

**PREVALENCE, CLINICAL PRESENTATION AND RISK FACTORS OF
OCULAR TRAUMA AT THE UNIVERSITY TEACHING HOSPITALS
EYE HOSPITAL, LUSAKA, ZAMBIA**

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**A Dissertation Submitted to the University of Zambia in Partial Fulfilment of
the Requirements of the Degree of Master of Medicine in Ophthalmology**

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By Dr. John Yotham Mvula

2019

DECLARATION

I, Dr. John Yotham Mvula, hereby declare that this dissertation is a product of my own work and that it has never been submitted in part or in full for a degree, diploma or other qualification at this or any other university.

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APPROVAL

This dissertation of **Dr. John Yotham Mvula** is approved as partial fulfilment of the requirement for the award of the Master of Medicine in Ophthalmology degree of the University of Zambia.

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ABSTRACT

The eye is an external organ, and so it is easy to injure. For this reason, eye injuries are common among people all over the world. It is reported that up to 20% of adult population has had ocular trauma at some point in their lives. The reason for conducting this study was to explore ocular trauma presentation and risk factors at University Teaching Hospitals (UTH) Eye Hospital, in Lusaka Zambia.

To investigate the clinical presentation and risk factors of patients presenting with ocular trauma at UTH Eye Hospital.

This was a hospital based, cross sectional study. It was carried out at the UTH Eye Hospital. The study was conducted over a period of 3 months, from 1st January to 31st March 2018, with a predetermined sample size of 84. All ocular trauma patients presenting to the study site who met the inclusion criteria were recruited for this study. Patients answered a structured questionnaire and were examined to determine the clinical presentation of ocular trauma. For the calculation of the prevalence the numbers taken were from 1st April 2017 to 31st March 2018.

A total of 84 patients with ocular trauma were recruited for this study. The respondents' ages ranged from 7 months to 57 years old. The prevalence was calculated to be 7.25%. There were 75% (n = 63) males and 25% (n = 21) females, giving a 3:1 male to female ratio. 40.5% (n = 34) of the respondents had injuries to the right eye and 44.0% (n = 37) to the left eye giving a uni-ocular involvement of 84.5% (n = 71) while the remaining 15.5% (n = 13) had injuries to both eyes.

The commonest object of injury in the respondents was a stick or some woody object, presenting with 17.9% (n = 15). Most respondents 46.4% (n = 39) were injured within the home environment followed by the work place 21.8% (n = 18) . The majority of the respondents 60.7% (n = 51) had normal visual acuity (i.e ranging from 6/6 to 6/18) and 29.8% were blind (VA worse than 3/60).

In this study the prevalence of ocular trauma was determined to be 7.25%. Object of injury was statistically significant with a p-value of 0.002. No statistical significance was noted in other risk factors.

Ocular trauma is a common presentation at UTH Eye Hospital with a prevalence of 7.25%. Most injuries took place in the home environment followed by the workplace.

Many respondents presented within 24 hours after the injuries and their visual acuities were largely normal i.e ranging from 6/6 to 6/18.

To sensitise parents in homes and workers in work places on ocular trauma. To institute work place policies that makes it mandatory for workers to wear protective wear. And to create an ocular trauma registry that would be mandated to keep data and disseminate information about ocular trauma in Zambia.

Key Words: Ocular Trauma, Prevalence.

DEDICATION

I dedicate this work to my beloved wife, Catherine, and to my children, Yandika and Kondwani, without whose support this work would not have materialised.

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ABBREVIATIONS AND ACRONYMS

AAO	-	American Academy of Ophthalmology
BE	-	Both Eyes
BETT	-	Birmingham Eye Trauma Terminology
ERES	-	Excellence in Research Ethics and Science
ICO	-	International Council of Ophthalmology
IOFB	-	Intraocular Foreign Body
IOP	-	Intraocular Pressure
IRB	-	Institutional Review Board
LE	-	Left Eye
MMED	-	Master of Medicine
MOH	-	MOH
OPD	-	Outpatient Department
PI	-	Principal Investigator
RE	-	Right Eye
RTA	-	Road Traffic Accidents
SPSS	-	Statistical Package for Social Sciences
STP	-	Specialist Training Programme
US	-	United States
USA	-	United States of America
USEIR	-	United States Eye Injury Registry
UTH	-	University Teaching Hospital
VA	-	Visual Acuity
WHO	-	World Health Organisation

CHAPTER ONE: INTRODUCTION

1.1 Introduction

According to Gibson (1961), an injury is damage to a person or to a tissue/organ, e.g. the eye, caused by a transfer of physical energy. There are five forms of physical energy that can cause injury, namely: mechanical, thermal, chemical, electrical and radiant.

According to British Medical Journal best practice webpage, ocular trauma refers to any injury to the eye. The injury may have been due to mechanical trauma (blunt or penetrating), chemical agents, or radiation (ultraviolet or ionizing) (Adelman and Raducu, 2017).

The eye, being an external organ, is prone to injuries. Eye injuries are common among people all over the world (Sandford-Smith, 2004). It is reported that up to 20% of adult population has had ocular trauma at some point in their lives (Wong et al., 2000).

Over the years, there has been an increase in the number of ocular trauma cases seen at the University Teaching Hospitals (UTH) Eye hospital. Anecdotal evidence from the theatre records revealed three fold increase in the number surgeries that had been conducted at UTH in 2007 and in 2016 as a result of ocular trauma. No numbers of cases seen in the outpatient department (OPD) were comparable because data from previous years were not available from the hospital records. But patients continue to be seen in greater numbers every week suffering from minor and major ocular trauma incidences.

Ocular trauma is an important, preventable, worldwide public health problem (Whitcher et al., 2001). Every year, approximately 2 million eye injuries occur in the United States (McGwin et al., 2005), of which more than 40,000 result in permanent visual impairment (Mieler, 2001). Pizzarello (1998) stated that injury is probably the first or second cause of monocular blindness in the world.

Worldwide research in ocular trauma has increased in recent years because of the devastation of the condition to national economies (Sthapit et al., 2012). Ocular trauma is the most important cause of unilateral loss of vision in developing countries. Up to 5% of all bilateral blindness is a direct result of trauma (Thylefors, 1992).

Two studies in Nigeria showed that prevalence of ocular trauma ranged from 4% (Ajayi et al., 2014) to 4.9% (Monsudi and Ayanniyi, 2013). However, there is generally paucity of data on prevalence of ocular trauma in the sub-Saharan region and in Zambia.

This study was done to investigate the presentation of ocular trauma at UTH Eye Hospital.

1.2 Statement of the Problem and Rationale

Ocular trauma affects every spectrum of society. The burden of ocular trauma in developing countries such as Zambia, is heavy (Serrano et al., 2003). In Zambia, and Lusaka in particular, there was no baseline data about ocular trauma. Studies from other regions of the world are available but they cannot be extrapolated into the Zambian context.

1.3 Rationale

Anecdotal evidence shows that there is a substantial number of ocular trauma cases at the UTH Eye Hospital. A comparison of one year data about surgeries obtained from emergency (phase 5) operating theatre as a result of ocular trauma conducted at the UTH Eye Hospital in 2007 and in 2016 was done. They showed that ocular trauma related surgeries were 51 in 2007 and 162 in 2016. This is a threefold increase in the number of surgeries from ocular trauma in 2016 compared to 2007.

Eye trauma largely remains a neglected public health problem and yet many cases of ocular trauma can be prevented by appropriate interventions (Bhupally et al., 2015).

However, there is deficiency of data on presentation and risk factors for ocular trauma.

1.4 Objectives

1.4.1 Main Objective

To investigate the prevalence, clinical presentation and risk factors of patients presenting with ocular trauma at UTH Eye Hospital.

1.4.2 Specific Objectives

- i. To estimate the prevalence of ocular trauma.
- ii. To determine the types of ocular trauma.
- iii. To establish the common causes of ocular trauma
- iv. To identify the socio-demographic factors associated with ocular trauma.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Studies in which the incidence of eye injury has been examined have produced varied results, in part because of differences of study designs. When considering eye injuries requiring hospital admission, incidence rates have ranged from 8 to 57 per 100,000 (Cillino et al., 2008). Despite the heterogeneity of results, these studies provide important information regarding the epidemiology of eye injuries.

Like any other part of the body, eyes are not exempted from these injuries despite being well protected by the eyelids, projected margins of the orbit, the nose and the cushion of fat from behind (Yogeswari et al., 2006). Although the eyes represent only 0.1% of the total body surface and only 0.27% of the anterior body surface, their significance to individuals and society is disproportionately higher (Sengupta et al., 2016).

The extent of trauma may range from simple superficial injuries to devastating penetrating injuries of the eyelids, lacrimal system, and globe (Garg, 2009). The world over, eye injuries are being recognised as a significant health problem. In some instances, this can be disabling. The American National Research Council reported, that injury is probably the most under-recognised major health problem facing USA today (USEIR, n.d.).

In this era of high-speed traffic and industrialisation, the incidence of injuries is generally increasing (Yogeswari et al., 2006). Epidemiological profile of ocular trauma varies in developing and developed countries. Economical background, public awareness and availability of resources are responsible for this difference. (Karve et al., 2017)

The study of injury presents unparalleled opportunities for reducing morbidity and for realizing significant savings in both financial and human terms (USEIR, n.d.)

2.2 Classification of Ocular Trauma

In this study, the Birmingham Eye Trauma Terminology (BETT) was used as the standard for the mechanical trauma classification. This has been in use since 1996, when it was introduced by Ferenc Kuhn. Prior to that year, documentation of ocular injuries were not standardised, hence leading to confusion of terms. Using a standardised language in ocular traumatology is mandatory to avoid ambiguity between health care professionals, regardless of the type of communication (Kuhn, 2008).

A schematic diagram to indicate some of the terms that were used in this study is shown in Figure 1.

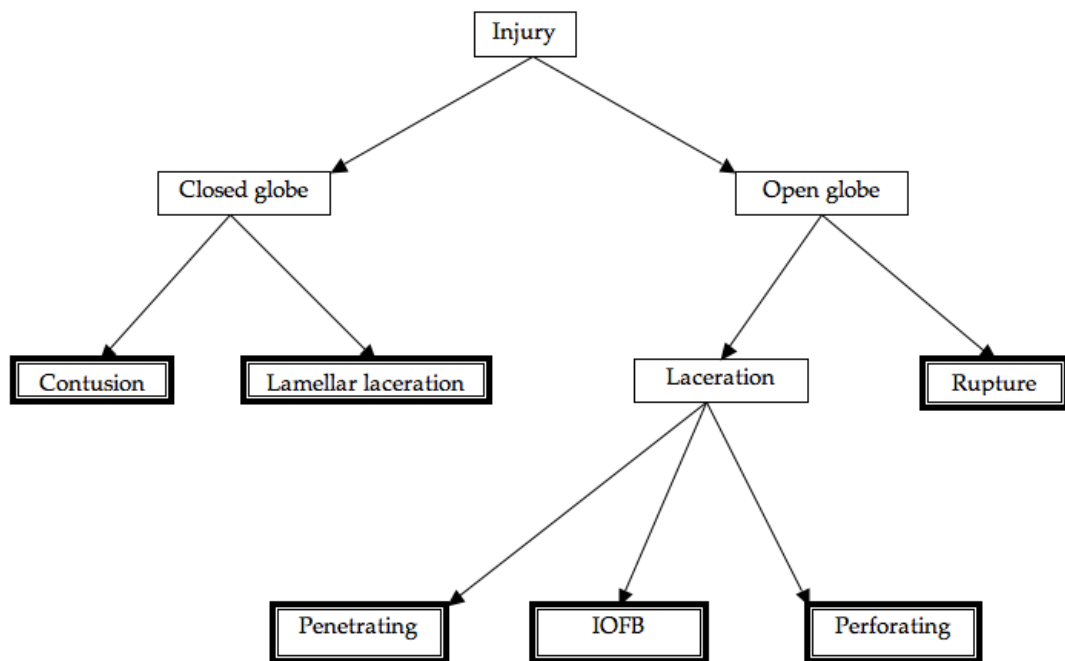


Fig 1: Birmingham Eye Trauma Terminology

NB: Birmingham Eye Trauma Terminology (Kuhn, 2008, p. 8): note that the double-framed boxes show the diagnoses that are used in clinical practice.

2.3 Causes of Ocular Trauma

According to Brad Bowling (2016), the most common causes of blunt trauma in the Western world include squash ball, elastic luggage and champagne corks. These are different from top causes reported in the developing world.

A study by Ukponmwan and Momoh (2015) in Nigeria revealed that a wide variety of objects are agents of ocular trauma causing penetrating eye injuries in children. These included sharp objects such as pencils, sticks, twigs, sharp edges of toys, and missiles from pellets, stones and metal rods.

In 1982, the most common single cause of ocular trauma in Malawi was wood chopping, undoubtedly because at that time, wood was almost the sole source of energy in its villages. This was coupled with poor safety practices employed in chopping and gathering wood (Ilsar et al., 1982).

In a study in Hong Kong (Poon et al., 1998), they found a wide variety of causes of eye injury. Common household items were associated with 22% (n = 1) injuries. 12% (n = 7) of the injuries were from toy gun pellets, and another 12% (n = 7) were from falls. Various chemicals caused injuries to 10% (n = 6) children, and 8% (n = 5) injuries were sports-related. Fireworks caused three (5%) injuries.

In a systematic review on ocular firework trauma in which 26 relevant articles were used, Wisse (2010) found that victims were male (77%), young (82%) and often bystander (47%). He also concluded that firework traumas were a preventable cause of severe ocular trauma and blindness because countries using restrictive firework legislation have remarkable lower trauma incidence rates. The United States Consumer Product Safety Commission reported that there were 10,500 injuries related to fireworks treated in US hospital emergency departments in 2014, 19% of which were eye injuries. (Tu and Granados, 2015)

It is for this reason that the International Council of Ophthalmology (ICO) endorses a global ban on consumer fireworks and encourages ICO member societies (such as the Zambia Ophthalmological Society) to advocate for legislation to ban consumer fireworks in their countries. (ICO, 2016)

2.4 Impact and Consequences of Ocular Trauma

Luccheta (2001) reported that the eyes are in third place, after hands and feet, among the most frequently involved anatomical regions in trauma cases. Consequently, the socio-economic impact of ocular trauma cannot be underestimated. Those affected often have to face loss of career opportunities, major lifestyle changes, and, occasionally, permanent physical disfigurement.

Since eye injuries are related to particular occupations and cultural environments, the type and prognosis of injuries seen in developing countries are not similar to those in industrialised countries. According to Négrel (1997), in Africa, and in many parts of Asia, eye injuries present their own patterns, not only in terms of aetiology or severity, but also in relation to the socio-economic background, reflecting the non-existence or inadequacy of safety measures, the lack of proper eye health facilities to provide adequate case management, the use of traditional medicines, poor education, and a lack of awareness amongst manual workers in hazardous occupations.

The global pattern of eye injuries and their consequences suggests that: some 55 million eye injuries restricting activities more than one day occur each year; 750,000 cases will require hospitalization each year, including some 200,000 open-globe injuries; there are approximately 1.6 million blind from injuries, an additional 2.3 million people with bilateral low vision from this cause, and almost 19 million with unilateral blindness or low vision (Negrel, 1997).

The Workers Compensation Act no. 10 of 1999 considers complete loss of both eyes or the remaining eye of a one eyed person as resulting in 100% degree of disablement. This is for the sake of compensation of workers with ocular trauma. This is in contrast to the loss of only one eye which is pegged at 30% disablement.

Other degrees of disablement are calculated according to the degree of visual impairment of one or both eyes. It can be seen that loss of sight is one of the dreaded disabilities that one can ever have (*Workers' Compensation Act, 1999*).

CHAPTER THREE: METHODOLOGY

3.1 Methodology

3.1.1 Study Design

This was a hospital based, cross sectional study.

3.1.2 Study Duration

The study was conducted over a period of 3 months. Patients were recruited from 1st January to 31st March 2018. For the calculation of the prevalence the numbers were taken from 1st April 2017 to 31st March 2018.

3.1.3 Study Variables

a) Independent Variables

1. Age
2. Sex
3. Residence (low or high density area)
4. Education background
5. Employment status
6. Place of occurrence of ocular trauma
7. Cause of ocular trauma
8. Circumstance during injury

b) Dependent Variables

1. Visual acuity
2. Ocular trauma

3.1.4 Study Setting

The study was carried out at UTH Eye Hospital. In order to serve the population better, UTH was recently divided into 5 different hospitals, namely Eye, Lusaka Adult, Lusaka Children's, Trauma and Emergency, and Women and Newborn Hospitals. The Eye Hospital is one of the recently declared hospitals and is a centre

of excellence for eye services in Zambia. It is a tertiary centre for the care of eye patients and is also a training site for post graduate specialists in ophthalmology [through the University of Zambia’s MMed programme and the Ministry of Health’s (MOH) Specialist Training Programme (STP)]. Medical students, nurses, and other support staff such as optometrists are also trained at UTH – Eye Hospital.

3.1.5 Study Population

All ocular trauma patients presenting to the study site who met the inclusion criteria were included in this study, as long as they consented to study participation.

3.1.6 Sample Size

The estimate of prevalence for the calculation of the sample size was 5.8%. This was obtained from the average of the studies cited in Table 1. These were selected based on similarities of the social status with Zambia as no prevalence studies were found for Southern African region.

Table 1: Estimate of Prevalence.

S.No.	Source	Country of Study	Year of Study	Prevalence (%)
1.	(Ajayi et al., 2014)	South West Nigeria	2014	4.00
2.	(Monsudi and Ayanniyi, 2013)	Birnin Kebbi, Nigeria.	2012	4.90
3.	(Vats et al., 2008)	Delhi, India	2008	2.40
4.	(Krishnaiah et al., 2006)	Andra Pradesh, India	2006	10.6
5.	(Hashemi et al., 2015)	Iran	2015	8.57
6.	(Loon et al., 2009)	Malaysia	2009	5.00

7.	(Chua et al., 2011)	Singapore	2011	5.10
Average Prevalence Estimate				5.80

The sample size was calculated using a single population proportion formula. Considering significance level of 5% and $n = 100$ - and the margin of error , the estimated sample size (n) was calculated as follows:

Therefore, 84 patients were earmarked for recruitment into the study for quantitative data collection and analysis.

3.2 Inclusion Criteria

1. Patient of any age, with a history of eye injury, who presented oneself at UTH Eye Hospital.
2. Patients who gave consent to participate in the study

3.3 Exclusion Criteria

1. Ocular trauma occurring more than 30 days before presentation.

3.4 Resource Personnel

The following people were involved in the study: ophthalmologists and ophthalmology registrars, ophthalmic and registered nurses working in the Eye OPD and the eye wards and registry clerks.

3.5 Data Collection Procedure

Patients who presented to the Eye OPD and the eye wards with a history of ocular trauma were invited to participate in the study. Consecutive patients were recruited. Before an informed consent was obtained, patients were asked to read a patient information sheet which outlined the scope of the study. For patients who could not read or understand English, an explanation of its contents was done. For children under the age of 18 years, consent was obtained through their parents or guardians. A copy of the patient information sheet is attached as appendix A.

A structured questionnaire was administered by the Principal Investigator or an assistant. Effort was made to have someone who knew the respondent's language to translate the questions in the patient information sheet and questionnaire for the respondent who did not understand English.

A thorough ocular examination was then conducted by the principal investigator (PI) or any clinician on duty in the Eye Hospital. This included visual acuity (VA) assessment using the Snellen's chart. A bio-microscopic slit lamp eye examination was performed to evaluate the extent of the injury to the globe and peri-ocular tissues. The other tools used in the examination included the indirect ophthalmoscope, 20D, 78D or 90D Volk lenses. Fundoscopy was done where appropriate. Prior to a fundoscopy, eyes were dilated with 1% tropicamide.

The WHO classification of visual acuity, as documented in Table 2, was used to classify the visual acuity of all patients who came.

Table 2: WHO Visual Impairment Classification

	Classification	Visual Acuity Ranges
1.	Normal vision	6/6 – 6/18
2.	Moderate Visual Impairment	<6/18 – 6/60
3.	Severe Visual Impairment	<6/60 – 3/60
4.	Blindness	<3/60

Source: World Health Organisation (“WHO | Visual impairment and blindness,” n.d.)

3.6 Data Collection Flow

The flow of the data collection is as stated in Figure 2.

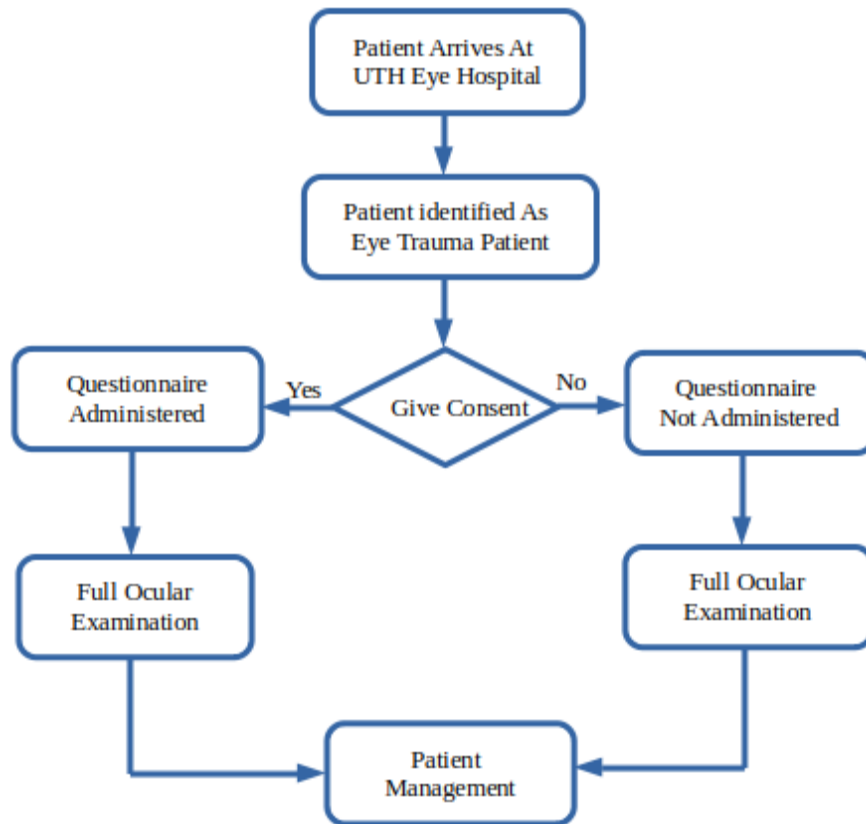


Figure 2: Data Collection Flow Chart

3.7 Data Management and Analysis

Questionnaires and examination forms were manually cleaned and the data was entered into and analysed with the Statistical Package for Social Sciences (SPSS) version 23. A p-value of less than 0.05 was considered statistically significant.

3.8 Ethical Approval

Ethical Approval was obtained from Excellence in Research Ethics and Science (ERES) Board. Permission to carry out the study was obtained from the UTH Eye Hospital Senior Medical Superintendent.

3.9 Data Confidentiality

Confidentiality was upheld during the process of data collection. All data collected was kept in a secure location. The patient's names were not written on any of the data collection forms described above. All patients were identified by a serial identification number that was assigned to them at the time of signing the informed consent form.

CHAPTER FOUR: RESULTS

4.1 Sex Distribution

A total of 84 patients with ocular trauma were recruited in this study. There were 75% (n = 63) males and 25% (n = 22) females. This constituted a male to female ratio of 3:1 (Table 3).

4.2 Age Distribution

The respondents' ages ranged from 7 months to 57 years old. Children aged 14 years and below accounted for 23.8% (n = 20) of the respondents. Of the 20 children, 14 years or younger, 20% (n = 4) were non school going, 15% (n = 3) were preschool going, 60% (n = 12) were in primary school and one had dropped out of school.

Of the 64 respondents older than 14 years, 6.3% (n = 4) were still school going, 20.3% (n = 13) were unemployed and 73.4% (n = 47) were employed.

The majority of the respondents, however, were aged between 15 and 35 years. The rest were between 36 and 57 years.

4.3 Duration of Injury

The median of the duration since injury was 2 days and ranged from 0 to 30 days. The proportion of respondents who presented within 24 hours of injury was 32.1% (n = 27). Those who came between 1 to 7 days were 53.6% (n = 45) and those who presented after 7 days were 14.3% (n = 12).

4.4 Residence of Respondents

Of the total number of patients, 56% (n = 47) came from high density areas of the city of Lusaka such as Kanyama and Mtendere. Those who came from low density areas of Lusaka such as Kabulonga and Makeni were 28.6% (n = 24). The remaining 15.5% (n = 13) were referred from outside of Lusaka city. Of the 13 respondent who came from outside Lusaka, only 7.7% (n = 1) presented to the hospital within 24 hours after the ocular trauma.

Table 3: Socio-Demographic Characteristics of Study Participants

Characteristic	N=84	
Sex n (%)		
Male	63	(75.0)
Female	21	(25.0)
Age n (%)		
0 - 14	20	(23.8)
15 - 35	47	(56.0)
>35	17	(20.2)
Duration of Injury (Day) Median (Range)	2.0	(0 – 30)
Residence n (%)		
Lusaka Low Density	24	(28.6)
Lusaka High Density	47	(56.0)
Out of Lusaka	13	(15.4)
Education n (%)		
None	5	(6.0)
Pre-grade	3	(3.6)
Primary	40	(47.6)
Secondary	24	(28.6)
Tertiary	12	(14.3)

4.5 Occupation and What Respondents did for a Living

The employment status of the respondents shows that the majority, 58.3% (n = 49) were employed. Of these 38.1% (n = 32) were artisans or those who were doing handy jobs such as carpentry, construction works and metal fabrications and 20.2% (n = 17) had white collar jobs or office work. On the other hand 41.7% (n = 35) of the respondent were unemployed, comprising of school going children at 23.8% (n = 18) and remaining 17.9% (n = 15) were adults without jobs.

4.6 Educational Background

Analysis of the educational background of respondents shows that those with primary education were 47.6% (n = 40) and those with secondary education were 28.6% (n = 24) . None school goers and pre-grades were 6.0% (n = 5) and 3.6% (n = 3) respectively.

4.7 Clinical Presentation of Ocular Trauma by Diagnosis

Of the respondents, 58.3% (n = 49) had closed globe injuries while 20.3% (n = 17) had open globe injuries. The remainder, 21.4% (n = 18) , had adnexal injuries.

As can be seen from Figure 3, the disaggregated data shows that the majority of the respondents, 20.2% (n = 17), presented with conjunctival injuries such as subconjunctival haemorrhage and lacerations. This was closely followed by penetrating injuries which included corneal or scleral lacerations or a combination of the two. This was 17.9% (n = 15) of the respondents. In third place was the corneal foreign bodies with 11.9% (n = 10). Majority of these were as a result of lack of use of protective wear by welders and grinders.

Figure 3: Dis-aggregations of ocular trauma presentation by diagnosis

4.8 Laterality

40.5% (n = 34) of the respondents had injuries to the right eye and 44.0% (n = 37) to the left eye. This entails that the uni-ocular involvement was 84.5% (n = 71) while the remaining 15.5% (n = 13) had injuries to both eyes.

4.9 Visual Acuity of Injured Eye at Presentation

The majority of the respondents 60.7% (n = 51) had normal visual acuity (VA of 6/6 to 6/18) in the injured eye(s). Twenty five respondents representing 29.8% were blind (VA worse than 3/60) while 8.3% (n = 7) had moderate visual impairment (VA worse than 6/18 to 6/60) and 1.2% (n = 1) had severe visual impairment (VA worse than 6/60 to 3/60). This is represented in Figure 4.

Figure 4: Visual Acuity at Presentation

NB: Normal VA = Normal Visual Acuity; MVI = Moderate Visual Impairment; SVI = Severe Visual Impairment.

4.10 Place of Occurrence of the Injury

In terms of place of occurrence of the injuries, the majority, 46.4% (n = 39) , happened in the home environment. This was followed by those that happened at the place of work with 21.8% (n = 18) .

4.11 Object of Injury

The commonest object of injury in the respondents was a stick or some woody object. This accounted for 17.9% (n = 15) of cases. The next was nails and metal fragments with 16.7% (n = 14) followed by fists with 11.0% (n = 10) . The rest of the results are depicted in the Figure 5.

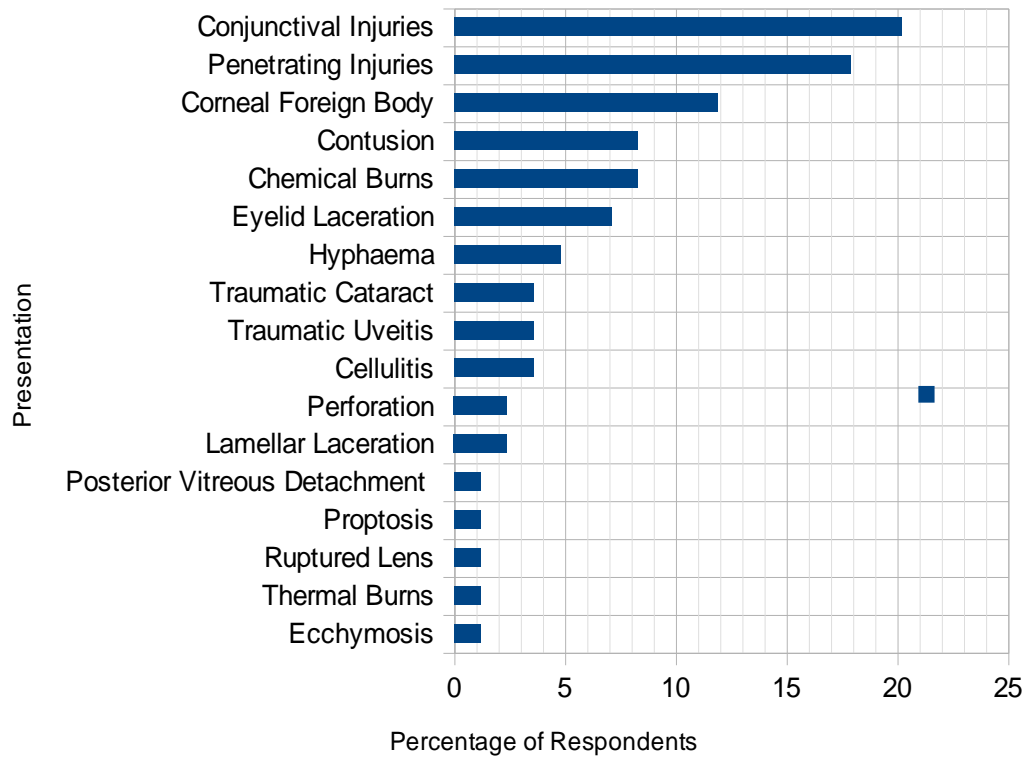


Figure 5: Object of Injury

NB: Others included one each of fireworks, pick, slasher, floor tile fragment, snake spittle and an unknown object.

4.12 Risk Factors Associated Ocular Injuries

Of all the risk factors for the ocular trauma only the object of injury was statistically significant with a p value of 0.002 (Table 7). The rest of the risk factors were not statistically significant as their p-values were more than 0.05 as depicted in Tables 4 to 7.

Table 4: Demographics by Visual Acuity Classification

	Visual Acuity Classification						Statistics p
	Normal VA		Visual Impairment		Blindness		
	n	%	n	%	n	%	
Sex							0.240
Male	35	68.6%	7	87.5%	21	84.0%	
Female	16	31.4%	1	12.5%	4	16.0%	
Age							0.808
0 - 14	11	21.6%	3	37.5%	6	24.0%	
15 - 35	28	54.9%	4	50.0%	15	60.0%	
>35	12	23.5%	1	12.5%	4	16.0%	
Density							0.816
Lusaka Low Density	15	29.4%	3	37.5%	6	24.0%	
Lusaka High Density	29	56.9%	3	37.5%	15	60.0%	
Out of Lusaka	7	13.7%	2	25.0%	4	16.0%	
Occupation							0.977
None	21	41.2%	3	37.5%	11	44.0%	
Artisan	19	37.3%	3	37.5%	10	40.0%	
Office Work	11	21.6%	2	25.0%	4	16.0%	
What does for Living							0.900
Unemployed	8	15.7%	1	12.5%	6	24.0%	
Preschool Children	2	3.9%	0	0.0%	0	0.0%	
School Going Children	11	21.6%	2	25.0%	5	20.0%	
Employed	30	58.8%	5	62.5%	14	56.0%	
Education							0.206
None	4	7.8%	0	0.0%	1	4.0%	

Pre Grade	3	5.9%	0	0.0%	0	0.0%
Primary	18	35.3%	6	75.0%	16	64.0%
Secondary	16	31.4%	1	12.5%	7	28.0%
Tertiary	10	19.6%	1	12.5%	1	4.0%

Table 5: Place of Occurrence, Cause of Trauma, Activity during Injury, History of Alcohol and Drug Use, History of Cigarette Smoking, Use of Protective Wear and Object of Injury by Visual Acuity Clarification

	WHO Visual Acuity Classification						Statistics p
	Normal VA		Visual Impairment		Blindness		
	n	%	n	%	n	%	
Place of Occurrence							0.916
Home	22	43.1%	4	50.0%	13	52.0%	
Work/School	19	37.3%	2	25.0%	7	28.0%	
In Transit	7	13.7%	2	25.0%	4	16.0%	
Others	3	5.9%	0	0.0%	1	4.0%	
Cause of Trauma							0.423
Accidental	37	72.5%	7	87.5%	16	64.0%	
Assault	14	27.5%	1	12.5%	9	36.0%	
Activity During Injury							0.551
Playing/leisure	20	39.2%	3	37.5%	14	56.0%	
Fighting	6	11.8%	1	12.5%	0	0.0%	
Working/Chores	22	43.1%	3	37.5%	10	40.0%	
Driving/Passenger	3	5.9%	1	12.5%	1	4.0%	
History of Alcohol Use							0.357
Yes	17	33.3%	1	12.5%	10	40.0%	
No	34	66.7%	7	87.5%	15	60.0%	
History of Cigarette Smoking							0.469
Yes	7	13.7%	2	25.0%	6	24.0%	
No	44	86.3%	6	75.0%	19	76.0%	
Protective Wear							0.213
Yes	2	15.4%	1	50.0%	0	0.0%	
No	11	84.6%	1	50.0%	6	100.0%	
Object of Injury							0.240

Missiles and Debris	27	52.9%	6	75.0%	20	80.0%
Fists	7	13.7%	1	12.5%	2	8.0%
Vehicle	6	11.8%	1	12.5%	0	0.0%
Others	11	21.6%	0	0.0%	3	12.0%

Table 6: Demographics by Diagnosis

	Diagnosis						Statistics
	Closed Globe		Open Globe		Adnexa		p
	n	%	n	%	n	%	
Sex							0.314
Male	36	73.5%	15	88.2%	12	66.7%	
Female	13	26.5%	2	11.8%	6	33.3%	
Age							0.309
0 - 14	8	16.3%	5	29.4%	7	38.9%	
15 - 35	29	59.2%	10	58.8%	8	44.4%	
>35	12	24.5%	2	11.8%	3	16.7%	
Density							0.277
Lusaka Low Density	18	36.7%	2	11.8%	4	22.2%	
Lusaka High Density	23	46.9%	12	70.6%	12	66.7%	
Out of Lusaka	8	16.3%	3	17.6%	2	11.1%	
Occupation							0.239
None	18	36.7%	6	35.3%	11	61.1%	
Artisan	18	36.7%	8	47.1%	6	33.3%	
Office Work	13	26.5%	3	17.6%	1	5.6%	
What Does for Living							0.369
Unemployed	8	16.3%	3	17.6%	4	22.2%	
Preschool Children	0	0.0%	1	5.9%	1	5.6%	
School Going Children	10	20.4%	2	11.8%	6	33.3%	
Employed	31	63.3%	11	64.7%	7	38.9%	
Education							0.080
None	1	2.0%	2	11.8%	2	11.1%	
Pre Grade	1	2.0%	0	0.0%	2	11.1%	
Primary	21	42.9%	12	70.6%	7	38.9%	
Secondary	16	32.7%	3	17.6%	5	27.8%	
Tertiary	10	20.4%	0	0.0%	2	11.1%	

Table 7: Place of Occurrence, Cause of Trauma, Activity during Injury, History of Alcohol and Drug Use, History of Cigarette Smoking, Use of Protective Wear and Object of Injury by Diagnosis.

	Diagnosis						Statistics
	Closed Globe		Open Globe		Adnexa		p
	n	%	n	%	n	%	
Place of Occurrence							0.479
Home	22	44.9%	10	58.8%	7	38.9%	
Work/School	15	30.6%	6	35.3%	7	38.9%	
In Transit	8	16.3%	1	5.9%	4	22.2%	
Others	4	8.2%	0	0.0%	0	0.0%	
Cause of Trauma							0.146
Accidental	31	63.3%	14	82.4%	15	83.3%	
Assault	18	36.7%	3	17.6%	3	16.7%	
Activity during Injury							0.468
Playing/leisure	19	38.8%	8	47.1%	10	55.6%	
Fighting	6	12.2%	0	0.0%	1	5.6%	
Working/Chores	20	40.8%	9	52.9%	6	33.3%	
Driving/Passenger	4	8.2%	0	0.0%	1	5.6%	
History of Alcohol and Drug Use							0.413
Yes	19	38.8%	5	29.4%	4	22.2%	
No	30	61.2%	12	70.6%	14	77.8%	
History of Cigarette Smoking							0.678
Yes	10	20.4%	3	17.6%	2	11.1%	
No	39	79.6%	14	82.4%	16	88.9%	
Use of Protective Wear							0.341
Yes	3	23.1%	0	0.0%	0	0.0%	
No	10	76.9%	5	100.0%	3	100.0%	
Object of Injury							0.002
Missiles and Debris	29	59.2%	16	94.1%	8	44.4%	

Fists	9	18.4%	0	0.0%	1	5.6%
Vehicle	6	12.2%	0	0.0%	1	5.6%
Others	5	10.2%	1	5.9%	8	44.4%

4.13 Prevalence

The number of ocular trauma cases over a one year period from 1st April 2017 to 31st March 2018 was 501 and the total number of new patients that were seen in the same period was 6,907. This gives us a prevalence of 7.25%.

CHAPTER FIVE: DISCUSSION

5.1 Sex Distribution

We had 75% male and 25% female giving us a male to female ratio of 3:1 . This is in keeping with other studies. Studies from India show that there is a higher chance of males having ocular trauma. For instance, Sengupta et al (2016), observed that among patients with eye injuries, males constituted 80-85% of the total number attending the outpatient and emergency department of the hospitals in his geographical region. Vats (2008) also found that males were significantly more affected than females.

Studies by Ajayi et al (2014) from Nigeria, Jahangir et al (2011) from Pakistan, Otoibhi and Osahon (2003) from Benin City Nigeria, Kolawole et al (2015) from Osogbo Nigeria Omoti (2004) also from Nigerian reveal a higher male to female ratio. This is attributed to the fact that males are more active and that they tend to be engaged in activities that predisposed them to more ocular trauma compared to their female counterparts (Adamu and Muhammad, 2017). This is also attested by Cillino et al (2008) who states that a male preponderance universally reported and thought to be related to occupational exposure, participation in dangerous sports and hobbies, alcohol use and risk-taking behaviour.

5.2 Age Distribution

The majority of the respondents, 56% (n = 47) , constituted adolescents and youth from the age of 15 to 35 years of age. This age group is normally the working group and very active in the workplace and the home. Therefore they are more prone to ocular trauma.

Children of 14 years and below accounted for 23.8% (n = 20) of the respondents. They would have ocular trauma because of their tendency to experiment with new objects and to imitate adult behaviours without being aware of the risk (Mohan and Sharma, 2013).

5.3 Duration of injury

The median of the duration since injury was 2 days and ranged from one hour to 30 days. The proportion of respondents who presented within 24 hours of injury was 32.1% (n = 27) . This is lower in contrast to other studies such as Kolawole et al's (2015) in Nigeria, who reported 58.3% of patients presenting to the eye hospital within 24 hours of injury, and Wadei et al (2016) in Egypt, who found that 56% of his respondents presented within 24 hours.

However this is similar to a study in Ghana that showed that only one third of the cases reported within 24 hours while 21% reported after one week of their injuries (Gyasi et al., 2007). Babar et al (2007) in Pakistan found delayed presentation was more common and that 63.61% patients presented after one week.

In this study, those who came between 1 to 7 days were 53.6% (n = 45) and those who presented after 7 days were 14.3% (n = 12) .

5.4 Residence of Respondents

Respondents that came from urban areas of the city of Lusaka were 84.5%. When disaggregated, 56% of the total number of respondents came from high density areas of the city of Lusaka. Low density areas of Lusaka accounted for 28.6% (n = 24) and the remaining 15.5% (n = 13) were referred from outside of Lusaka city. This was expected and tallies with what Cillino et al (2008) found that the causes of the injury were significantly associated with geographic location of the residence of patients (p = 0.009; Pearson's chi square test).

In contrast to this study's findings, in Uganda Mayek et al (2017), found that the majority (66.4%) of the respondents resided in rural areas. Ojabo et al (2015) also found that 65.0% (n = 51) respondents lived in a rural areas, and the remaining 35.0% (n = 27) respondents lived in urban areas. This could be because of poorly rolled out eye services where many people from rural areas have to rely of medical facilities in the cities.

5.5 Occupation and What Respondent did for a Living

The unemployed were 41.7% (n = 35), followed by artisans with 38.1% (n = 32) of all respondents. Artisans included those who were doing handy jobs such as carpentry, construction works and metal fabrications. The ones who did white collar jobs constituted 20.2% (n = 17) of respondents.

Qi et al (2015) found that most of his respondents were farmers and workers (51.9%), while students accounted for 18.3%.

Persons with poor economic activity tended to be prone to having ocular trauma. This study showed that those who were either unemployed or those that did handy jobs were the majority of respondents. These two categories had a cumulative total of 79.8% of all cases seen in the study.

The Indian study by Sengupta et al. (2016) also showed that less wealthy person are prone to partake in risk taking activities and thus increase their chance of ocular injuries.

5.6 Educational Background

The majority, 47.6%, of the respondents were those with primary education. There was no statistical significance between educational background and trauma ($p = 0.08$). Vats et al found that 23.4% of his respondents were illiterate and equally saw no association between education status and trauma.

However, an Indian study by Sengupta (2016) reported that less educated persons are prone could partake in risk taking activities easily.

5.7 Clinical Presentation of Ocular Trauma by Diagnosis

Of the respondents, 58.3% (n = 49) had closed globe injuries majority of which presented with conjunctival haemorrhage and lacerations 20.2% (n = 17) and contusions 8.3% (n = 1). On the other hand, open globe injuries constituted 20.3% (n = 17) of the total number of respondents.

In a study of 147 subjects in Egypt, it was found that 80% had suffered open globe injury and 19.6% had closed globe injuries (Soliman and Macky, 2008). According to Bhupally et al (2015) most common mode of ocular trauma in their study was closed globe injury due to blunt trauma (77.6%) and chemical injuries (13%) as the least common. Vats et al also cited closed globe injury with blunt trauma as the commonest types of ocular trauma with 41.7%.

In contrast to the above findings, Ojabo (2015) found that the most common injury was corneo-scleral lacerations, accounting for 83.3% of his respondents. Also Wadei found only 13.8% had closed globe injuries and 83.8% had open globe injuries (Wadei et al., 2016).

5.8 Laterality

In 84.5% (n = 71) of the respondents, the ocular injuries were uni-ocular 40.5% for the right eye and 44.0% to the left eye while 15.5% (n = 13) had injuries to both eyes. This corresponds to other studies that showed a high rate of uni-ocular affection, such as Ajayi et al (2014) which found 93% uni-ocular involvement.

While some studies such as those done in Benin city in Nigeria (Omoti, 2004) and another place in Nigeria (Ukponwan and Akpe, 2008) found that the left eye was more commonly affected compared with the right, this study showed no preponderance of any eye.

5.9 Visual Acuity of Injured Eye at Presentation

In this study, the majority (60.7%) of the respondents had normal visual acuity with 29.8% being blind. This contrasts with other studies such as by Ajayi et al (2014)

where nearly half the patients were blind in the affected eye, and Kolawole et al (2015) who found 76.7% of respondent were blind at presentation.

This shows that most of the ocular injuries were actually not serious.

5.10 Place of Occurrence of the Injury

A higher frequency of trauma to eyes occurred in the home environment (46.4%) and the work place (21.8%) in that order. It correlates with other studies done in Colombia (Serrano et al., 2003), and Osogbo Nigeria (Kolawole et al., 2015) where the majority of ocular injuries were sustained in the home environment.

Other studies from Nigeria (Ajayi et al., 2014), India (Nirmalan et al., 2004), Singapore (Voon et al., 2001) and Australia (McCarty et al., 1999) had the work environment, where the majority of cases occurred.

Desai et al (Desai et al., 1996) reported that the distribution of place of injury is significantly different for males and females, wherein males were notably more likely to sustain an injury in the workplace, with females being twice as likely to have sustained an injury at home.

According to Cillino et al (2008), The most frequent causes in men were outdoor related (30.9%), work-related (25.4%), and sport-related (17.5%). Women injuries were home-related (52.2%) and outdoor activities related injuries (30.4%). In urban areas, road accidents were more frequent; in rural areas, work-related injuries were more frequent with a greater rate of intraocular foreign bodies (IOFBs) than in urban areas. In contrast to the above findings, Ajayi et al (2014) reported that domestic related eye injuries were very few (3.5%).

Seeing that most studies, including this one, reveal that the two major places of occurrence of ocular trauma are the home and work environments, primary prevention programmes targeting parents in homes and workers in ocular trauma

prone work environments such as welders and those in construction industry would prevent most ocular injuries.

5.11 Object of Injury

The commonest object of injury in the respondents was a stick or some woody object accounting for 17.9%. This was followed by nails and other metal fragments at 16.7% and then by fingers and fists with 11.0%.

Other studies which showed sticks as the leading cause of ocular injuries include Monsudi and Ayanniyi (2013) at 25.8% and Ilsar et al., (1982) at 25.4%.

Different studies have shown different results all together. This goes to show how diverse the inciting objects of injuries are in different settings. This can be explained by the different work ethics and the demographic composition of the communities in the different study populations.

5.12 Risk Factors Associated with Ocular Trauma

Documented risk factors for ocular trauma include sex (men more than women), consumption of alcohol (Loon et al., 2009), younger age more than older persons (Ukponmwan and Momoh, 2015), history of cigarette smoking (Chua et al., 2011), failure to wear adequate eye protection while performing high risk activities such as baseball, basketball and use of power tools in the home environment and substance abuse including alcohol and marijuana (AAO, n.d.).

However, in this study only the object of injury was found to be statistically significant (p value 0.002) as a risk factor for ocular trauma. All other factors mentioned above were not statistically significant.

5.13 Prevalence of Ocular Trauma

In this study the prevalence was determined to be 7.25%. In the African region and throughout the world, prevalence studies on ocular trauma have produced varied results. This is because of the different risk factors and the composition of the

community that formed the catchment of the study populations. In a study by Ajayi et al (2014) they found a prevalence of 3.8%. In another study by Krishnaiah (2006), the prevalence was determined to be 10.6%. Monsudi and Ayanniyi (2013) found a prevalence of 51.7% in their study of ocular trauma .

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In view of the foregoing, the following are our conclusions from this study:

1. The prevalence of ocular trauma was 7.25%.
2. The commonest presentation of ocular trauma is closed globe injury.
3. The commonest places of occurrence of ocular trauma was the home environment followed by the work place.
4. Sticks and woody objects were the commonest objects of injury. The Object of injury was found to be a statistically significant risk factor for ocular trauma.

6.2 Recommendations

In view of the foregoing, we would like to make the following recommendations:

- i. Sensitisation of parents in homes and workers in work places to be carried out as these are the major sources of ocular trauma.
- ii. To institute work place policies that makes it mandatory for workers to wear protective goggles when working with metallic fragments or welding and grinding. And to encourage self employed metal fabricators to be aware of the need to always have the personal protective equipment available at all times.
- iii. In order to compare and continually update the epidemiological data on ocular trauma, we also recommend that an ocular trauma registry be created whose task would be to keep data and disseminate information about ocular trauma in Zambia.

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APPENDICES

Appendix A: Participants' Information Sheet

Introduction

My names are Dr. John Y. Mvula. I am a Master of Medicine (in Ophthalmology) student conducting a research on injuries to the eye. All patients with eye injuries that occurred in the last one month, who come to the University Teaching Hospital (UTH) are being asked to join the research. You are one of them.

Nature and Purpose of the Study

According to global data, injuries to eyes are a common cause of blindness in one eye despite more than 80% of all eye injuries being classified as preventable. In Lusaka, little information is available concerning this problem. The purpose of this research is to determine the types, causes and risk factors for eye injuries in patients who come to UTH.

Procedures of the Study

If you agree to participate in the study, you will be asked to sign a consent form allowing me to collect some information about you and the circumstances of the injury. After that, a full eye examination will be done to look at the type of the eye injury that you have.

Possible Risks and Discomfort

To the best of my knowledge, no known risk will be posed by your participation in this study.

Possible Benefits

All patients participating in this study will be given a health talk on ocular trauma. Recommendations from this study will contribute to the body of knowledge in improving the care of patients with ocular trauma. The data obtained from this study may help form the basis for effective management and prevention of ocular trauma

Financial Arrangements

You will not be paid for participating in the study. But you will also not be required to pay for the cost of any of the eye examination and basic treatment associated with the study.

Confidentiality

All information obtained in this study will be strictly confidential. Data that will be collected and reported, will not include your name. Your records will be given unique identification number that will act as your identity.

Your participation in this study is strictly voluntary. You will not suffer any consequences if you decide not to enrol. You may withdraw your consent for this study at any time without giving any reason and without any consequences on you and your medical care. Even after withdrawing you will still be treated like every other patient with an injury to the eye.

Thank you for considering to participation in the study.

If you have questions, concerns and clarifications, please contact the principal investigator, Dr. John Y. Mvula or the Chairperson of Excellence in Research Ethics and Science Board on the following contact details:

Dr. John Y. Mvula, Eye Hospital University Teaching Hospitals Private Bag RW1X LUSAKA Phone: +260 95 549 1888	The Chairperson, ERES Converge IRB Plot 33, Joseph Mwilwa Road Rhodes Park LUSAKA Phone: +260 95 515 5633 or +260 95 515 5634
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Appendix B: Consent Form

I, _____ , hereby confirm that I have sufficiently been explained to about the nature, conduct benefits and risks of this clinical study. I have received, and /or read and understood the above written information about the study. I am aware that my personal details will be anonymously processed into the research report. I have understood that I may voluntarily, at any point, withdraw my consent and participation into the study without suffering any consequence. I have been given sufficient opportunity to ask questions and seek clarifications and, of my own free will, declare my participation in the study.

Date: ____ / ____ / _____

Participant's signature or thumb print

I have received a signed copy of this agreement.

Date: ____ / ____ / _____

Person obtaining informed consent

Research Identification Number

Appendix C: Questionnaire Form

ID Number:

Date of Presentation:

Time of Presentation:

Date of injury:

Time of Injury:

A: Sex : _____

1. Male
2. Female

B. Age (Specify) : _____

C: Duration Since Injury (Calculated) : _____

D: Residence (Specify) : _____

E: Occupation (Specify) : _____

F: Educational Background : _____

0. *Non school Going*
1. Never Been to School
2. Did not Complete Grade 7
3. Finished Primary School
4. Finished Secondary
5. Finished Tertiary
6. Still at Primary School
7. Still at Secondary School
8. Finished Grade 9

9. At Preschool
10. Still a Student at Tertiary

G: Place of Occurrence of Injury : _____

1. *Factory Premise*
2. Farm
3. Office
4. Home
5. School
6. Place of Work
7. Public Building
8. Recreational Facility
9. Sports Field or Arena
10. On the Road or Highway
11. *Other (Specify):* _____

H. Category of Cause of Injury: _____

1. Animal Inflicted
2. Assault
3. Road Traffic Accident (RTA)
4. Contact Lens Use
5. Sport
6. Domestic – i.e. while doing house chores
7. Leisure
8. Work related
9. Falling
10. Fireworks

11. Child Play
12. Accidental Injury
13. *Other (Specify):* _____

I. Activity During Injury : _____

1. Grinding
2. Welding
3. Drilling or Hammering
4. Vehicle repair
5. Driving or Riding
6. Loading Goods
7. Working with Chemicals
8. Sports
9. Fighting
10. Tree Climbing
11. Walking or Running or crawling
12. Drinking Alcohol
13. Digging
14. Playing
15. Farming
16. *Other (Specify):* _____

J. If injury was During A Sport Activity, indicate the Type of Sport : _____

1. Football
2. Tennis
3. Basketball
4. Squash
5. Badminton
6. Golf
7. Cycling
8. Running
99. Not Applicable

K: Alcohol or Drug Use prior to Injury : _____

1. Yes
2. No
3. Unknown

L: History of Cigarette Smoking : _____

1. Yes
2. No
3. Unknown

M: Use of Protective Wear During Injury (For Workplace or Sport Injuries) : _____

1. Yes
2. No
3. Not Applicable

N: Object of Injury : _____

0. Unknown
1. Metal Fragments or Nails
2. Wire
3. Stone
4. Grinding Wheel
5. Woody Debris or Stick or Plank
6. Finger or Fist
7. Knife or Scissors
8. Hammer
9. Toy Bullets
10. *Other (Specify):* _____

O: How could this particular ocular trauma have been prevented? : _____

0. I don't Know
1. Use eye goggles
2. Avoid Violence
3. Not to Climb trees
4. Concentrate with what one is doing
5. Stop Drinking Alcohol
6. Make Sure Child is Playing Safely or Stop Kids From Playing Badly
7. Not to Play with Fire Works
8. Avoid Perpetrator of Violence
9. *Other (Specify):* _____

Questionnaire Administered By:

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Appendix D: Examination Form

Date :

/ /

ID Number:

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Ocular Examination:

Laterality of Injured Eye : _____

- 1. Right Eye
- 2. Left Eye
- 3. Both Eyes

Visual Acuity Unaided (specify):

Right Eye : _____

Left Eye : _____

Best Corrected Visual Acuity (specify):

Right Eye : _____

Left Eye : _____

Intraocular Pressure (specify):

Right Eye : _____ mmHg

Left Eye : _____ mmHg

Description of Physical Findings:

Eyelids

EOM

Conjunctiva

Sclera

Cornea

Anterior Chamber

Pupil

Iris

Lens

Fundoscopy:

RE:

LE:

0 = No View

1 = Normal

2 = Not Done

3 = Not Indicated, Applicable

4 = Other: Describe:

Diagnosis : _____

(Open Globe Injuries)

1. Penetrating
2. Intraocular Foreign Body
3. Perforation
4. Rupture

(Closed Globe Injuries)

5. Contusion of eye or adnexa
6. Lamellar Laceration
7. Corneal Foreign Body
8. Conjunctival Injury

(Adnexal Injuries of the Globe)

9. Orbital Wall
10. Lacrimal Apparatus Injury
11. Ocular Nerve Injury
12. Lid Laceration

(Other Eye injuries:)

13. Thermal Burns
14. Chemical Burns
15. Proptosis (R/O Orbital Fracture)
16. Dislocated lens
17. Pre-septal or Orbital Cellulitis
18. Echymosis
19. Traumatic Cataract
20. *Other (Specify):* _____

Name of Examiner: _____