



# The Epidemiology of Fatal Gunshot Injuries in Dar es Salaam, Tanzania: A Five-Year Autopsy Study

Ng'walali PM<sup>1\*</sup> and Kazaura M<sup>2</sup>

<sup>1</sup>Department of Pathology, Muhimbili University of Health and Allied Sciences, Tanzania

<sup>2</sup>Department of Epidemiology and Biostatistics, Muhimbili University of Health and Allied Sciences, Tanzania

\*Corresponding author: Paul M. Ng'walali, Department of Pathology, School of Medicine, Muhimbili University of Health and Allied Sciences, P.O. Box 65001 Dar es Salaam, Tanzania, P.O. Box 65430 Dar Es Salaam, Tanzania, Tel: +255 782250061; Email: ngwalali@gmail.com

## Research Article

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## Abstract

Gunshot wounds are common and form a major health problem. They severely affect the criminal justice and health-care systems in the world. Data on gunshot deaths in Tanzania are not readily available. The common source of information is through the police and media reports; especially when associated with armed robbery. Using descriptive cross-sectional study, we assessed the epidemiology of fatal gunshot injuries at one of the largest National Hospital in Tanzania over a period of five years. We examined, reviewed and then classified gunshot injuries and deaths guided by the International Statistical Classification of Diseases and Related Health Problems, 10<sup>th</sup> Revision (ICD)-10. The victims of fatal gunshot injuries were examined to establish the age, sex, circumstances of death and manner of death, anatomical site of entrance. In addition, we classified the manner of gunshot as police, bandit, suicide and interpersonal or homicide or accident. All the data were retrieved from the Hospital's mortuary into data abstraction from. We reviewed 6162 autopsies from the registry starting from 2015 to 2019. The incidence of gunshot injury death was 38.0 persons per 1000 forensic autopsies per year (95% Confidence Interval: 33.4, 43.1). Almost 95% of the victims were males, young (median age=32, Inter-Quartile Range = 15). The incidence of gunshot deaths has been significantly decreasing from 42.4 in 2015 to 15.9 in 2019 per 1000 autopsies. The majority of victims were shot in the chest (37.2%) and more than 60% are gunned down either by low enforcers of bandits.

**Keywords:** Autopsy; Gunshot; Epidemiology; Tanzania

## Introduction

A gunshot injury is a physical trauma due to a bullet from a firearm [1,2]. Assaults by a gun is considered to be five times more likely to result in death than other assaults involving other lethal weapons [3,4]. It is estimated that, globally mortality due to firearm injuries increased from 209,000 to 251,000 in 1990 and 2016 respectively [5]. Of the 161,000 gunshot deaths in 2016, 161,000 (64.1%) were due to assault, 57,000 (22.7%) were suicide, and 23,000 (9.2%)

due to other causes. In second decade of 21<sup>st</sup> century, many countries of the Americas had the highest mortality rates. For example, there were 39,773 gunshot injury deaths reported in the United States in 2017 [6]. Of these 60% were suicides, 37% were homicides and 23,000 were accidents [5,7].

Although exact and comprehensive data about gunshot injuries and mortality in many of the sub-Saharan African countries are not available [8], it is estimated that in 2000 there were more than 300,000 deaths as a result of intentional

injuries in Africa [9]. In the same year, an estimated 46.0% and 9.1% of injury deaths in South Africa were caused by homicide or interpersonal violence and suicide or self-inflicted violence respectively [10]. There are reports of rising incidence of gunshot injuries in several countries in West Africa like Nigeria [11]. In Maputo City, Mozambique, almost 9% of all registered deaths were caused by firearm discharge [12].

Like in many other sub-African countries, data on gunshot injuries and deaths are not readily available. Main sources of information are through police and media reports that frequently mention fatalities from gunshot injuries in relation to armed robbery, and unrests involving the security services and the public. Although the law in Tanzania limits the availability of private gun ownership, gunshot injury deaths still occur [13]. Despite the control of private gun ownership, illegal possession of guns is common especially in border regions, big cities and towns.

In most cases, motives of gunshot injuries in sub-Saharan countries are diverse and complex. For example in Nigeria, major motives for gunshot injuries include armed robbery, kidnapping, police brutality and interpersonal clashes [14]. Nevertheless, in countries like Tanzania, unlicensed ownership maybe one of the triggers for the increased prevalence of gunshot injuries. While case fatalities due to gunshot injuries are rising in Tanzania, the magnitude and patterns have not been fully studied. The present study aims to assess the trend during the past five years and characteristics of fatal gunshot injuries of gunshot victims in an urban setting in Tanzania.

## Materials and Methods

### Study Design

This was descriptive cross-sectional study that was conducted at Department of Pathology, Muhimbili National Hospital (MNH) in Tanzania.

### Setting

The MNH is a tertiary care hospital located in Dar es Salaam, Tanzania. Dar es Salaam is the largest and commercial capital cities in Tanzania with a 2019-population projection of over 5 million [15]. In Tanzania, all medico-legal autopsies are governed by law in cases of death due to non-natural causes.

### Study Population

In the period between January 2015 and December 2019, we reviewed a total of 6261 forensic autopsies at the

Department of Pathology of MNH in Tanzania. We reviewed each case by assessing the underlying cause of death following codes in the International Statistical Classification of Diseases and Related Health Problems, 10<sup>th</sup> Revision (ICD)-10 [15] Major four categories were (a) Intentional, self-harm (ICD code, X<sub>72</sub>-X<sub>74</sub>), (b) Intentional, assault (X<sub>93</sub>-X<sub>95</sub>), (c) Unintentional (W<sub>32</sub>-W<sub>34</sub>) and (d) Undetermined (Y<sub>22</sub>-Y<sub>24</sub>). All these death codes were confirmed after medical and legal investigations by the Muhimbili National Hospital Mortuary pathologists.

### Process and Measures

Victims of gunshot injuries were classified as homicide (justifiable and non-justifiable), suicide, and accidental on the basis of the information surrounding the circumstance of the death and the information gathered from the police form 99 (PF 99). In all cases, the relative of the victim or a witnesses or both were available during the examination. Justifiable homicide involved the victims being shot by the law enforcers. The information gathered from PF 99 include: particulars of the deceased (estimated age and sex), date and circumstances of death. The victims were examined to determine the age, sex, circumstances of death and manner of death, anatomical site of entrance. We classified site of injury as chest, abdomen, head, neck and limbs. In addition, we classified the manner of gunshot as police, bandit, suicide and interpersonal, homicide or accident. All the data were retrieved from the MNH mortuary database into the abstraction from.

### Statistical Analysis

Data analysis involved descriptive measures. We performed all statistical procedures using Statistical Package for Social Sciences (Ver. 24).

### Ethical Clearance

The Ethical Committee of Muhimbili University of Health and Allied Sciences reviewed and approved the protocol. We conducted all examinations with the presence of a victim's relative, witness and a member from the police department. Unless the relative was available, only the witness and a member from the police force department were present.

### Results

We reviewed 234 gunshot deaths over the five year period under study. During the same period, there were 6162 autopsies recorded in the registry. This makes 38.0 gunshot deaths (95% Confidence Interval: 33.4, 43.1) per 1000 forensic autopsies per year. Most of the victims were males 222 (94.9%). The median age of all gunshot deaths was 32

(Inter-Quartile Range = 15) years; minimum and maximum ages being 3 and 83 years respectively (Table 1).

Characteristics	Number (%)
<i>Year of incident</i>	
2015	51 (21.8)
2016	63 (26.9)
2017	59 (25.2)
2018	37 (15.8)
2019	24 (10.3)
<i>Sex of victim</i>	
Male	222 (94.9)
Female	12 (5.1)
<i>Age of victim (years)</i>	
< 19	4 (1.7)
20 – 24	40 (17.1)
25 – 29	36 (15.4)
30 – 34	33 (14.1)
35 – 39	33 (14.1)
40 – 44	23 (9.8)
45 – 49	7 (3.0)
50 – 83	20 (8.5)
Undocumented	38 (16.2)

**Table 1:** Percent of fatal gunshot injuries by background characteristics, MNH, Tanzania, 2015-19 (n=234).

All young (below 20 years) and old (at least 45 years) of the gunshot deaths were males. Of the female gunshot deaths, 11 were aged between 20 and 35 years. The incidence of gunshot deaths has been significantly decreasing year-on-year from 2015 to 2019 ( $\chi^2_{\text{trend}} = 20.924, p < 0.001$ ); from 42.4 to 15.9 per 1000 autopsies (Table 2). The 2019-incidence was significantly lower than those of any earlier date.

Year of incident	Total autopsies	Gunshot (‰)	95%CI
2015	1203	51 (42.4)	(32.0, 55.8)
2016	1197	63 (52.6)	(41.0, 67.2)
2017	1141	59 (51.7)	(39.3, 66.6)
2018	1108	37 (33.4)	(23.9, 46.2)
2019	1513	24 (15.9)	(10.4, 23.9)
<b>TOTAL</b>	<b>6162</b>	<b>234 (38.1)</b>	<b>(28.4, 50.8)</b>

$\chi^2_{\text{trend}} = 20.924, p < 0.001$

**Table 2:** Trend of gunshot deaths, MNH, Tanzania, 2015-19.

In table 3, we present siting of the gunshot wound and motives of shooting. The majority of gunshot deaths were in the chest, 87 (37.2%), abdomen 49 (20.9), head and neck 37 (15.8%) and chest/abdomen 28 (12.0%). Although the majority (42.3%) of the gunshot injury deaths brought to MNH have unknown manner of shooting, more than 60% are gunned down either by law enforcers or bandits. In addition, among the female victims, eight were shot by bandits and 73 of all males were shot by the police. The two suicide victims were all males. The youngest, three-year male victim, was shot by the bandit. The most common anatomic sites of the bullet entry were chest 78 (37.2%), the abdomen 49 (20.9%), the head and neck 37 (15.8%) or in both the chest and abdomen, 28 (12.0%).

Site/manner of shooting	Number (%)
<i>Anatomical site</i>	
Chest	87 (37.2)
Abdomen	49 (20.9)
Head/neck	37 (15.8)
Chest/abdomen	28 (12.0)
Upper limbs	16 (6.8)
Other multiple	6 (2.6)
Undocumented	11 (4.7)
<i>Manner of gunshot</i>	
Police	77 (32.9)
Bandit	52 (22.2)
Suicide	2 (0.9)
Interpersonal/Homicide/Accidental	4 (1.7)
Unknown	99 (42.3)

**Table 3:** Proportion of fatal gunshot injuries by anatomic location and manner of gunshot, MNH, Tanzania, 2015-19 (n=234).

## Discussion

The incidence from this study is lower as compared to that of 2018 in Banwari from the Transkei sub-region of South Africa with a reported incidence of 145.4 deaths related to firearm injuries per 1000 autopsies per year [16]. Furthermore, 2017 Gothecha et al. reported higher rate, 150 per 1000 autopsies, of fatal gunshot injuries in the County of Nairobi [17]. Earlier in 2009, a comparative incidence from more extended area in South Africa was 196.4 per 1000 autopsies [18]. In addition, a report by Nwachokor et al, reported a higher incidence of 442.9 per 1000 autopsies per year in Warri, Nigeria [19]. On the other hand, the incidence of gunshot deaths from this study is higher as compared to incidence from Kmfo Anokye Teaching Hospital, Kumasi, in

the northern part of Ghana, West Africa, which was 16.8 per 1000 autopsies per year [20]. Lower incidences of gunshot deaths in this study as compared to those in South Africa and Nigeria be a reflection of strict gun ownership laws and control in Tanzania.

Although the disparity of mortality is registered for all diseases and illnesses, specifically, men are more likely to die from gunshot injuries than women [21,22]. In this study, there are more men dying of gunshot injuries than women. Elsewhere in some of the sub-Saharan counties, on average, women are more protected from gunshot injury death than their counterparts [17,23-25]. Reasons behind gunshot injury death favouring males than females would differ based on the manner of gunshot [22].

In this study, law enforcers and bandits are leading categories for homicides through gunshot injuries. It may be difficult to clearly justify for each gunshot injury shot by the police. However, whenever there is firearm exchange between bandits and the law enforcers, the former are killed or even the police are themselves killed by the bandits. Nevertheless, an increase of crime, interpersonal violence including police brutality in urban settings have led to a rise in incidence of gunshot injury deaths [26,27].

In the current study, suicide accounted for only 0.9% of all fatal gunshot injuries. This proportion is very low as compared to a worldwide study by Naghavi and Marczak [5]; nevertheless the level is consistent with a Nigeria study by Seleye-Fubara that showed lower rate of suicide as compared to homicide deaths [27]. Of the total fatal gunshot injuries in the United States for 2017, 60% were suicide [6], which is very higher comparing with the current study. The difference can be explained by the fact that, accessibility of guns in the United States is easier as comparing to Tanzania. In our study, the chest (37.2%) was the commonest sites of the entry gunshot wounds in homicidal deaths. This observation differs from a Nigerian study which shows high rate of entrance wounds on the head [27].

## Conclusion

To conclude, the incidence of gunshot injury death at MNH is 38.0 per 1000 autopsies per year. The incidence has been declining over the years. The majority of the victims are men and in most cases young. More than half of the victims are killed by bandits or the law enforcers.

## Declarations

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**Conflicts of interest:** Authors declare that they have no competing interests

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