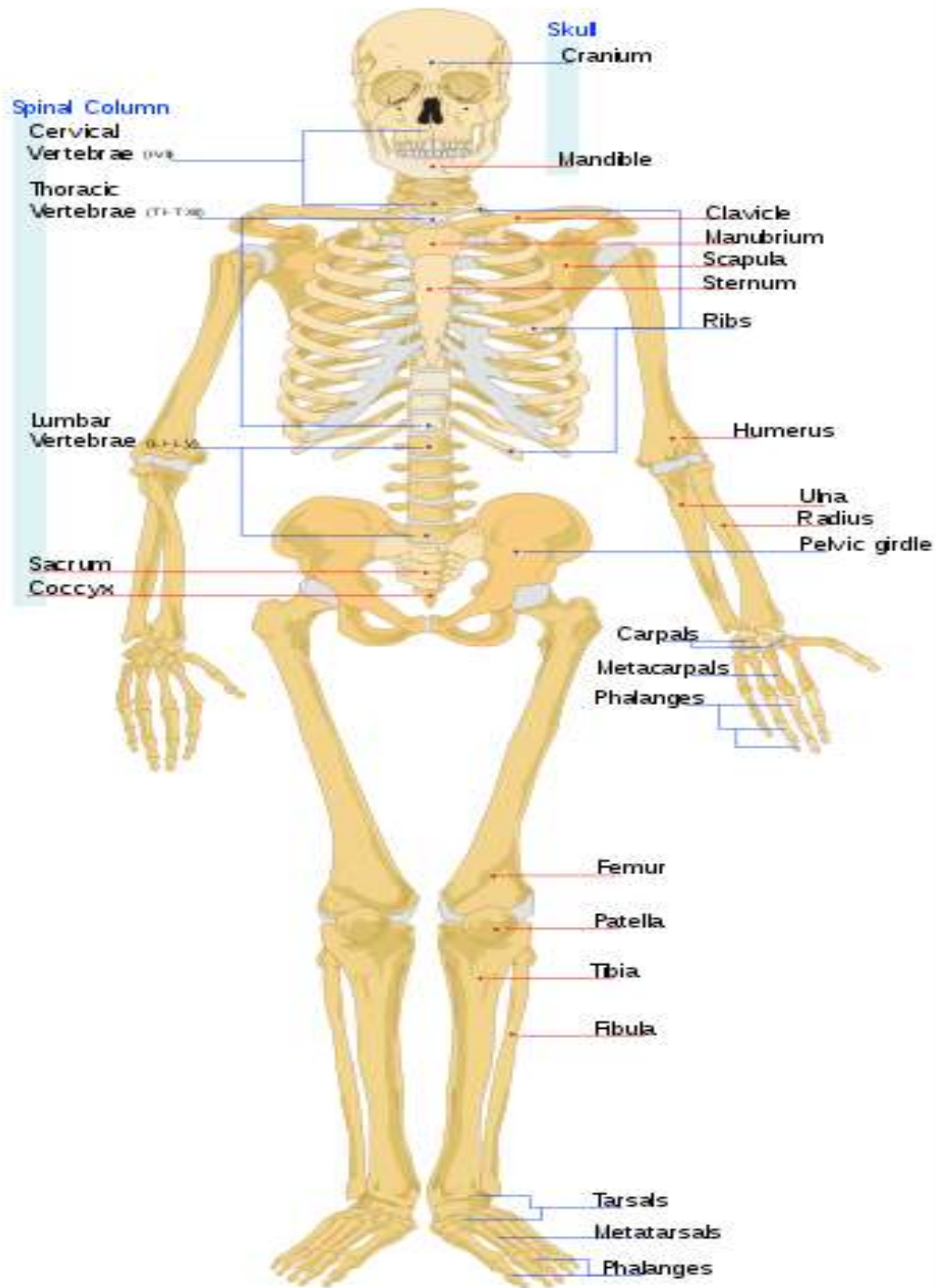


Figure 1: Human Skeleton (9)(10).

1.1 Literature Review

Forms of skeletal trauma

Fractures are most common form of skeletal trauma(15)(17)(18)(19), Dislocations are uncommon while fracture dislocations are rare among children(3)(20).

It has been reported that fractures are a common event in childhood, with considerable variations in the incidence rate from 1.2% to 5% among different studies. This variability may depend on the child's condition, age, and social and environmental factors.(21)

Around one-third of all children suffer at least one fracture before the age of 17 and fractures are the cause of 9% of all injuries in children that come to the attention of health services(22)(23).

Demographic factors

The prevalence of skeletal trauma defers between boys and girls. In a study done by Valerio et al has shown that, the lifetime risk of sustaining a fracture in childhood is approximately 42%-64% in boys and 27%-40% in girls(21) fractures more often occur in boys than girls(6)(16)(22)(24), girls usually sustain fractures at a younger age compared to boys where the study reported that “The highest frequency of fractures occurred at 12 years of age in boys (15.3%) and 9 years of age in girls (13.2%); the lowest frequency of fractures occurred at 2 years of age in boys (2.7%) and 3 years of age in girls (2.5%)”(21). Also in a study done by Tahir et al in Kashmir has shown that, “most fractures occurred in children aged 7–12 years (55.6%) and decreased in younger and older children outside this age group”(6). Although dislocations and fracture- dislocation are uncommon and rare respectively, in the prevalence of these injuries many studies reported high prevalence in boys than girls(3). Some dislocations occur in young ages while others in older age in children, for example Shoulder dislocation have been reported in few cases in adolescents and is very rare in children below five years of age(25) Hip dislocation has been reported to occur in young age, with literature reporting occurrence in children less than 3 years(26)

Anatomical location/site of the injury

Studies have shown contradiction in the location of skeletal injuries in children particularly fractures. Some (22)(27) have shown that the most common fracture sites was the distal forearm, followed by the tibia/fibula shaft and the forearm shaft(22). While another study (23) has shown, the most common site affected in both sexes is the radius/ulna(30%), closely followed by the small bones of the hand and wrist. Also in a study done by Oner et al in Turkey (28), have shown no sex differences in the distribution of fractures in upper and lower extremities where he reported that the most common fracture in both sexes was distal radius fracture (26.4%) followed by distal humeral fractures (13%), finger fractures (11.5%), forearm both bone fractures (8.6%), clavicle fractures (6.6%), and metatarsal fractures (4.3%). With exception to Ankle, elbow and shoulder fractures were more common in girls, whereas wrist and forearm fractures were more in boys.

Though dislocations are uncommon and fracture-dislocations are rare among children they do occur(3). Some studies have shown that, for the large joints, the shoulder **is** the one that most commonly dislocates, followed by elbow joint(3), for the upper extremity shoulder , elbow and wrist are commonly dislocate during sports(29).

Causes of the injury

The causes of skeletal trauma in children may include, fall on the same plane, fall from a height, downhill falls, collision, traffic, crush injury and cut(22),Of these causes some studies have reported that the most common cause of injuries were falls.(19)(22).while others have reported that, Road traffic accident is the most common cause of injury.(7)(8). Motorcycles were responsible for the majority of road traffic crushes followed by automobile.

Pedestrian accounts for the majority of victims followed by passengers, and the commonest mechanism of injury is blunt trauma.(7).Fractures of the long bones were more often caused by falls whereas fractures of the axial skeleton, hand, and foot were more often caused by collisions, other blunt trauma, and traffic accidents. For example, 72% of fractures of the

forearm shaft were caused by falls while 38% of skull fractures were caused by road traffic accidents. Falls accounted for 38% of tibial/fibular shaft fractures(22).

These causes are either due to accident or physical child abuse. But studies have shown unintentional trauma is the most common contributing factor(7)(30). Skeletal trauma is present in a significant number of abused children, age and developmental abilities are key components in raising clinical suspicion for child abuse.(18)(31)

Location of occurrence of the trauma

In occurrence of Skeletal trauma in children, studies have shown skeletal trauma in children most frequently occurred in homes(7)(21), followed by playgrounds and footpaths, sports facilities and educational facilities(21)

1.2 Problem Statement

With increasing motorization activities(especially motorcycle) in both urban and semi-urban communities of developing countries, the incidence of traumatic injuries in children is on the increase(7)

Pediatric trauma is often distressing for parents and the treating clinician, a major public health problem and common cause of morbidity and mortality worldwide. In developing countries Tanzania included, it is the third most common cause of death in children after infectious diseases and diarrhea particularly in the first 5 years of life(6). Musculoskeletal trauma patients including children with skeletal injuries are common at MOI. MOI being a national tertiary facility in Tanzania receives and manages many children with skeletal trauma. However no or little literature is available to date, that show the distribution of these injuries in children in our environment.

1.3 Rationale

MOI being a national tertiary facility in Tanzania offering orthopedics and trauma services, most children with skeletal trauma in Tanzania are referred to this center. Unfortunately no published data that describes the distribution of skeletal trauma in children treated at this center are available. The purpose of this study is to explore the distribution of the skeletal trauma in children treated at MOI. The findings from this study might provide insight on distribution of these injuries and might contribute to development of appropriate preventive measures of skeletal trauma in children.

1.4 Study Questions

1. How is the skeletal trauma in children distributed? and
2. What are the forms of this injury?

1.5 Objectives

1.5.1 Broad objective

To explore the distribution of skeletal trauma in children who are treated at MOI between July 2017 and April 2018.

1.5.2 Specific objectives

1. To determine the types/forms of skeletal trauma in children treated at MOI between July 2017 to April 2018
2. To determine the demographic factors of children treated for skeletal trauma at MOI between July 2017 to April 2018
3. To determine the anatomical location/site of skeletal trauma in children treated at MOI between July 2017 to April 2018
4. To determine the causes of injuries of skeletal trauma in children treated at MOI between July 2017 to April 2018
5. To determine the location of occurrence of skeletal trauma in children treated at MOI between July 2017 to April 2018

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study design

This was a hospital based prospective descriptive cross-sectional study.

2.2 Study area/period

The study was carried out at the emergency department of Muhimbili Orthopaedic Institute from July 2017 to April 2018. Muhimbili Orthopaedic Institute is a major and is the only tertiary hospital offering Orthopaedics and trauma and neurosurgical services in Dar es Salaam and neighboring regions. It is the main referral center for patients with musculoskeletal injuries from Dar es Salaam City, neighboring regions and the entire country.

2.3 Study population

The study population included all children aged 0-17years with skeletal trauma presented at the emergency department of MOI between the mid July 2017 and mid January 2018.

2.4 Sampling procedure

The convenient sampling technique was the sampling procedure

2.5 Inclusion criteria

All children aged 0-17 years with skeletal trauma whose parents had consented during the study period (1. A child is a person below the age of 18, unless the laws of a particular country set the legal age for **adulthood** (34). 2. A child is a person of either sex between the time of birth and adolescence (33).)

2.6 Exclusion criteria

A child whose next of kin would refuse to consent

2.7 Sample size estimation

The proportion of 30% (15) was used to obtain the sample size by using the following formula

$$N = Z^2 p (1-p) / E^2$$

Where N is a sample size

Z= 1.96 at 95% confidence interval

P= proportion of children with skeletal trauma which is 30% (15).

E= is the margin error rate 5%

Substituting these values to the equation above; $N = 1.96^2 \times 0.30(0.70) / (0.05)^2$; $N = 322$.

10% to be added to increase the internal validity of the study, so $N = 354$.

Therefore the minimum sample size was 354 children with skeletal trauma treated at Muhimbili Orthopaedic Institute in the period of July 2017 to April 2018.

2.8 Research instruments

Standard structured guided Questionnaire was used in a face-to-face interview with patient/relative. Pre-testing of the questionnaire was done one week before the beginning of the study. One trained researcher assistant was available for interviewing patients and data entry. The x-ray films for musculoskeletal injuries were done at MOI as per institute protocol. The interpretations and recording of x ray films was done by the author.

2.9 Data collection tools and technique

Data was collected using a standard structured questionnaire. Information collected include, patient demographic information, body region injured, type of skeletal trauma (fractures, dislocations and fracture-dislocation), cause of injury and the locations of occurrence of skeletal injury.

Other parameter recorded was time interval between injury and arrival at EMD of Muhimbili Orthopaedic Institute. Diagnosis reached through clinical history, examination and radiological investigations (e.g. x ray).

Also the information about diagnosis and registration number were retrieved from patient's file and admission register books.

2.10 Data processing

The information obtained from the filled questionnaires was checked for quality, before entering into Statistical Package for Social Studies (SPSS)

2.11 Data analysis

The obtained data was analyzed by SPSS program version 23. Categorical variables were described by Frequency distributions, and continuous variables were described by means and standard deviation. Chi-square was used to test for association of categorical variables. P-value of 0.05 was considered significant.

2.12 Ethical Issues

Before conducting the study, the proposal was ethically cleared by the MUHAS ethical clearance board. Written informed consent was obtained from a relative of the patient who participated in the study after being informed of the aims of the study and confidentiality, and assuring him/her that refusal to participate would not affect the patient management.

CHAPTER THREE

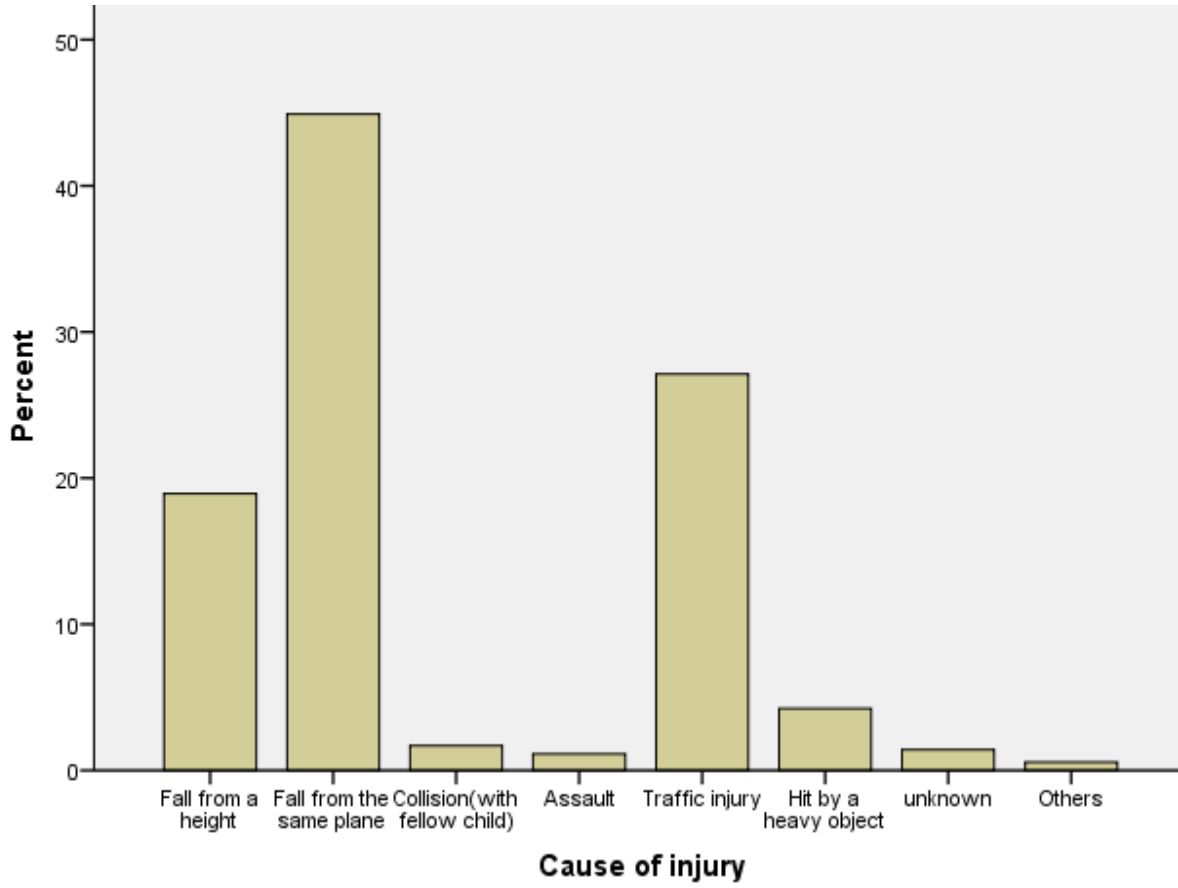
3.0 RESULTS

A total of 354 children aged 0 to 17 years with skeletal trauma were treated at MOI from mid July 2017 to mid January 2018 and were enrolled in the study. Males were 245(69.2%) and females were 109(30.8%), with approximated male to female ratio of 2:1. The majority of patients were in the school age group of 7-12 years 127 (35.9%), followed by preschool age group of 3-5years 110(31.1%), adolescent age group of 13-17years 76(21.5%) and the minority were in the infant and toddler age group of 0-2years 41(11.6%.) patients. majority of the patients were in primary school and were coming from Dar es salaam (See table 1)

Figure 2 shows causes of skeletal trauma in which majority of trauma are due to falls 226(63.8%), followed by road traffic crashes which accounted for 96(27.1%) in which motorcycle crushes were 45(46.9%), **automobile** crushes were 45(46.9%) and bicycle crushes were 6(6.3%). Of the victims of road traffic crushes majority were pedestrians 51(52.0%) followed by passengers 38(38.8%), motorcyclists 5(5.1%), bicyclist 3(3.1%), and driver was one which contributed one percent. Other causes were hit by heavy object 15(4.2%), collision with the fellow child 6(1.7%), assault 4(1.1%) and others were cut oneself and bite from fellow child 2(0.6%)

Table 1: Social-demographic characteristics of the study population

Variable	Frequency	Percentage
Age group		
0 – 2	41	11.6
3 – 6	110	31.1
7 – 12	127	35.9
13 – 17	76	21.5
Total	354	100
Gender		
Male	245	69.2
Female	109	30.8
Total	354	100
Residency		
Dar es salaam	286	80.8
Other region	68	19.2
Total	354	100
Dar es salaam		
Kinondoni	119	41.6
Ubungo	68	23.8
Ilala	58	20.3
Temeke	32	11.2
Kigamboni	9	3.1
Total	286	100
Education		
Not yet in school	96	27.1
In Nursery/Preschool	48	13.6
In primary school	138	39.0
In Secondary school	55	15.5
Primary school dropout	17	4.8
Total	354	100



]

Table 2: Cross tabulation between region/site of the body injured and Causes of injury

Count		Cause of injury								Total
		Fall from a height	Fall from the same plane	Collision (with fellow child)	Assault	Traffic injury	Hit by a heavy object	unknown	Others	
Region/Site of the body injured	Head	3	0	0	1	6	2	0	0	12
	Spine	1	1	0	0	1	0	0	0	3
	shoulder	1	4	0	0	0	0	0	0	5
	Arm	21	49	0	1	8	0	1	0	80
	Forearm	13	49	0	1	6	2	1	0	72
	Hand	0	4	0	0	0	2	0	2	8
	Pelvic	1	0	0	0	5	0	0	0	6
	Thigh	22	41	2	0	37	6	2	0	110
	Leg	2	6	3	0	26	1	1	0	39
	Foot	0	1	0	1	4	2	0	0	8
	Joint	3	4	1	0	3	0	0	0	11
Total		67	159	6	4	96	15	5	2	354

P – Value: 0.000

Femur, Humerus and R/U fractures were mostly caused by falls followed by motor traffic crushes, while T/F fractures and Skull fractures were mostly due to m.t.c, followed by falls. Clavicle fractures were commonly due to falls (Table 2).

Place where injury occurred

Domestic environment (home) was the most common place of injury (Table 3), about 219(61.9%) of all injuries occurred at home, followed by 94(26.6%) roads.

Table 3: Distribution of places where skeletal trauma in children occurred

Place	Frequency	Percent
Home	219	61.9
School	10	2.8
Sports	31	8.8
Road	94	26.6
TOTAL	354	100

Anatomical location/site of injury

The most injured site was the thigh that involved the femur bone 110(31.1%), followed by the arm that involved humerus 80(22.6%).(Fig. 3)

Isolated fractures of radius were rare 4(1.1%) but majority of injury of forearm involved both radius and ulna 71(20.1%), likewise injuries to the leg, involved both bones T/F 44(12.5%) as shown in fig.4.

Majority of long bone fracture occurred in M/3, mostly femur fractures, followed by distal fractures which is mostly humerus, and the least one was the P/3 fracture as shown in table 4.

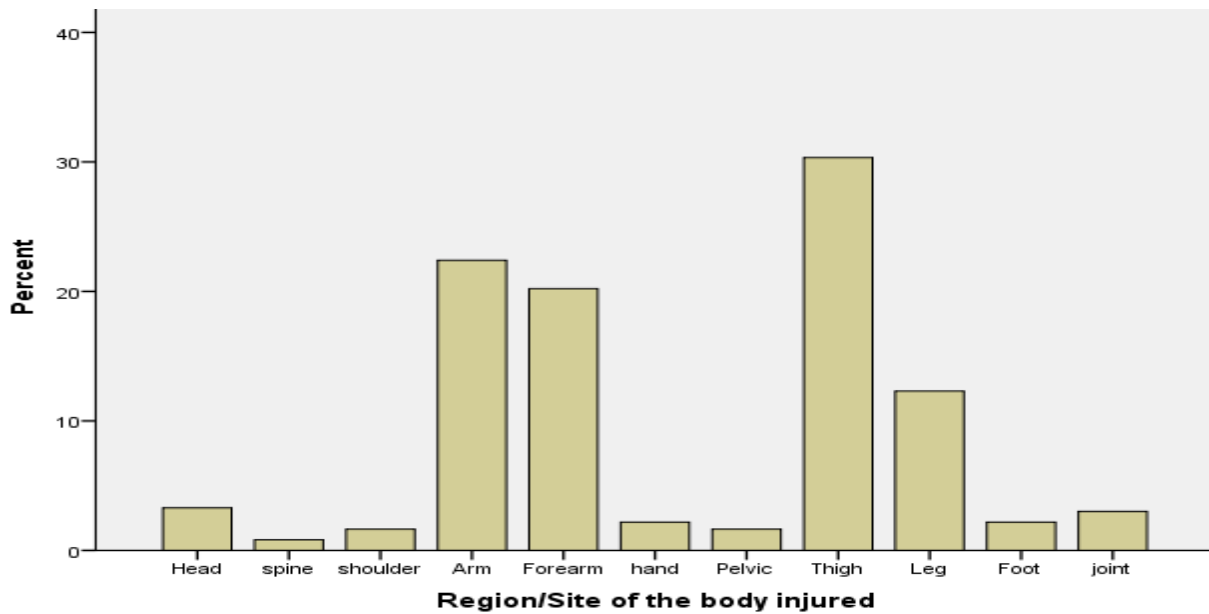


Figure 3: Distribution and frequency of regions/sites of the body injured

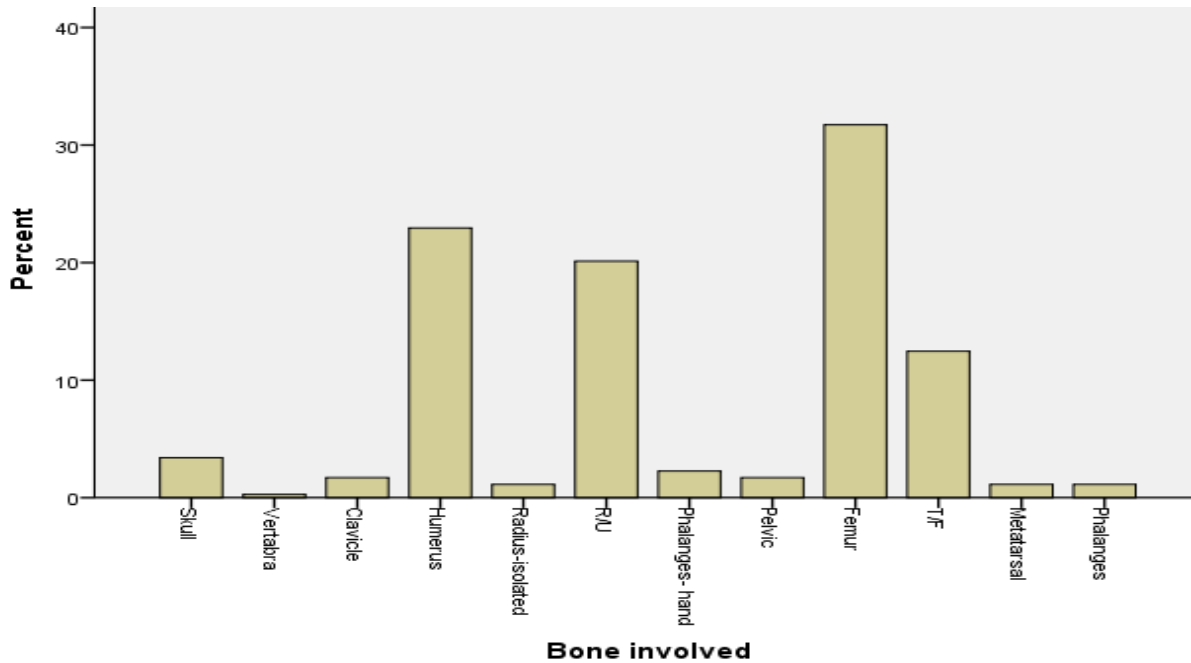


Figure 4: Distribution of bone involved in skeletal trauma in children

Table 4: Cross tabulation between bone involved and location of fracture

		Location of the fracture					Total
		Proximal	P/3 shaft	M/3 shaft	D/3 shaft	Distal	
Bone involved	Clavicle	0(0.0%)	0(0.0%)	6(100%)	0(0.0%)	0(0.0%)	6(100%)
	Humerus	2(2.5%)	3(3.7%)	10(12.3%)	2(2.5%)	64(79%)	81(100%)
	Radius-isolated	0(0.0%)	1(25%)	0(0.0%)	0(0.0%)	3(75%)	4(100%)
	R/U	1(1.5%)	0(0.0%)	38(55.9%)	18(26.5%)	11(16.2%)	68(100%)
	Femur	6(5.4%)	4(3.6%)	72(64.3%)	25(22.3%)	5(4.5%)	112(100%)
	T/F	1(2.3%)	1(2.3%)	25(58.1%)	13(30.2%)	3(7.0%)	43(100%)
Total		10(32%)	9(2.9%)	151(48.1%)	58(18.5%)	86(27.4%)	314(100%)

P – Value: 0.000

Note: 314 = Total number of fractures in the involved long bones and their anatomical locations in the bones.

Form of injury

Majority of skeletal trauma encountered during the study period were in the form of fracture (Fig.5).

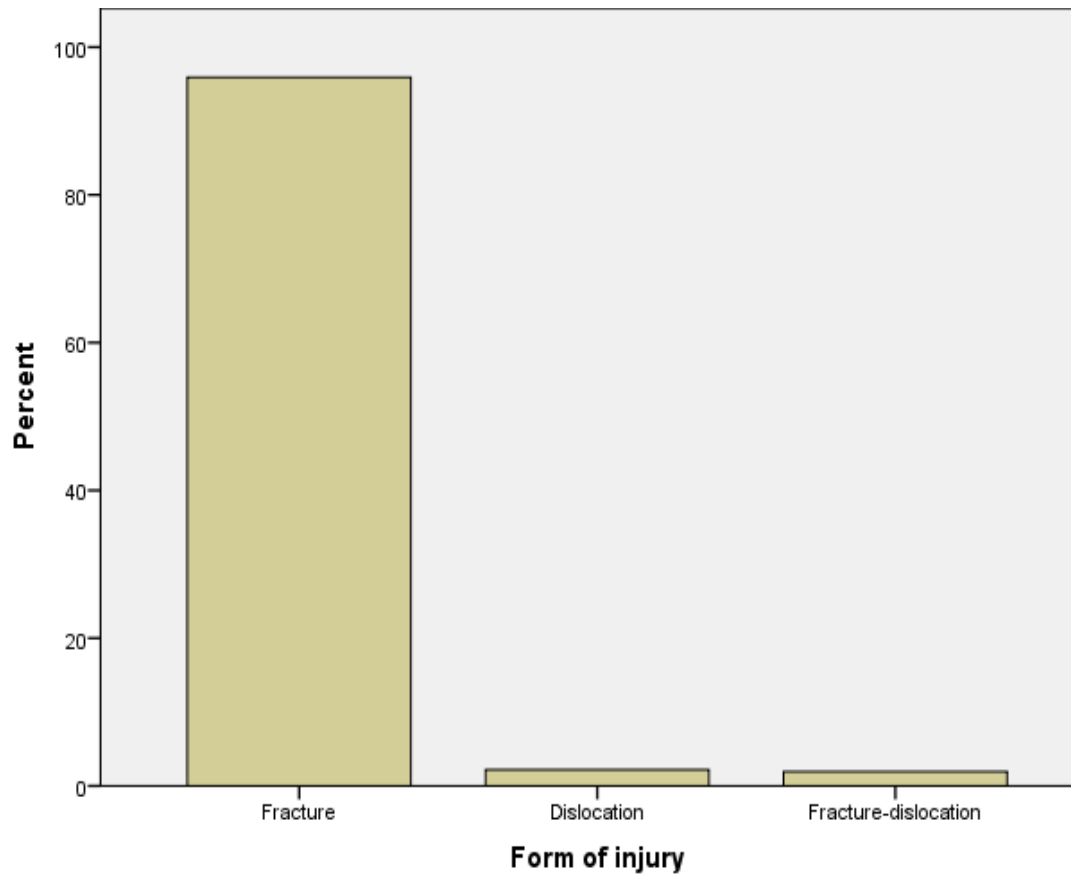


Figure 5: Distribution of forms of skeletal trauma in children

CHAPTER FOUR

4.0 DISCUSSION

Pediatric trauma is a major public health problem and common cause of morbidity and mortality worldwide. It is the third most common cause of death in children after infectious diseases and diarrhea in developing countries. Often it is distressing for parents and the treating clinician.

This study has provided insight into distribution of skeletal trauma in children at National Hospital in Tanzania. The findings are likely to reflect the real picture of the distribution of these injuries in other hospitals in Tanzania as well as other low income countries.

During the study period, a total number of 354 children with different forms of skeletal trauma presented to MOI hospital, of these 354, males were 243(69.4%) and females 107(30.6%), with approximated male to female ratio of 2:1. The majority of patients were in the school age group of 7-12 years, which accounted for 36.3%. These findings seem to be similar with other studies in Africa, such as studies done in 2015 by Edomwony et al in Nigeria (3), and in 2015 by Qayoom et al in Nigeria(6), In south America, a study done by Antônio Pinto J. et al in Brazil(16), In Europe a study done by Hedström et al in Sweden(22), All these studies have reported that males outnumbered females in sustaining skeletal trauma. However a study done by Valerio et al in 2010(21) also had similar findings where he reported that the lifetime risk of sustaining a fracture in childhood is approximately 42%-64% in boys and 27%-40% in girls.

This study showed most affected age group is that of age group of 7 – 12years 127(35.9%), followed by preschool age group of 3-5(31.1%), adolescent age group of 13-17 years(21.5%) and the minority were in the infant and toddler age group of 0-2(11.4%). these results conform with a study done by Qayoom et al in Nigeria in 2015 which reported that the most fractures occurred in children aged 7–12 years and decreased in younger and older children

outside this age group(6). The reason why the males became more victim of the skeletal trauma than females, this could be explain by the fact that at this age group, boys´ participation in vigorous physical activity or contact sport may increase exposure to injuries like fall related trauma. Also at this age group motor ability increases, as motor ability increases, the involvement in physical activities increases and the risk of injuries increases, particularly in boys(21)

In this study, falls in general were the leading cause of trauma in which fall **on** the same plane (from a standing height) were (44.9%) and fall from a height were (18.9%) making the total falls being (63.8%), followed by road traffic crashes which accounted for (27.1%) in which motorcycle crushes were (46.9%), automobile crushes were (46.9%) and bicycle crushes were (6.3%). These findings are in agreement with the studies done by Kihiko et al in Kenyatta hospital in Kenya in 2010(19) and Hedstron et al in 2010(22). In contrast with these findings the study done in northwestern Tanzania reported road traffic crushes to be the commonest cause of blunt paediatric injuries(7) this difference could be explained by the fact that, this study was only about skeletal trauma, while the study in northwestern Tanzania was about general pediatric injuries. Of the victims of road traffic crushes majority were pedestrians (52.0%), followed by passengers (38.8%), Motorcyclists (5.1%), Bicyclist (3.1%) and Driver (1%), this finding shows to conform with other studies elsewhere (7)(19)(22).. Other causes were hit by heavy object (4.3%), collision with the fellow child (1.7%), assault (1.1%) and others like cut oneself on the finger and bite on the finger from fellow child (0.6%).

This study showed that, the majority (62%) of paediatric skeletal trauma occurred at domestic environment, which is in agreement with other studies done elsewhere (6)(7)(19)(21), followed by road (26.6%), playground(8.6%) and (2,9%) occurred on school premises. Most of the domestic injuries are mainly due to fall **on** the same plane while playing with fellow children and fall from a height like coaches and tables. Injuries which are sustained in playground are due to falls and contacts. In school, these injuries occurred due to falls.

It was found in this study that the most injured site is the thigh, around 110(31.1%) of all skeletal trauma occurred in the thigh that involved the femur bone, followed by arm that involved the humerus 80(22.6%) and 72(20.3%) at the leg that involved the two bones T/F. The least of site for the trauma to occur was spine which involves joints and the vertebra bones. These results showed to contradict with other studies(22)(23)(27), where, some have shown that the most common fracture sites was the distal forearm(22)(27) followed by the tibia/fibula shaft and the forearm shaft(22), while another study (23) has shown that the most common site affected in both sexes is the radius/ulna (30%), closely followed by the small bones of the hand and wrist. This variation in outcome had been observed and mentioned in literature(22) that, some studies have shown contradiction in the location of skeletal injuries in children particularly fractures. In this study Joints were involved and contributed about 3.1% of all skeletal injuries and was found that the large joints outnumbered the small joints in the ratio of 2:1 and the most involved small joints are those of fingers. The large joints involved include shoulder, wrist, hip, knee, and ankle. Also this study found that isolated fractures of radius were rare (0.9%) but majority of injuries of forearm involved both radius and ulna (20.1%) and the injuries to the leg involved both tibia and fibula. This findings showed to differ with the findings from study done by Oner et al in Turkey in 2015(28) which reported that isolated radius fractures were more prevalent accounted about (26.4%) than forearm both bone fractures which were (8.6%).

In this study the long bones exhibited various distribution of fracture locations, majority of long bone fracture were M/3, mostly of femur, followed by distal fractures mostly humerus and the least one was the P/3 fractures. This study showed that distal humerus was the second most location for skeletal trauma. This finding seems to be similar with the finding from the study done by oner et al in Turkey which reported that distal humerus is the second site for fracture (28).

Most studies have shown that, fractures are more common form of skeletal trauma(15)(18) (19), and dislocations are uncommon while fracture dislocations are rare among children(3)(20). These seem to be similar with the results in this study that have shown that Majority of skeletal injuries were fractures 351(95.9%), followed by dislocations 8(2.2%) and Fracture-dislocations 7(1.9%).

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDECTIONS

5.1 Conclusion

The skeletal trauma in children is a public health problem. Boys are twice affected by skeletal trauma than girls and the school age group of 7-12 years being the most age group affected, falls and road traffic crushes are the two major causes of skeletal trauma in children and main victims of road traffic crushes were pedestrian and passengers. Home was a major place of occurrence for skeletal trauma in children followed by roads.

Fractures appeared to be the major form of skeletal trauma mostly occurred in long bones and commonly at mid third of femur and distal humerus, followed by both bones of radius and ulna and both bones of tibia and fibula.

5.2 Recommendations

Knowledge on environmental causes of skeletal trauma is a primary step to formulating preventive measures. As most skeletal trauma occurred in the home environment followed by roads, efforts should be directed at reducing childhood injuries in the home environment as well as road traffic crashes.

Preventive measures to road traffic crushes require the participation of people both at community and national level.

5.3 Study Limitation

This was a single centre study with small sample size could not reflect the actual picture of distribution of skeletal trauma in children in the community.

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APPENDICES

Appendix I: Questionnaire

DISTRIBUTION OF SKELETAL TRAUMA IN CHILDREN TREATED AT MUHIMBILI ORTHOPAEDIC INSTITUTE.

PART A: GENERAL INFORMATION

1. Form number:

2. Registration NO.

3. Age:

4. Sex: a) Male..... b) Female

5. Place of residency:

6. Education:
 - a) Not yet in school.....

 - b) In Preschool/Nursery.....

 - c) In Primary school

 - d) In Secondary school

 - e) Attained primary school, no longer in school.....

7. Date of injury:

8. Date of admission

9. Place where the injury occurred:

- a. Home.....
- b. School.....
- c. School.....
- d. Sports.....
- e. Others: specify.....

10. Cause of injury:

- a) Fall from a height.....

- b) Fall from the same plane.....

- c) Collision (with fellow).....

- c) Assault.....

- d) Traffic injury:
 - i) Vehicle.....as.....

 - ii) Motorcycle.....as.....

 - iii) Bicycle.....as.....

- e) Others: (specify).....

11. Body region injured:

- a. Head.....
- b. Spine.....
- c. Shoulder.....
- d. Arm.....
- e. Forearm.....
- f. Hands.....
- g. Thigh.....
- h. Leg.....
- i. Foot.....
- j. Joint (specify).....
- k. Others (specify).....

PART B: INFORMATION FROM RADIOLOGICAL FINDINGS

12. Types/form of injury;

- a) Fracture (specify).....
- b) Dislocation (Specify).....
- c) Fracture-dislocation (specify).....

THANK YOU FOR YOUR PARTICIPATION

Appendix II: Informed Consent Form

Consent to participate in the study titled “DISTRIBUTION OF SKELETAL TRAUMA IN CHILDREN TREATED AT MOI”

Greetings: I am Dr. Musa O. Kawambwa, Orthopaedics and Traumatology resident, I am conducting a study on distribution of skeletal trauma in children treated at MOI, starting from June 2017 to February 2018.

Purpose of the Study: To describe the distribution of skeletal trauma in children treated at MOI. The information that will be obtained will stimulate other studies on strategies of intervention and prevention of these injuries in children.

Participants: you are among the participants in this study, if you are agree to participate in this study, you will be asked questions and examined.

Confidentiality: All the information obtained will be kept confidential. Only an identification number will be used.

Risk: We ensure that there is no harm in engaging into the study.

Rights to refuse: you have a right to refuse to participate in the study. Your refusal will not affect in your management in any way.

Benefits: If you agree to participate in this study, your examination and investigation will be followed-up closely by the investigating doctor. We hope that the obtained information from this study will benefit others as well.

Who to contact: If you have any other questions regarding this study, feel free to contact me, the investigator, Dr. Musa O. Kawambwa, Muhimbili Orthopaedic Institute, P.O. Box 65474, Dar es Salaam, Tel No 0622 728 167

If you have any questions concerning your rights as a participant, you may contact Dr. Joyce Masalu, Chairperson of the college research and publication committee, P.O. Box 65001, Dar es Salaam. Telephone: 2150302/6.

Signature

Do you agree to participate.

Participant does not agree.....

I,have read the consent form and my questions have been answered and I agree to participate in this study.

Signature of Participant's relative.....

Signature of Investigator.....

Date of signed consent.....

Appendix III: Fomu Ya Ridhaa Ya Kushiriki Utafiti

Ridhaa ya Kushiriki Utafiti Kuhusu kuangalia mgawanyo wa majeraha(mivunjiko/miteuko) ya mifupa itokanayo na ajali kwa watoto wanaotibiwa katika taasisi ya mifupa MOI- Julai 2017- Julai 2018.

Salaam!

Mimi naitwa Dr. Musa O. Kawambwa ni mwanafunzi wa shahada ya uzamili chuo kikuu cha tiba Muhimbili, nafanya utafiti juu ya mgawanyo wa majeraha(miteuko/mivunjiko) ya mifupa itokanayo na ajali kwa watoto watibiwao MOI kati ya Julai 2017 hadi Julai 2018

Dhumuni la utafiti huu: Kupata taarifa sahihi ya mgawanyo wa majeraha(miteguko/mivunjiko) ya mifupa kwa watoto wanaotibiwa katika Taasisi ya mifupa Muhimbili

Ushiriki: Kama utakubali kushiriki kwenye utafiti huu utaulizwa maswali,na mtoto atachunguzwa kuhusu ugonjwa wake.

Usiri: Taarifa zote za uchunguzi zitakuwa siri na zitaingizwa kwenye kompyuta, ni nambari ya utambulisho tu ndiyo itakayotumika, jina halitanukuliwa.

Madhara: Hakuna madhara yoyote yatakayotekea katika kushiriki katika utafiti huu.

Haki ya kukataa kushiriki katika utafiti huu: Kushiriki katika utafiti huu ni hiari, na kutokukubali kushiriki hakutoathiri haki yako ya matibabu.

Faida ya kushiriki kwenye utafiti: Kama utakubali kushiriki kwenye tafiti huu, Faida utakazo pata ni pamoja na kuonwa na kufuatiliwa vipimo kwa ukaribu na daktari anayefanya utafiti. Tunatumaini kwamba taarifa zitakazopatikana zitawanufaisha na wengine pia

Kwa mawasiliano zaidi: Kama una maswali au maelezo kuhusu utafiti huu, uwe huru kuwasiliana nami, Dr. Musa O, Kawambwa, Muhimbili Orthopaedic Institute, P.O. Box 65474, DSM. Simu: 062272816. Kama una maswali kuhusu haki yako kama mshiriki wasiliana na Dr. Joyce Masalu, Mwenyekiti wa kamati ya utafiti, P.O. Box 65001, DSM. Simu +255 754 757577.

Je, umekubali kushiriki?

Mimi.....Nimesoma maelezo nakuyaelewa vizuri, na nimekubali kushiriki kwenye utafiti huu.

Sahihi ya Mshiriki.....

Sahihi ya Mtafiti.....

Tarehe