



**University of Rwanda**

**College of Medicine and Health Sciences**

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**Epidemiology and outcomes of geriatric trauma patients consulting at the CHUK  
Emergency Department**

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## DECLARATION

I hereby declare that this work: “Epidemiology and outcomes of geriatric trauma patients consulting at the CHUK Emergency Department (ED)” is my own under supervision and guidance of my professors in Emergency Medicine.

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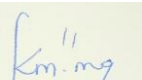
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All thanks to God Almighty, for having gifted me with perseverance to pursue my way this far.

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## **ACRONYMS AND ABBREVIATIONS**

|             |  |
|-------------|--|
| <b>CHUK</b> | : Centre Hospitalier Universitaire de Kigali |
| <b>CMHS</b> | : College of Medicine and Health Sciences    |
| <b>EC</b>   | : Ethic Committee                            |
| <b>ECCM</b> | : Emergency and Critical Care Medicine       |
| <b>ED</b>   | : Emergency Department                       |
| <b>EMS</b>  | : Emergency Medical Services                 |
| <b>F</b>    | : Female                                     |
| <b>GCS</b>  | : Glasgow Coma Scale                         |
| <b>GPs</b>  | : General Practitioner                       |
| <b>HR</b>   | : Heart Rate                                 |
| <b>IQR</b>  | : Interquartile range                        |
| <b>IRB</b>  | : Institutional Review Board                 |
| <b>KTS</b>  | : Kampala Trauma Scale                       |
| <b>M</b>    | : Male                                       |
| <b>MAP</b>  | : Mean Arterial Pressure                     |
| <b>MD</b>   | : Medical Doctor                             |
| <b>RTA</b>  | : Road Traffic Accident                      |
| <b>SPO2</b> | : Peripheral Capillary Oxygen Saturation     |
| <b>WHO</b>  | : World Health Organization                  |

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## **ABSTRACT**

### **Introduction**

Traumatic injuries in the elderly often represent a major medical and surgical challenge, as even simple isolated fractures can be life-threatening in the geriatric population. However, data on the frequency and types of injuries among the elderly in Rwanda is currently lacking. This study explored the epidemiology and outcomes of trauma for patients more than 65 years of age presenting to the emergency department (ED) of the Centre Hospitalier Universitaire de Kigali, a public tertiary referral hospital in Kigali, Rwanda.

### **Methods**

This single-centre, prospective cross-sectional study was conducted from July 2019 to January 2020 at the ED of CHUK. Trauma patients aged 65 and above presenting to the ED and alive at the time of evaluation were eligible for inclusion. Demographic information collected included age, gender, and occupation status. Data on the triage colour, mechanism of injury, transfer status, transport method to CHUK, time spent at the ED, complications, and predictors of mortality was also collected.

### **Results**

For the 100 patients enrolled, the median age was 77 for women and 71 for men. Most geriatric trauma patients either had a source of sustainable income (50%) or were not currently employed (48%). The majority of patients were from Kigali City (53%). The most common mechanism of injury was falls (63%), followed by road traffic accidents (28%). The majority of patients spent less than 48 hours in the ED (63%). The mortality rate was 14%, with most deaths resulting from injury-related complications. Triage colour, KTS, and GCS were significant predictors of mortality, with p-values of 0.002, <0.001, and <0.001, respectively.

### **Conclusions**

Falls and road traffic accidents are the predominant mechanisms of geriatric trauma presenting to the CHUK ED. Most deaths result from injury-related complications, and triage colour, KTS, and GCS are significant predictors of mortality among geriatric trauma patients. Targeted improvements in injury prevention and treatment for the elderly can result in improved outcomes and increased life expectancy.

**Key Words:** Geriatric; Elderly; Trauma; Emergency Department

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Geriatric trauma, most commonly defined as trauma affecting patients aged 65 and older,<sup>1,2</sup> is an emerging global problem that is significant for its association with increased morbidity and mortality.<sup>3</sup> The growing prevalence of elderly trauma has led to an increase in geriatric trauma studies and the development of geriatric trauma care units.<sup>4</sup> The priorities for physicians treating geriatric trauma are to reduce morbidity and mortality and contribute to injury prevention strategies.<sup>5</sup>

Traumatic injuries in the elderly are challenges of great concern, as even relatively simple, minor fractures can be life-threatening for geriatric patients.<sup>6</sup> Advanced age is an established risk factor for poorer outcomes after trauma; elderly trauma patients suffer a higher mortality rate that can be attributed to age, pre-existing disease, complications, and injury severity.<sup>5,6</sup> The unique physiology, behaviour, and anatomy of geriatric trauma patients result in distinct patterns of injuries that can significantly affect the older adult's quality of life.<sup>7,8</sup>

Geriatric patients respond to trauma differently than younger patients due to the presence of comorbid conditions, decreased physiologic reserve, vascular system elasticity changes, and medication use.<sup>9</sup> For example, geriatric patients tolerate blood and volume losses poorly and often present with abnormal systolic blood pressure and heart rate that suggest hemodynamic instability.<sup>10,11</sup> Consequently, their medical and surgical resource needs for their injuries are disproportionately greater compared to the same injuries in younger patients.<sup>10</sup>

Road traffic accidents (RTAs) and falls are the main mechanisms of injury in the elderly.<sup>4</sup> Falls in particular are one of the most common causes of traumatic brain injuries and injury-related deaths among geriatric patients.<sup>4,12</sup> Each year globally, approximately 30% of the population over the age of 65 and 50% over the age of 80 experience falls,<sup>2,7</sup> and in 2015, medical costs for falls exceeded \$50 billion.<sup>13</sup> Additionally, the incidence of falls resulting in emergency admissions and mortality has been increasing in recent years.<sup>2</sup>

As the elderly population grows, the fraction of geriatric trauma patients is rapidly increasing.<sup>3</sup> In sub-Saharan African, geriatric trauma patients are neglected and pose a significant treatment challenge.<sup>5</sup> Outcomes of geriatric trauma patients may be especially poor in developing countries, where the lack of advanced pre-hospital care systems, trauma centres, and effective ambulance systems for transporting patients from the trauma scene to the hospital are neglected areas that prevent optimal trauma care.<sup>5,9</sup>

In sub-Saharan Africa, many countries are experiencing demographic transitions, including Rwanda. Rwanda has made rapid and significant improvements in life expectancy and total fertility through healthcare system investments and poverty reductions, but the consequent growth in the number of elderly people may present challenges.<sup>14</sup> Life expectancy at birth was 46.4 years in 1978, increased to 53.7 years by 1991, decreased to 51.2 years by 2002, and then increased again by about 26% from 51.2 to 64.5 years by 2012.

Rwanda's population is expected to more than double in the next 50 years, from 11.6 million in 2015 to 25.3 million by 2065.<sup>15,14</sup> In 2015, there were 356,000 older persons in Rwanda (ages 65 and above), representing 3.16% of the total population, with a greater number of females than males.<sup>16</sup> This number is expected to approximately double by 2030 to 695,000 (comprising 4.42% of the total population), reach 1,642,000 by 2050 (comprising 7.07% of the population), and increase by nearly tenfold by 2070 to 3,416,000 (comprising 12.8% of the population).<sup>16</sup> Rural and urban populations are expected to age differently; the total number of older people is projected to quadruple in urban areas and double in rural areas.<sup>16,14</sup> Thus, urbanisation policies will need to consider Rwanda's changing demographics and ageing population in terms of infrastructure, public health, and healthcare.<sup>14</sup>

Currently, there is a lack of systematic data on the epidemiology and outcomes of geriatric trauma patients in Rwanda. Given the unique challenges of treating geriatric trauma patients, especially in the Sub-Saharan African context, this information would be useful for designing public health efforts targeting geriatric trauma prevention and for guiding hospital protocol development or resource allocation for appropriate acute management of geriatric trauma patients.

## **1.2 Aims and Objectives**

### **1.2.1 General objective**

To determine the epidemiology and outcomes of geriatric trauma patients in the emergency department (ED) CHUK.

### **1.2.2 Specific objectives**

- To determine the demographic features of geriatric trauma patients.
- To determine the mechanisms of injury among geriatric trauma patients.
- To evaluate mortality rates in geriatric trauma patients.
- To identify the predictors of mortality in geriatric trauma patients.
- To identify hospital admission factors predicting discharge disposition in geriatric patients.

## **CHAPTER TWO**

### **METHODOLOGY**

#### **2.1 Study description**

This study was a prospective cross-sectional analysis of the epidemiology and outcomes of geriatric trauma patients presenting at the CHUK ED over a seven-month period.

#### **2.2 Study site**

This single-centre, prospective cross-sectional study was conducted in the emergency department of the University Teaching Hospital–Kigali (CHUK), in Kigali, Rwanda from July 2019 to January 2020. CHUK is a tertiary hospital located in district of Nyarugenge in Kigali City. It is the largest referral hospital in the country with a capacity of 519 beds, including 24 beds in the emergency department. When a trauma patient arrives at the emergency department, they are first evaluated by a triage nurse, and then assessed in detail by an emergency medicine specialist, resident or General Practitioner. Subsets of patients do require emergency operating room sooner than later. In 2019, the CHUK ED received 1,170 geriatric patients.

#### **2.3 Patient population**

Geriatric trauma patients were defined as adults at least 65 years of age presenting to the emergency department at CHUK.

##### **2.3.1 Inclusion criteria**

Patients were eligible for inclusion if they presented with trauma, were at least 65 years old, were alive at the time of evaluation, and consented to participation.

##### **2.3.2 Exclusion criteria**

Patients were excluded if they were presenting for medical reasons, were less than 65 years old, or did not consent.

## **2.4 Study Outcomes**

The primary outcome for this study was the epidemiology of geriatric trauma in the ED at CHUK. Demographic information included age, gender, and occupation. In addition, we documented the time of injury, the time of arrival at CHUK, the triage colour (corresponded to a modified version of the South Africa triage scale in emergency department), the time seen by a doctor, mechanism of injury, and status of transfer and transport to CHUK.

## **2.5 Study procedures**

Prior to study enrolment, patients were informed of the study, and written consent was obtained. The study investigator and nurses working in the emergency department obtained consent and collected the data. We collected data from patient records and patient's charts prospectively during the patient's time in ED and hospital care using a questionnaire. Data collection ceased when a patient was discharged or died.

### **2.5.1 Follow-up if cohorts study or trial**

Patients were not directly followed-up during their time in the hospital. After data collection was completed for all patients, files were reviewed to look for complications and mortality.

### **2.5.2 Measurement of outcomes**

The primary outcome was to measure the epidemiology of geriatric trauma patients and their mortality outcomes in the ED and hospital. Length of stay in the ED was classified as either more or less than 48 hours, as that is the threshold for a long stay in the ED. Mortality was classified as either before or after 7 days post-admission. Shock index was calculated for patients by dividing heart rate by systolic blood pressure to evaluate the level of haemorrhagic shock. Kampala Trauma Score, a predictor of trauma injury mortality in East African settings that is based on patient age, respiratory rate, systolic blood pressure, number of serious injuries, and neurologic status.<sup>18</sup> Total KTS ranges from 5 to 16, with lower scores indicating more severe injury. was also calculated for patients and averaged for the study.

### **2.5.3 Sample size**

This study gathered a convenience sample, with the sample size determined by the number of patients that presented over the period of the study. Purposive sampling was used to identify all cases who met the inclusion criteria for the study. All cases who met criteria and consented to participation were enrolled in the study. Data was gathered for 100 patients.

### **2.5.4 Data Management**

All data was collected on hard copies of the questionnaire and then stored in a password-protected Excel database that could only be accessed by study members. Study personnel each used a unique login ID and password to access the data to maintain its confidentiality. The following demographic data was collected: medical record number, age, sex (but no names).

### **2.6 Statistical Analysis**

This data was analysed using STATA 14 software. Continuous variables were presented as means or medians, while categorical variables were presented as percentages. A  $\chi^2$  test was used to evaluate the significance of categorical data. A logistic analysis was used for testing association between demographic, types of injuries, and outcomes. A P-value of less than 0.05 was considered statistically significant.

### **2.7 Ethical considerations**

This study was approved by the University of Rwanda//CMHS IRB and the CHUK ethics committee (No 210/CMHS IRB/2019, EC/CHUK/0114/2019).

Any identifying information collected in this study was demographic in nature. Names or other identifying information of participants were not recorded. The study questionnaires were kept locked and any data stored in Excel was password-protected.

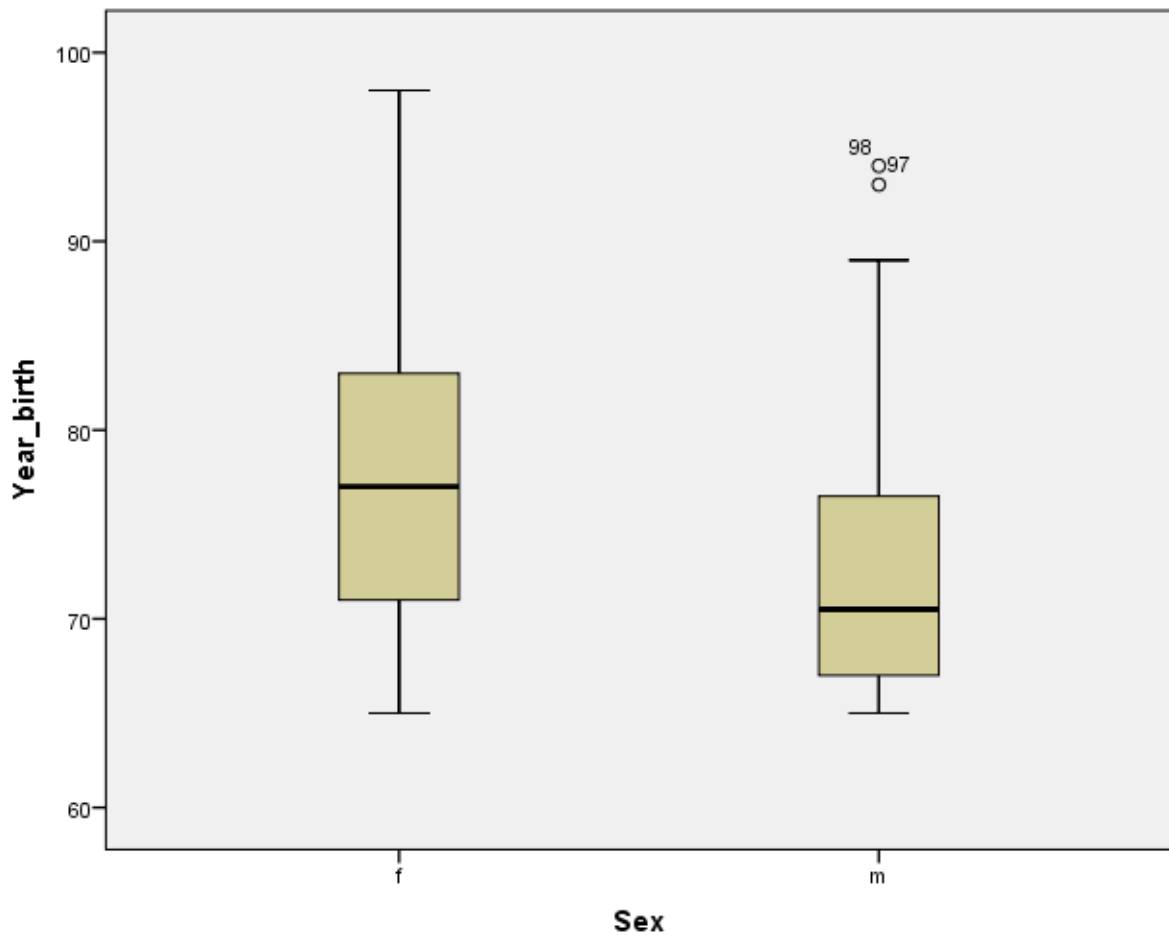


## CHAPTER THREE

### RESULTS

The median age of male geriatric patients (71) was slightly younger than that of female geriatric patients (77). The range of ages was slightly larger for female patients, with an IQR of 12, than for male patients, with an IQR of 10 (Figure 1). The overall median age was 73 years, while the overall Q1 was 68 years and Q3 was 80 years. Their corresponding overall interquartile range (IQR) was 22 years. Outliers were found among male geriatric trauma patients at 97 and 98 years.

**Figure 1: Age distribution of geriatric trauma patients at the CHUK ED according to gender.**



Half of the geriatric trauma patients had a sustainable source of income (50%), working as a farmer or a cow breeder, and the majority of them were from Kigali City (53%). The majority were transferred from another hospital (60%). The common modes of transportation to CHUK were district hospital ambulance (44%) or private car (43%) (Table 1).

**Table 1. Occupation, location, transfer and mean of transport of geriatric trauma patients to the CHUK ED**

| <b>Variables</b>                            | <b>Category</b>                    | <b>Count</b> | <b>Percentage</b> |
|---|------------------------------------|--------------|-------------------|
| <b>Occupation</b>                           | <b>Sustainable income</b>          | 50           | 50.0%             |
|   | <b>None</b>                        | 50           | 50.0%             |
| <b>Residence of patient</b>                 | <b>In Kigali City</b>              | 46           | 46.0%             |
|   | <b>Out of Kigali City</b>          | 53           | 53.0%             |
|   | <b>Out of Rwanda</b>               | 1            | 1.0%              |
| <b>Was the patient transferred to CHUK?</b> | <b>No</b>                          | 40           | 40.0%             |
|   | <b>Yes</b>                         | 60           | 60.0%             |
| <b>Form of transport to CHUK</b>            | <b>District hospital ambulance</b> | 44           | 44.0%             |
|   | <b>EMS</b>                         | 11           | 11.0%             |
|   | <b>Private car</b>                 | 43           | 43.0%             |
|   | <b>Walking</b>                     | 2            | 2.0%              |

The most common mechanism of injury was falls (63%), followed by RTAs (28%). RTAs included vehicular, moto, or bicycle accidents. Yellow was the most common triage colour (51%), followed by orange (37%) (Table 2). The majority of geriatric patients were admitted (70%).

**Table 2. Mechanism of injury, triage category, and disposition of geriatric trauma patients at the CHUK ED**

| <b>Variable</b>            | <b>Category</b>     | <b>Count</b> | <b>Percentage</b> |
|----------------------------|---------------------|--------------|-------------------|
| <b>Mechanism of injury</b> | <b>Fall</b>         | <b>63</b>    | <b>63.0%</b>      |
|                            | RTA                 | 28           | 28.0%             |
|                            | Assault             | 4            | 4.0%              |
|                            | Others              | 2            | 2.0%              |
|                            | Knocked by a stones | 1            | 1.0%              |
|                            | Foreign body        | 1            | 1.0%              |
|                            | Dog bite            | 1            | 1.0%              |
| <b>Triage colour</b>       | Red                 | 9            | 9.0%              |
|                            | Orange              | 37           | 37.0%             |
|                            | <b>Yellow</b>       | <b>51</b>    | <b>51.0%</b>      |
|                            | Green               | 3            |                   |
| <b>DISPOSITION</b>         | <b>admission</b>    | <b>70</b>    | <b>70.0%</b>      |
|                            | Discharge           | 26           | 26.0%             |
|                            | Observation         | 2            | 2.0%              |
|                            | Counter-refer       | 2            | 2.0%              |

The majority of geriatric trauma patients spent less than 48 hours in the ED (63%), and thus did not have an unusually long stay. Most had a normal shock index, between 0.5 and 0.7 (66%). The average Kampala Trauma Score was between 13 to 16 indicating that most patients were mild injured degree. However, 14% of geriatric trauma patients passed away, with a corresponding mortality rate of 140 deaths per 1,000 geriatric trauma patients admitted to the ED. Most patients did not have comorbidities (81.0%), and the majority of patients did not experience any complications (79.0%). The complications that were observed included alcohol withdrawal syndrome, wound infection, bedsores, and lower limb gangrene, each affecting 1.0% of the patients. Most deaths resulted from injury-related complications (Table 3)

**Table 3. Length of time in the ED and injury-related complications for geriatric trauma patients at CHUK**

| <b>Variable</b>             | <b>Category</b>         | <b>Count</b> | <b>Percentage</b> |
|-----------------------------|-------------------------|--------------|-------------------|
| <b>TIME SPENT</b>           | <b>&lt;48 hours</b>     | <b>63</b>    | <b>63.0%</b>      |
|                             | >48 hours               | 37           | 37.0%             |
| <b>COMBORBIDITIES</b>       | <b>Hypertension</b>     | <b>10</b>    | <b>10.0%</b>      |
|                             | <b>None</b>             | <b>81</b>    | <b>81.0%</b>      |
|                             | Diabetes Mellitus       | 2            | 2.0%              |
|                             | HIV                     | 2            | 2.0%              |
|                             | Mental disorder         | 1            | 1.0%              |
|                             | Asthma                  | 1            | 1.0%              |
|                             | Dilated cardiomyopathy  | 1            | 1.0%              |
|                             | Previous injury         | 1            | 1.0%              |
| <b>SHOCK INDEX</b>          | <0.5                    | 12           | 12.0%             |
|                             | <b>0.5-0.7 (normal)</b> | <b>66</b>    | <b>66.0%</b>      |
|                             | >0.7                    | 22           | 22.0%             |
| <b>KAMPALA TRAUMA SCORE</b> | <b>13-16 (mild)</b>     | <b>87</b>    | <b>87.0%</b>      |
|                             | 9-12 (moderate)         | 13           | 13.0%             |
|                             | 5-8 (severe)            | 0            | 0.0%              |
| <b>COMPLICATIONS</b>        | <b>Death</b>            | <b>14</b>    | <b>14.0%</b>      |
|                             | Anaemia/infected wound  | 1            | 1.0%              |
|                             | Bed sores               | 1            | 1.0%              |
|                             | Alcohol withdrawal      | 1            | 1.0%              |
|                             | Hyponatremia            | 1            | 1.0%              |
|                             | Infected wound post     | 1            | 1.0%              |
|                             | External fixation       |              |                   |
|                             | Right low limb wet      | 1            | 1.0%              |
|                             | gangrene                |              |                   |
|                             | Other                   | 1            | 1.0%              |
| <b>None</b>                 | <b>79</b>               | <b>79.0%</b> |                   |

**Table 4. Predictors of mortality among geriatric trauma patients at the CHUK ED. Gender, injury mechanism and severity, vital signs, and presence of comorbidities were assessed for whether they were predictive of overall mortality.**

|                         |                 | Overall mortality |            |          |            |                  |
|-------------------------|-----------------|-------------------|------------|----------|------------|------------------|
|                         |                 | Alive             |            | Deceased |            | p-value          |
|                         |                 | Count             | Percentage | Count    | Percentage |                  |
| <b>Gender</b>           | <b>F</b>        | 37                | 43.0%      | 7        | 50.0%      | 0.626            |
|                         | <b>M</b>        | 49                | 57.0%      | 7        | 50.0%      |                  |
| <b>Triage colour</b>    | <b>Green</b>    | 2                 | 2.3%       | 0        | 0.0%       | <b>0.002</b>     |
|                         | <b>Orange</b>   | 32                | 37.2%      | 5        | 35.7%      |                  |
|                         | <b>Red</b>      | 4                 | 4.7%       | 5        | 35.7%      |                  |
|                         | <b>Yellow</b>   | 48                | 55.8%      | 4        | 28.6%      |                  |
| <b>GCS</b>              | <b>14-15</b>    | 81                | 94.2%      | 7        | 50.0%      | <b>&lt;0.001</b> |
|                         | <b>9-13</b>     | 3                 | 3.5%       | 5        | 35.7%      |                  |
|                         | <b>≤8</b>       | 2                 | 2.3%       | 2        | 14.3%      |                  |
| <b>MAP</b>              | <b>&lt;70</b>   | 2                 | 2.3%       | 0        | 0.0%       | 0.104            |
|                         | <b>&gt;100</b>  | 20                | 23.3%      | 7        | 50.0%      |                  |
|                         | <b>70-100</b>   | 64                | 74.4%      | 7        | 50.0%      |                  |
| <b>HR</b>               | <b>&lt;60</b>   | 6                 | 7.0%       | 1        | 7.1%       | 0.170            |
|                         | <b>60-100</b>   | 71                | 82.6%      | 9        | 64.3%      |                  |
|                         | <b>&gt;100</b>  | 9                 | 10.5%      | 4        | 28.6%      |                  |
| <b>SP02</b>             | <b>&lt;90</b>   | 4                 | 4.7%       | 2        | 14.3%      | 0.159            |
|                         | <b>&gt;90</b>   | 82                | 95.3%      | 12       | 85.7%      |                  |
| <b>Temperature</b>      | <b>&lt;36</b>   | 22                | 25.6%      | 5        | 35.7%      | 0.412            |
|                         | <b>36-37.5</b>  | 62                | 72.1%      | 8        | 57.1%      |                  |
|                         | <b>&gt;37.5</b> | 2                 | 2.3%       | 1        | 7.1%       |                  |
| <b>Respiratory rate</b> | <b>&lt;15</b>   | 2                 | 2.3%       | 0        | 0.0%       | 0.789            |
|                         | <b>15-20</b>    | 80                | 93.0%      | 13       | 92.9%      |                  |
|                         | <b>&gt;20</b>   | 4                 | 4.7%       | 1        | 7.1%       |                  |

|                            |                              |    |       |    |       |                  |
|----------------------------|------------------------------|----|-------|----|-------|------------------|
|                            | <b>High risk</b>             |    |       |    |       | 0.959            |
| <b>MECHANISM OF INJURY</b> | <b>of mortality</b>          | 24 | 27.9% | 4  | 28.6% |                  |
|                            | <b>Low risk of mortality</b> | 62 | 72.1% | 10 | 71.4% |                  |
| <b>SHOCK INDEX</b>         | <b>&lt;0.5</b>               | 11 | 12.8% | 1  | 7.1%  | 0.724            |
|                            | <b>0.5-0.7</b>               | 57 | 66.3% | 9  | 64.3% |                  |
|                            | <b>&gt;0.7</b>               | 18 | 20.9% | 4  | 28.6% |                  |
| <b>KTS</b>                 | <b>13-16</b>                 | 80 | 92.0% | 7  | 8%    | <b>&lt;0.001</b> |
|                            | <b>9-12</b>                  | 6  | 46%   | 7  | 54%   |                  |
|                            | <b>5-8</b>                   | 0  | 0%    | 0  | 0%    |                  |
| <b>COMORBIDITY</b>         | <b>No</b>                    | 73 | 84.9% | 10 | 71.4% | 0.219            |
|                            | <b>Yes</b>                   | 13 | 15.1% | 4  | 28.6% |                  |

Triage colour , Kampala Trauma score and GCS were found to be significant predictors of mortality for geriatric trauma patient admitted to the ED, with p-values of 0.002, <0.001 and <0.001, respectively. The other variables did not show significant association with mortality among geriatric trauma patients (Table 4).

## **CHAPTER FOUR**

### **DISCUSSION**

A large number of geriatric patients' age was above 70 year. These findings are consistent with those in the study conducted by Lankaonde et al, which found that the median age was  $71.7 \pm 6.1$  years.<sup>2</sup> These older ages may be due to the improvement of life expectancy among Rwandans and Africans in general. As Rwanda's population continues to age, trauma will carry greater risks for geriatric patients.

The most common mechanisms of injury among geriatric patients admitted to CHUK were falls (63%) and RTAs (28%). These findings are similar to those of previous studies of Ashraf and Said, which have found that falls cause about 60% of geriatric trauma and RTAs 44.4%.<sup>4,9</sup> This may be due to reduced stability among geriatric patients, which exposes them more to fall-related injuries. Another possible cause could be osteoporosis, which is common at older ages and can lead to more severe injuries. In Rwanda, increased road infrastructure and vehicle use may be leading to higher rates of RTAs overall.

The mortality rate was 140 deaths per 1,000 geriatric trauma patients within the seven-month study period, or 14.0% of patients. Similar findings were reported by Said et al, which found that mortality rate was 13.9% in a urban hospital in Kenya.<sup>9</sup> This may be explained by the fact that both studies were conducted in East Africa. Meanwhile, the mortality findings from this study differ from those reported in Italy.<sup>6</sup> These differences can be attributed to variation between the sub-Saharan African and Western European contexts in care setting and transport of geriatric trauma patients from site of injuries, which can affect the quality of acute management and thus patient outcomes. These results suggest that mortality rates for geriatric trauma in Rwanda are typical of the East African context and remain slightly elevated above rates in developed countries.

Triage colour and GCS were found to be significant predictors of mortality among geriatric trauma patients presenting to the ED, consistent with other studies.<sup>3,10</sup> An explanation for this finding is that GCS is the most common indicator used to classify head injury severity, and patients with GCS of 8 and below have poor prognoses when stratification and management do not start from the injury site. A similar explanation may apply to triage colour, which is used to stratify patients in different triage groups according to their injury severity. Another significant mortality predictor in geriatric trauma patients was the KTS.

Findings from other studies have also demonstrated that KTS is applicable to settings like CHUK.<sup>16</sup> This is likely because KTS is a tool adapted to low income settings and considers the patient's age, injury severity, and neurological status. However, the KTS may not be useful alone for predicting mortality among geriatric trauma patients at CHUK, because a large number of patients come from District Hospitals after being resuscitated, which may impact their presenting blood pressure and neurological status. This explains why the overall mortality rate in our study was 14%, despite the majority of patients (87%) presenting with a mild KTS score. This finding demonstrates why KTS should be complemented by triage colour and possibly GCS, which evaluates a patient's neurological status more in-depth than the AVPU score used in KTS. Overall, these findings suggest that KTS, GCS, and triage colour are appropriate and useful injury severity metrics for the Rwandan emergency care context.

#### **4.1. Limitations**

The study was limited to one health facility and the sample size was only 100. Thus, generalisation (external validation) to other settings other than CHUK may not be applicable. Additionally, as mortality was assessed for all patients at the end of data collection, regardless of their date of enrolment, patients were not assessed following a uniform length of time.

#### **4.2. Recommendations**

As falls and RTAs are the most common mechanisms of geriatric trauma, improvement projects and public health measures targeting their prevention among the elderly should be implemented at the community level, such as, community exercise classes, or calcium supplementation. As KTS, GCS, and triage colour are predictive of mortality and thus can give physicians a basic indication of the extent and complexity of treatment required, patients could also be assigned a triage colour at the site of injury instead of triaging when they arrive at CHUK, as this would provide physicians a more accurate measure of their injury severity. Physicians can use a combination of KTS and triage colour, with the possible addition of GCS when an assessment of neurological status more detailed than AVPU is needed.

This study should be extended to settings other than CHUK to obtain a more general picture of geriatric trauma in Rwanda as well.



### **4.3. Conclusion**

Geriatric trauma is a severe and increasing problem in Rwanda, with high mortality rates and a growing elderly population. Falls and RTAs are the predominant mechanisms of geriatric trauma for patients presenting at the ED of CHUK in Kigali, Rwanda, and thus can be the targets of public health prevention efforts. Most deaths result from injury-related complications, and triage colour, KTS, and GCS are significant predictors of mortality among geriatric trauma patients admitted to the ED. These risk factors can be taken into account as acute care guidelines and protocols for geriatric trauma care evolve in Rwanda.

## REFERENCES

1. Llompарт-Pou JA, Pérez-Bárcena J, Chico-Fernández M, Sánchez-Casado M, Raurich JM. Severe trauma in the geriatric population. *World J Crit Care Med.* 2017;6(2):99. doi:10.5492/wjccm.v6.i2.99
2. Lankoandé M, Bonkougou P, Simporé A, Somda G, Kabore RAF. Inhospital outcome of elderly patients in an intensive care unit in a Sub-Saharan hospital. *BMC Anesthesiol.* 2018. doi:10.1186/s12871-018-0581-x
3. Gardner R, Dams-O'Connor K, Morrissey M, Manley G. Geriatric Traumatic Brain Injury: Epidemiology, Outcomes, Knowledge Gaps, and Future Directions. *J Neurotrauma.* 2017;906. <http://online.liebertpub.com/doi/10.1089/neu.2017.5371>.
4. Hefny AF, Abbas AK, Abu-Zidan FM. Geriatric fall-related injuries. *Afr Health Sci.* 2016;16(2):554-559. doi:10.4314/ahs.v16i2.24
5. Chalya PL, Mabula JB, Ngayomela IH, et al. Geriatric injuries among patients attending a regional hospital in shinyanga Tanzania. *Tanzan J Health Res.* 2012.
6. Iaria M, Surleti S, Fama F, Villari S, Gioffre-Floria M. Epidemiology and Outcome of multiple trauma in the elderly population in a tertiary care hospital in southern Italy. *BMC Geriatr.* 2009;9(SUPPL.1):2007.
7. Adam S, Eid H, Barss P, Lunsjo K, Grivna M, Torab F. Epidemiology of geriatric trauma in United Arab Emirates. *Arch Gerontol Geriatr.* 2008;47(3):377-382.
8. Magidson PD, Thoburn AK, Hogan TM. Emergency Orthogeriatrics: Concepts and Therapeutic Considerations for the Geriatric Patient. *Emerg Med Clin North Am.* 2020. doi:10.1016/j.emc.2019.09.002
9. Saidi H, Mutiso B. Injury Outcomes in Elderly Patients Admitted at an Urban African Hospital. *Surg Sci.* 2013;04(06):292-297. doi:10.4236/ss.2013.46057
10. Ahmed N, Greenberg P. Early risk stratification of in hospital mortality following a ground level fall in geriatric patients with normal physiological parameters. *Am J Emerg Med.* 2019. doi:10.1016/j.ajem.2019.12.031
11. Brown CVR, Rix K, Klein AL, et al. A comprehensive investigation of comorbidities, mechanisms, injury patterns, and outcomes in geriatric blunt trauma patients. *Am surg.* 2016;82(11):1055-1062. <http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L616622723%0Ahttp://rug.on.worldcat.org/atoztitles/link/?sid=EMBASE&issn=00031348&id=doi:&atitle=A+comprehensive+investigation+of+comorbidities%2C+mechanisms%2C+injury+patterns%2C+an>.

12. So WH, Chan HF, Li MK. Investigation of risk factors of geriatric patients with significant brain injury from ground-level fall: A retrospective cohort study in a local Accident and Emergency Department setting. *Hong Kong J Emerg Med.* 2018. doi:10.1177/1024907918775166
13. El-Menyar A, Tilley E, Al-Thani H, Latifi R. Females fall more from heights but males survive less among a geriatric population: Insights from an American level 1 trauma center. *BMC Geriatr.* 2019. doi:10.1186/s12877-019-1252-6
14. Martina, Aboderin I, Bayisenge J, Irambeshya A. Population Ageing in Rwanda: Current Needs, Future Projections, and Implications for Policy. 2018;(January):1-77. [https://assets.publishing.service.gov.uk/media/5b6c063440f0b640a5370011/Implications\\_of\\_Demographic\\_Change\\_in\\_Rwanda\\_FULL\\_REPORT.pdf](https://assets.publishing.service.gov.uk/media/5b6c063440f0b640a5370011/Implications_of_Demographic_Change_in_Rwanda_FULL_REPORT.pdf).
15. NISR. Fourth Population and Housing Census, Rwanda, 2012. Thematic report: Population projections. *Rwanda.* 2014.
16. *Unlocking Rwanda's Potential to Reap the Demographic Dividend.*; 2017.
17. Sharon R. Weeks, Catherine J. Juillard, Martin E. Monono, et Al, Is the Kampala Trauma Score an Effective Predictor of Mortality in Low-Resource Settings? A Comparison of Multiple Trauma Severity Scores, *World Journal of Surgery*, 2014
18. Kobusingye O, Ronald R. Hospital-Based Trauma Registries in Uganda. *The Journal of Trauma.* 2000.

# APPENDICES

## APPENDIX 1 : Questionnaire

### Geriatric trauma patients Study Questionnaire

#### 1. Identification

Study ID number \_\_\_\_\_

Patient ID \_\_\_\_\_

Sex:     Male     Female

Year of birth \_\_\_\_\_

Occupation \_\_\_\_\_

District \_\_\_\_\_

Transfer \_\_\_\_\_

#### 2. Trauma characteristics and patient evaluation

Date / time of injury: Date \_\_\_\_\_ Time \_\_\_\_\_

Date /time of arrival at CHUK: Date \_\_\_\_\_ Time \_\_\_\_\_

Transport to CHUK:  EMS     DH ambulance     Private car     walking     other  
\_\_\_\_\_

Triage color:  Red     Orange     Yellow     Green

Date /time seen by treating team \_\_\_\_\_

GCS: \_\_\_\_\_ BP \_\_\_\_\_ HR \_\_\_\_\_ SPO2 \_\_\_\_\_ Temperature \_\_\_\_\_ RR \_\_\_\_\_

Mechanism of injury:  fall     RTA     Assault     Others \_\_\_\_\_

Injury site:  Head     Neck     thorax     Abdomen and back

Genitals     Upper limbs     Lower limbs

Comorbidity:  HTN :  DM  hepatitis  cancer  other

Imaging diagnostic:  head injury  spine injury  upper limb injury  low limb injury  other

### 3. Management done at CHUK emergency

ABC:  Oxygen  C-collar  Intubation  Mechanical ventilation  other\_\_\_\_\_

Fluid:  Bolus  Maintenance

Medications:  Painkillers  SAT  other\_\_\_\_\_

Immobilization:  skin traction  backslap  Other\_\_\_\_\_

Disposition:  Admission  Observation  Discharge  Counter-refer

Times spend in ED  48h  above 48h

Mortality  before 7 days  after 7 days

Complications  pneumonia  DVT  neurological problem  other

Data collector: Names: .....

Signature.....

## **APPENDIX 2: Informed Consent Form**

### **Epidemiology and Outcomes of Geriatric trauma patients presenting at ED (Emergency Department) CHUK**

#### **Informed Consent Agreement**

Please read carefully this consent agreement before you decide to participate in this study

**Purpose of this research study:** The purpose of this study is to describe epidemiology and outcomes, to assess the criteria's and mechanisms of injury.

**What you will do in the study:** If you sign the agreement, we will get information from you or your care take the identification, cause of trauma, mechanism of injury, and other information will be get from the medical file.

**Time required:** The study will require about approximately 5 minutes of your time for interview.

**Possible Risks:** There is no known possible risk or harms to you participating in this study.

**Benefits:** There are no direct benefits to you for participating in this research study.

**Confidentiality:** The information that you give in the study will be handled confidentially. Your data will be anonymous which means that your name will not be collected or linked to the data. Because of the nature of the data, it may be possible to deduce your identity; however, there will be no attempt to do so and your data will be reported in a way that will not identify you.

**Voluntary Participation:** Participation in this study is voluntary.

**Right to withdraw from the study:** You have the right to withdraw from the study at any time without penalty.

**Payment:** You will receive no payment for participating in the study.

**If you have questions about the study, contact:**

Dr. Martin SABIGABA, MD, PGY-3  
University of Rwanda; CHUK  
Phone: +250 787887729  
Email: sabigabamartin@yahoo.com

Dr. Gabin MBANJUMUCYO  
University of Rwanda; CHUK  
Phone: +250 788645488  
Email: mgabin5@gmail.com

**If you have questions about your rights in the study, contact:**

Professor Kato J. Njunwa  
Chairperson, Institutional Review Board  
Phone: +250788490522  
Deputy Chairperson, Institutional Review Board  
Phone: +250783340040  
College of Medicine and Health Sciences, University of Rwanda  
P.O. Box 3286  
Kigali, Rwanda  
Email: researchcenter@ur.ac.rw  
Website: <http://cmhs.ur/ac/rw/>

**Agreement:**

I agree to participate in the research study described above.

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Patient/Legal Next of kin**

For patient's unconscious, the next of kin, co-signature/consent is required.

**Parent/Guardian**      **Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

\_\_\_\_\_



## **Amasezerano yo kugira uruhare mu bushakashatsi**

Mbere yo gusinya aya masezerano, banza uyasome neza ubaze nibibazo niba ari ngombwa

**Intego y'ubushakashatsi:** Intego yubu bushakashatsi nugushaka kumenya umubare y'abarwayi bafite imyaka 65 nohejuru yaho bakoze impanuka iyo ariyo yose, imikirire yabo ningaruka zinza canke mbi zibabaho baza kwivuza muri CHUK muri service ya buvuzi bwihutirwa mugihe cumwaka umwe.

**Icyo usabwa muri ubu bushakashatsi:** Nyuma yo kwemera amasezerano umurwayi cyangwa umurwaza asabwa amakuru ku birebana nimpanuka, icyayiteye n'andi makuru arebwa mu ifishi y'umurwayi.

**Igihe gikenewe:** turaganira iminota itanu ku gihe cyawe.

**Ingaruka:** ntangaruka ubu bushakashatsi bwa kugiraho kuwabwitabiriye

**Inyungu:** Nta nyungu z'ako kanya uzabona muri bu bushakashatsi.

**Ibanga:** Amakuru yose utanga muri ubu bushakashatsi azagirwa ibanga. Ayo makuru azahabwa kode. Nta hantu na hamwe amazina yawe azakoreshwa. Cyangwa ngo ahuzwe n'amakuru watanze. Ariko kandi kubera imiterere y'ubushakashatsi, imyirondoro yawe ishobora gukenerwa, gusa ntabwo izigera ishyirwa ahagaragara cyangwa ngo ikoreshe ku buryo abantu bashobora kumenya uwo uri we.

**Kwitabira ku bushake:** Uzagira uruhare muri ubu bushakashatsi ku bushake bwawe gusa.

**Igihe wahagarikira uruhare rwawe muri ubu bushakashatsi:** Ushobora guhagarika uruhare rwawe muri ubu bushakashatsi igihe icyo aricyo cyose kandi nta gihano.

**Ubwishyu:** Nta gihembo kizahabwa umuntu kuko yagize uruhare muri ubu bushakashatsi.

**Niba ufite ibibazo bijyanye n'ubu bushakashatsi, binyuze kuri aba bakurikikira:**

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**Niba ukeneye kumenya ibijyanye n'uburenganzira bwawe muri ubu bushakashatsi, wakwiyambaza aba bakurikira:**

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Umuyobozi wungirije, Urwego rukuru rugenzura ubushakashatsi

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Email: [researchcenter@ur.ac.rw](mailto:researchcenter@ur.ac.rw)

Website: [http://cmhs.ur/ac/rw/](http://cmhs.ur.ac/rw/)

**Kwemera amasezerano:**

Ndemera kugira uruhari muri ubu bushakashatsi nasobanuriwe.

**Umukono:** \_\_\_\_\_

**Itariki:** \_\_\_\_\_

**Umurwayi/Umurwaza wemewe n'itegeko**

Ku barwayi batabasha kuvuga canke barebye cane mbese bari muri koma, umurwaza cyangwa undi muntu umuhagarariye ashya umukono aha hakurikira.

**Umukono w'umubyeyi/Umuhagarariye wemewe n'itegeko:** \_\_\_\_\_

**Itariki:** \_\_\_\_\_

## APPENDIX 3: IRB Approval



**CENTRE HOSPITALIER UNIVERSITAIRE  
UNIVERSITY TEACHING HOSPITAL**

**Ethics Committee / Comité d'éthique**

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July 5<sup>th</sup>, 2019 Ref.: EC/CHUK/0114/2019

Review Approval Notice

**Dear Martin SABIGABA**

*Your research project: "Epidemiology and outcomes of geriatric trauma patients consulting emergency department at CHUK"*

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 17<sup>th</sup> June, 2019 to evaluate your request for application of ethical approval for the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your research project.

You are required to present the results of your study to CHUK Ethics Committee before publication.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

**Mr. MUNYANEZA Emmanuel**  
The Secretary, Ethics Committee,  
University Teaching Hospital of Kigali



*<<University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations>>*

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**CMHS INSTITUTIONAL REVIEW BOARD (IRB)**

Kigali, 13<sup>th</sup> /05/2019

Dr Martin SABIGABA  
School of Medicine and Pharmacy, CMHS, UR

**Approval Notice: No 210/CMHS IRB/2019**

Your Project Title *"Epidemiology and Outcomes of Geriatric Trauma Patients Consultation at ED (Emergency Department) CHUK"* has been evaluated by CMHS Institutional Review Board.

| Name of Members             | Institute            | Involved in the decision |              |                               |
|-----------------------------|----------------------|--------------------------|--------------|-------------------------------|
|                             |                      | Yes                      | No ( Reason) |                               |
|                             |                      |                          | Absent       | Withdrawn from the proceeding |
| Prof Kato J. Njunwa         | UR-CMHS              | X                        |              |                               |
| Prof Jean Bosco Gahutu      | UR-CMHS              | X                        |              |                               |
| Dr Brenda Asimwe-Kateera    | UR-CMHS              | X                        |              |                               |
| Prof Ntaganira Joseph       | UR-CMHS              | X                        |              |                               |
| Dr Tumusiime K. David       | UR-CMHS              | X                        |              |                               |
| Dr Kayonga N. Egide         | UR-CMHS              | X                        |              |                               |
| Mr Kanyoni Maurice          | UR-CMHS              | X                        |              |                               |
| Prof Munyanshongore Cyprien | UR-CMHS              | X                        |              |                               |
| Mrs Ruzindana Landrine      | Kicukiro district    |                          | X            |                               |
| Dr Gishoma Darius           | UR-CMHS              | X                        |              |                               |
| Dr Donatilla Mukamana       | UR-CMHS              | X                        |              |                               |
| Prof Kyamanywa Patrick      | UR-CMHS              |                          | X            |                               |
| Prof Condo Umutesi Jeannine | UR-CMHS              |                          | X            |                               |
| Dr Nyirazinyoye Laetitia    | UR-CMHS              | X                        |              |                               |
| Dr Nkeramihigo Emmanuel     | UR-CMHS              |                          | X            |                               |
| Sr Maliboli Marie Josce     | CHUK                 | X                        |              |                               |
| Dr Mudenge Charles          | Centre Psycho-Social | X                        |              |                               |

After reviewing your protocol during the IRB meeting of where quorum was met and revisions made on the advice of the CMHS IRB submitted on 10<sup>th</sup> May 2019, **Approval has been granted to your study.**

Please note that approval of the protocol and consent form is valid for **12 months.**

You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrolment of participants.
3. All consent forms signed by subjects should be retained on file. The IRB may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval
5. Failure to submit a continuing review application will result in termination of the study
6. Notify the IRB committee once the study is finished

Sincerely,

Date of Approval: The 13<sup>th</sup> May 2019

Expiration date: The 13<sup>th</sup> May 2020

  
Professor GAHUTU Jean Bosco  
Chairperson Institutional Review Board,  
College of Medicine and Health Sciences, UR



Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate Studies, UR