COMPARISON OF CLINICAL CHARACTERISTICS, CARE AND OUTCOMES OF TRAUMA PATIENTS PRESENTING DURING REGULAR AND OFF HOURS AT EMERGENCY MEDICINE DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL

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Department of Emergency



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By,

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A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the Degree of Master of Medicine in Emergency Medicine of the

Muhimbili University of Health and Allied Sciences
October, 2018

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance of dissertation entitled ***Comparison of clinical characteristics, care and outcomes of trauma patients presenting during regular and off hours at emergency medicine department of Muhimbili National Hospital*** in partial fulfilment of the requirements for the degree of Master of Medicine in Emergency Medicine of Muhimbili University of Health and Allied Sciences.

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Dr. Hendry .R. Sawe

Supervisor

Date_____

DECLARATION AND COPYRIGHT

I, **Elly Mulesi**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature_____ **Date**_____

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DEDICATION

To the beloved family; my parents, my brother and sister for their love, prayers, guidance and encouragement over the years. Thank you for always being there in my triumphs and sorrows.

ABSTRACT

Background:

Trauma constitutes a significant public health burden, accounting for ten percent of all global deaths. World Health Organization estimates that mortality due to trauma is more than that caused by Tuberculosis, Malaria and HIV/AIDS combined. Disproportionately Low Income Countries (LIC) has higher trauma burden than Higher Income Countries (HIC) and relatively poor outcomes. Timing of presentation to the hospital such as regular work hours versus off hours have shown to impact outcomes in trauma in HIC. In Tanzania the timing of presentation in trauma has never been investigated.

Aim: To compare proportion, clinical characteristics, care and outcomes of adult trauma patients (≥18 years) presenting to the emergency medicine department of Muhimbili national Hospital (EMD-MNH).

Methods: This was a prospective comparative descriptive study of adult trauma patients (≥18years) presenting to EMD-MNH from July 2017 to December 2017. Structured questionnaires incorporated into online data capture software were used to document patients' demographics, clinical characteristics, care received and outcomes. Primary outcomes were difference in clinical presentation and EMD care and secondary outcomes were mortality, length of hospital stay and disposition. Study data was summarized with descriptive statistics including mean, standard deviation, median and interquartile range. Student's t test (t-test) was used for comparison of mean and descriptive categorical data was analyzed using Chi-square (x^2) with SPSS version 21.0

Results: We enrolled 1395 (49%) patients from 2898 trauma patients who presented to the ED. Of those who were enrolled, 818 (58.6%) presented during off hours. The median age of presentation of those enrolled was 33 years (interquartile range 26-44 years) and overall 1069 (76.6%) were male. Overall 1261 (90.4%) had minor Injury Severity Score (ISS) and 98 (7.6%) had moderate ISS, while 36 (2.6%) had major ISS. Among those 36 (2.6%) who had major injury (ISS≥15), 3(0.5%) presented during regular hours versus 31(4.0%) during off-hours with ($p < 0.001$). Overall 40(2.9%) that had used alcohol, and the majority of these 35(4.3%) presented during off hours while 5(0.9%) of regular hours ($p<0.000$). Overall 24h mortality with 2(0.2%) presenting during off-hours and none during regular hours, $p<0.235$.

Conclusion: Off-hour presentation was associated with high male proportion, major trauma and injuries associated with alcohol influence. Even though these factors did not seem to impact on the ED and 24h mortality, clinicians are to be keener due to higher acuity and severity of patients presenting in off-hours in LIC.

TABLE OF CONTENT

CERTIFICATION i
DECLARATION AND COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
ABSTRACT v
LIST OF TABLES viii
LIST OF ABBREVIATIONS ix
DEFINITION OF KEY TERMS x
1. INTRODUCTION 1
1.1Background 1
1.2 Literature Review 4
2. Problem statement 14
3. Rationale. 15
4. RESEARCH QUESTION 16
4.1 Primary research question. 16
4.2 Secondary research questions 16
5. OBJECTIVES 17
5.1Broad objective: 17
5.2Specific objectives: 17
6. STUDY HYPOTHESES 18
7. METHODOLOGY 19
7.1Study design 19
7.2Study area: 19
7.3 Study population 19
7.3.1 Target population: 19
7.4Study population: 20
7.4.1 Accessible population: 20
7.5 Sampling design: 20
7.6 Subjects 20
7.6.1 Inclusion criteria 20
7.6.2 Exclusion criteria: 20
7.6.3 Variables of Interest 21

7.7 Sample size 22
7.8 Patient recruitment and data collection 23
7.8.1 Standardized data collection tool 23
7.9 Data analysis 23
7.10 Ethical consideration 24
8 CONCEPTUAL FRAMEWORK 25
9 RESULTS 27
9.7 Demographics. 28
9.2 Characteristics of trauma patients on arrival 29
9.3 Clinical characteristics by time of presentation 30
9.4 Clinical characteristics of patients by time of presentation 31
9.5 Injury severity score by the time of presentation 32
9.6 Staffing level by the time of presentation 33
9.7 EMD Care by time of presentation 34
9.8 Trauma outcomes by time of presentation 35
10. DISCUSSION 36
10.1 Study limitations 41
11. CONCLUSION 42
11.1 RECOMMENDATIONS 43
12. REFERENCES 44
13. APPENDIX 1: DATA COLLECTION SHEET 51
13.1 APPENDEX 2: CONSENT FORM (English version) 59
13.2 CONSENT FORM (Swahili version) 62

LIST OF TABLES

Table 1: Demographics of trauma patients by the time of presentation 28

Table 2: Socio-clinical characteristics of trauma patients by time of presentation 29

Table 3: Table of clinical characteristics by time of presentation 30

Table 4: Table of clinical characteristics by time of presentation 31

Table 5: Table of injury severity score by time of presentation 32

Table 6: Average number EMD staffing level by the time of presentation 33

Table 7: EMD care by time of presentation 34

Table 8: Disposition, Length of stay and mortality by the time of presentation 35

LIST OF ABBREVIATIONS

CPR	-	Cardiopulmonary Resuscitation
CT scan	-	Computed Tomography Scan
ED	-	Emergency Department
EMD	-	Emergency medicine department
EMS	-	Emergency Medical Services
FAST	-	Focused Assessment with Sonography in Trauma
GCS	-	Glasgow Coma Scale
HIC	-	Higher Income Countries
HIV	-	Human Immunodeficiency Virus
ICU	-	Intensive Care Unit
IRB	-	Institutional Review Board
ISS	-	Injury Severity Score
LMIC	-	Low- and Middle-Income Countries
LIC	-	Low Income Countries
MNH	-	Muhimbili National Hospital
MUHAS	-	Muhimbili University of Health and Allied sciences
RTI	-	Road Traffic Injury
SBP	-	Systolic Blood Pressure
SPSS	–	Statistical package for the Social Sciences
SSA	-	Sub-Saharan Africa
UK	-	United Kingdom
USA	-	United States of America
WHO	-	World Health Organization

DEFINITION OF KEY TERMS

EMD Length of Stay: Will be defined as the time trauma patient arrived in the Emergency department to the time the patient is disposed to the ward/ theatre or to the ICU.

Off hours: Defined as Tanzanian non-official/non-working hours weekday, 1531Hrs to 0729Hrs.(1)

Regular Hours: Defined Tanzania official working hours 0730Hrs to 1530Hrs. (1)

Survival at 24 hours: Defined as trauma patient being alive after first 24hours of hospital presentation

Weekend: Defined as Saturday, Sunday and public holiday during weekdays. (1)

24 Hours mortality: Any death that has occurred within first 24 hours of presentation(within and outside EMD of MNH) in a trauma patient who was planned / had been disposed to the ward/ICU or theatre.

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1. INTRODUCTION

1.1 Background

The World Health Organization (WHO) estimates that trauma is the leading cause of mortality globally, (1)(2)with an estimate of over million people suffering disability each year. (2,3) The WHO also estimate that in 2030, trauma is expected to rise to be the third cause of disability worldwide.(4) Road Traffic Injuries (RTI) is the said to be the most common cause of all trauma causes globally.(5)

Disproportionately Low Income Countries (LIC) has higher trauma burden than Higher Income Countries (HIC).(6) It is estimated that the mortality and morbidity of trauma/related injuries have surpassed that infectious diseases such as Tuberculosis, HIV/AIDS, and Malaria.(7) Although injuries from domestic violence, war have also shown to contribute to this regional trauma burden in LIC, yet vastly RTI contributes in LIC trauma burden and it has mostly been associated to fast growing of cities and urbanization. (8)

It is estimated that as high as 73.7% is the death rate in LIC, mostly from SSA. (9) Over half (55%) of global fatalities attributed to RTI results from Sub- Saharan Africa (SSA), while less than 15% is from North America and Western Europe. (6) It is important to note that this burden of morbidity and mortality may be underscored due to weak data capture infrastructure in the majority of LIC, especially in rural areas of Tanzania. (10,11) This calls for urgent intervention and more preventive measures to be instituted to reduce the burden of both mortality and morbidity in the region.

The timing of presentation of trauma patients to health facilities have shown to affect their outcome especially when patients presents in non-working hours/off hours.(12–14)This

effect is known as ‘off-hour’ or ‘after hour’ effect or weekend effect.(15) System factors such as staffing level, availability investigation and procedures as well as patient’s factors such as age, initial presenting vital signs, mechanism of injury, severity of injury have been implicated to contribute to this poor outcome during these hours.(12,13,16,17) However with early recognition and appropriate timely interventions after trauma may alter these outcome despite factors that may contribute to poor prognosis during off hours.

Although ‘off-hour’ phenomenon is known to exists in non-trauma conditions, there is conflicting data on existence in trauma patients.(18) Trauma patients presenting to level 1 and II trauma center have shown to have similar outcomes regardless of time of presentation.(19–22) However there is suggested evidence of poor outcomes of trauma patients presenting to level III, IV and V in which are also regarded as non-trauma centers.(18,23) It is important to acknowledge the existence or absence of ‘off hours’ since absence of ‘off hour effect’ shows the maturity/stability of health system despite patients clinical characteristics.(15)

Studies have shown that regardless of the time of presentation by trauma victims is improved in outcome in trauma patient in HIC when compared to those in LIC.(14,19–22) Early recognition of potential and/ or anticipated life threatening injuries among health care providers, trauma management training programs, good pre hospital services and presence of dedicated trauma teams at all times care have shown to be protective against off hours in HIC.(19–22) Lack of these strategies in many of LIC such as Tanzania have shown to have an impact in mortality in trauma patients.(14,24–27) When compared to HIC most of deaths that occur in LMIC are preventable with early intervention. (28)

One decade ago, doctor to patient ratio was as low as two doctors per 100 000, in a population of over 45 million Tanzanians. (29,30) Despite the known burden of understaffing in many of Tanzanian health facilities there is evidence of further shortage of staff to during off hours.(25,27) It is not clear if this shortage has an impact to trauma patients, especially during public holidays, weekends and during the night when the existing shortage is even increased. (14,24–26)

Trends of morbidity and mortality in have shown to be improved by timely intervention of trauma care, Emergency Departments and trauma centers in HIC.(19–23) There is known mortality reduction in both trauma and non-trauma conditions since establishment Emergency Department in Tanzania.(31) We also lack trauma centers in Tanzania, with Muhimbili Orthopaedic Institute (MOI) serving as the highest trauma level care in the country. However there is no available data that shows comparison among trauma patients presenting between regular and off hours and if this mortality could be further reduced by proper staffing, and with even availability and provision of similar management to trauma patients during off hours as that provided during regular hours.

1.2 Literature Review

Trauma is among the top ten leading causes of mortality worldwide. (2,3) According to WHO it is estimated death that have resulted in trauma have by far surpassed those attributed to leading infectious diseases such as Tuberculosis, Malaria, and HIV/AIDS.(7)This burden mostly implicated in LIC especially in SSA where by estimates.(32) In SSA region alone RTI accounted for almost one fifth of global death toll, with about 40% higher death rate than global road injury death rate, with exceeding of over 8 million non-fatality injuries in 2010. (33) This has an approximate of US $65 to 100 billion coming from LMIC, the amount that exceeds the total amount that LMIC receives for development annually.(32)

Time of arrival of trauma patients to health care facilities have largely been implicated to contribute in outcomes of trauma patients. Several studies have shown that trauma patients presenting to the hospital during regular working hours have shown to have better outcome than those presenting during off hours.(13,14) For example, Barbosa et al in a study that aimed to determine if admission during off hours such as night is the independent factor to mortality in trauma patients, found that of trauma patients that were admitted during off hours were had significantly higher mortality 6.9% than those who presented during the day 2.2% with ($P<0.014$). (13)

Similarly, a study done in Chalya et al, that described the burden and patterns of trauma in one tertiary hospital in Tanzania, found that even though the proportion of trauma patients presenting during off hours such as during night was only one quarter (25%) of all trauma patients presenting to the hospital, there was almost half higher mortality increase (63.9%) in this group than those presented during the day(36.1%), and this mortality difference was known to be significant($P<0.001$). (14)

Generally, there is evidence that suggest higher male to female ratio among trauma patients presenting to the hospitals, with proportion of males being twice that of female to present with trauma in HIC. (19–21,23) It is also known that this male to female ratio difference in seen in trauma patients does not widely differ during regular and off hours in HIC.(19,20,23) Metcalfe and his colleagues while determining the weekend effect in higher trauma level of care found that among all proportion of trauma patients presenting to the hospital, male to female ration did not significantly differ with (62.7% versus 37.3%) during the day and (67.3% versus 32.7%) by (P<0.023). (20) Male predominance was also similar as when found by Boniface et al in Tanzania, in a study to determine factor associated with RTI, where by male proportion was almost thrice (76.6%) that of female (23.4%).(34) However no data is available with regards to continued existence of this predominance during off hours as when compared to regular hours.

The productive, middle aged group is said to be the most common age group to be associated with trauma presenting to the hospital with almost similar presentation during both regular and off hours in trauma patients presenting to the many of HIC.(19,20,23) However some studies in HIC have shown variation in age, with younger patients presenting more during off hours than during the day.(13,23) For example, one study by Barbosa and his colleagues found that patients presenting the mean age of all trauma patients to be (35.5± 20.7) years however of trauma patients presenting during off hours were likely to be younger with 32.8±(18.0)years versus 37.9±(29.1)years who presented during regular hours, with P< 0.001. (13) There is paucity of data in on whether this significant variation of age seen in HIC is also similar in LIC such as Tanzania.

There is evidence that arrival to the hospital by Emergency Medical Services (EMS) such as ambulances improves the survival in non-trauma conditions.(35)This is yet to be proven in trauma patients arriving to the hospitals as there is insufficient data on patterns of mode of arrival in the studies that have been done to determine the differences in trauma patients arriving to the hospital between regular and off hours.(12,19–23) Unlike HIC, most of trauma patients arrives to the hospital by other means of transport than EMS such as ambulances.(14,36) One study from LIC in Tanzania by Chalya et al found that only 0.4% of trauma patients had arrived to the hospital by ambulances, while the majority had arrived by police cars. (14) This reflects on non-existing formal EMS system in Tanzania.

In one of recent in Europe, Metcalfe and his colleagues have found that although ambulance seen is among common hospital arrival method, there was significantly decrease ambulance transfers during off hours 5.4% (with $P< 0.421$) versus 13.8% (with $P<0.024$) during regular hours in patients who sustained major trauma that were transferred to major trauma centers.(20) It is questionable due to lack of data, whether ambulance arrivals by trauma patients differs during off hours as found in HIC, and if this has a role in outcome of these patients.

Among modifiable risks of trauma is alcohol use, implicated in both intentional and unintentional injuries.(37) There is evidence that there is odds to sustain trauma is as high as 3.5 times when under influence of alcohol, especially if the motive is the intentional injury. (37) One study in Israel by Soffer et al found that, not only alcohol was associated to most of trauma presented during off hours such as weekend but also mechanism of injury differed in between the groups that was under influence of alcohol and the group which was not under alcohol influence. (38)

LIC studies especially from SSA have shown that alcohol implication in trauma is not uncommon as Nicol et al found that over one third of all trauma admission in South Africa were associated with alcohol use, while Boniface et al in Tanzania found that over 20% of all riders involved in RTI were reported to be under alcohol influence. (34,37,39) Studies from HIC have shown that most of trauma patients presenting during off hours are under influence of alcohol when compared to regular hours.(38,40–42) Paljula et al found that among head trauma patients presenting to the hospital there were 25.2% (95% CI 17.5 to 32.8) alcohol related cases versus 4.0% (95% CI −2.03 to 9.96) of non-alcohol related cases that presented during weekends with about 11.5% (95% CI 6.77 to 16.31) increase of head traumas during weekends. (41) Little is known regarding influence of alcohol and their time of presentation in Tanzania, which could help to ensure police task force during off hours.

While WHO estimates that over 90% of all unintentional injuries result from LMIC, little is known of the burden of intentional injuries. (32,37) Although trauma may occur at any time, off hours is more associated with intentional injuries. (37) Schuurman et al in South Africa found that not only off hours was associated with more intentional injuries but off hours was also associated with increase in proportion of injured patients of both intents.(37) Several studies in Tanzania have been consistent with description of motive in trauma where by unintentional injuries are said to be more common among trauma patients presenting to the hospital than trauma with intent. (14,43) It is not known if this motive remain similar during regular and off hours in Tanzania as other LICs.

Clinical characteristics such as vital signs, severity of injury and Glasgow Coma Scale (GCS) have shown to impact management but also in prediction of outcome of trauma

patients. (44,45) HIC studies have demonstrated similar vital signs systolic blood pressure(SBP), heart rate (HR), respiratory rate (RR) and saturation pressure of oxygen (SpO2) of injured patients presenting between regular and off hours.(19–23) Parsch et al found that among trauma patients presenting at Trauma Level I in German, there was no significant variation of these parameters, with mean HR of 89.9 ± 23.0 b/min among all trauma patients mean heart rate of 90.1 ± 22.5 b/min was found in patients presenting during regular hours and mean of 89.9 ± 23.2 b/min was found for off hours, it was also noted that no difference in mean SBP of 105.6 ± 42.9 during regular hours versus 110.0 ± 38.5 mmHg during off hours with a mean of 108.9 ± 39.6 mmHg.(19) Although one study in Tanzania found that, over 25% of trauma patients arriving to the hospital had significantly low SBP, little is known if these vital signs during off hours would be similar to those presenting during regular hours. (14)

Several number of scales of level of consciousness have been identified and rated as predictors of outcome.(44) GCS has been used as precise good predictor of in hospital mortality.(45) In one study in Asia, Ono et al looking at "off hour effect among trauma patients requiring subspecialty intervention in Japan", found mean GCS of 13.5±3.0 in all trauma patients, and there was no significant difference among patients presenting during regular hours (13.6±2.9) and those presenting during off hours(13.4±3.1), with $P<0.054$. (23)Similar findings have been obtained in studies from similar HIC settings. (12,19,20,46) There is evidence of one study in Tanzania by Kiwango et al that found low GCS on admission was associated with higher mortality rates among patients with head injury.(47) But unlike HIC, there is lack of data on studies to compare GCS score during regular and off hours.(47)

Among the reasons that makes the weekend or off hour effect to be debatable is whether if these patients are more severe injured at times of presentation in off hours than it is for regular hours. 'When comparing trauma care inside and outside business hours in level-1 trauma center in German', Parsch et al found that there was no significant different in Injury Severity Score (ISS) of trauma patients presenting during regular hours (32.3±14.3) and those presenting during off hours (32.6±14.4), since the mean ISS was (32.5±14.3) in German.(19) However trauma patients attending a non-trauma center in Asia as found by Ono et al, had higher ISS(19.9±14.4) during off hours was found compared to those who presented during regular hours(17.1±14.6), and this was found to be statistically significant (18.6±14.6) with P<0.001.(23) Although acknowledged that injury severity has impact on outcome of trauma patients in LIC studies, there is no comparative study showing ISS among trauma patients presenting between regular and off hours.(14,34,43)

Availability of in hospital services such as radiology services, surgical procedures other system factors such as staffing level, have been shown to impact management of trauma patients presenting during off hours. (19,22,48) This is postulated mainly to be because of equipped and presence of enough skilled personnel found in trauma centers but found to be lacking in non-trauma centers. (21,22,49)

In a recent study by Faul et al, it was found that there was disproportionate staffing of different skills among different trauma center levels in the United States of America(USA).(50) There were almost three times as many neurosurgeons at Level I and II versus trauma centers (mean=4.9) versus Level III and IV trauma centers (mean=1.8), there was also as twice as many trauma surgeons at Level I and II trauma centers (mean=6.1) than at Level III and IVs (mean=3.6), while orthopaedic surgeons in Level I and II trauma centers also outnumbered other orthopaedic surgeons in Level III and IV

trauma centers (mean=10.2, mean=6.9, respectively).(50) This disproportionate of staff impacting at outcome of trauma patients calls for trauma centers need in non-established hospitals especially in LIC like Tanzania.

Tanzanian as one of LIC particularly SSA, lack designated Trauma centers, and the majority of non-trauma centers in these countries are understaffed.(14,24,26,51) Despite the need of early and timely intervention needed for trauma patients, injured patients are being managed with non-trauma patients. (14,24,26,51) The majority trauma patients are being managed in under staffed hospitals necessitating longer waiting time to the acutely injured. Chalya et al found that though majority of injured patients (81.1%) presenting to the hospital were attended within three hours of hospital arrival, waiting time ranged between 20 minutes to 9 hours (median=3) hours.(14) There is suggested evidence of understaffing during off hours in Tanzania. (14,24–26) However, no available data to elucidate if the staffing level impart different management in trauma patients presenting during regular and off hours.

Early management such as investigations and treatment in acutely injured patients aims at improving better outcome in mortality and morbidity. Several studies have shown that there is no difference management provided to trauma patients regardless of time of presentation. (19,20,23,52) For example, Parsch et al found that, among trauma patient in Trauma level I who underwent for radiological services such as CT scan, with the mean of (27.6±12.4)min as waiting time, there was similar waiting time were for those who present during regular hours (28.5±18.7)min and those who presented in off hours(27.3±9.5)min, P=0.0637. (19) It was also found that no significant difference in rate of scans for trauma patients who were scanned for bedside ultrasound in trauma, Focused Assessment with Sonography for Trauma (FAST) and laboratory services such as provision of blood

products for trauma patients requiring massive transfusion.(19) Similar findings of even quality of care are found in many other HICs. (19–21,23) There is paucity of data from LIC especially Tanzania regarding comparison of health services between regular and off hours, especially when there is restriction/limited services during off hours. (14,24–26,28)

There is evidence that there is no difference in mortality among trauma patients in HIC that presented during regular and off hours in trauma centers.(19–22) However in the same well resourceful settings where by trauma center are not established there has been associated increase in poor outcome in both mortality and adverse events. (12,13) A meta-analysis and systematic review of 28 disease and conditions reviewing the existence of off hour effect by Zhou et al found that, there was significantly mortality reduction in in-hospital mortality for trauma patients attended at trauma centers ((0.97, 0.86– 1.09), than those attended in non-trauma center((1.14, 1.07–1.22). (18)

A study done in one of Tanzanian tertiary hospitals, Chalya and his colleagues found significant higher mortality (63.9%) among trauma patients that presented to the hospital at night than those who presented during the day (36.1%), P<0.001. (14) The increased mortality of injured patients especially during off hours such as night warrants further evaluation especially when there is paucity of generalizable data in LIC on existence and magnitude of difference in mortality of trauma patients presenting to the hospitals between regular and off hours.

Longer Emergency Department(ED) length of stay is a known predictor of mortality in trauma. (53) Most of severed injured patients are more likely to stay longer in the ED for further resuscitation and stabilization. However further corrections of already resuscitated patients have shown to be associated with longer ED stay and has not shown to be beneficial. (54) Mowery et al found, even though patient who stayed at ED were more

likely to have higher ISS>15, ED length of stay of more than 2 hours had significant increased overall mortality compared with those with a shorter ED length of stay (13.2% vs. 5.7%; P= 0.03), and it was that ED length of stay was an independent predictor of mortality with an increased hospital mortality for every additional hour spent ED for trauma patient. (53) It was also found that and despite good radiological, in hospital consultation and interventional procedure, 8.3% of trauma patients who had an average of four hours ED stay or more ultimately died. (53) There is no supporting in LIC, especially Tanzania on comparison of ED and in hospital stay between regular and off hours among trauma patients.

In many studies trauma patients admitted to ICU were found to have higher Injury Severity Score(ISS) than those who were admitted to the wards.(14,43) Controversy exists on whether the high mortality seen in ICU patients admitted during weekends is due severity of injuries or due to delay in admission to receive the critical care. (55) Carr et al found that there was no difference in the ICU need between those who presented during regular and off hours, however there was significant increased ICU stay in the trauma patients admitted during the weekends. (21) Even though there was no increased mortality in trauma patients admitted to ICU it was found that patients with lower-severity injuries (ISS>16; IRR=1.08;95%CI, 1.03- 1.13), patients with penetrating trauma (IRR=1.16; 95% CI, 1.02-1.32), and younger patients (IRR=1.12;95%CI, 1.07-1.17) had longer ICU Length of stay if they presented on weekends as compared with weekdays presentation.(21)

Most of ICUs in LIC lack spaces, medication and technical equipment contributing to the magnitude of increased mortality.(28,43) One study in Tanzania found that there was increased mortality in trauma patients admitted to ICU which was associated with delay in admission in this group of patients.(43) However another study from LIC, Elkhayari et al aiming to determine the 'outcome of patients admitted to ICU during hours' in Morocco and found that even though the majority of trauma patients were admitted to ICU during off hours than during the day time (64% versus 24%, P=0.001), there was no significant difference in ICU mortality for time of ICU admission (51% versus 37%, day time versus night time, respectively, (P=0.05).(55) It is not known however if off hours ICU admission need, mortality and length of stay is similar to that of regular hours in Tanzania.

2. Problem statement

Disproportionately LIC have disproportionately higher trauma burden than HIC. (32,56) The majority of LMIC located in SSA have low doctor to patient ratio. (57,58) Tanzania like most of LIC lacks formal pre-hospital trauma and Emergency Medical Service (EMS) important in initial care of acutely injured.(26) And with limited number of resources, several number health services are said to be limited during off hours in Tanzania.(24,26) It is not known if the low doctor to patient ratio and limited number of health services during these hours have any impact to trauma patients.

Level of trauma care centers have been associated with different outcomes.(18) There is contradicting data on the effect of trauma timing of hospital presentation from most of HIC that, there's no existence of 'off-hour' effect in trauma patients during presenting at Level I care, while poor outcome have been associated in lower trauma level such as Level IV and V presenting during off hours. However it remains unclear whether/if this phenomenon actually exists in LMIC especially in Tanzania where there are no dedicated trauma level centers.(51) In LIC resources are generally scarce when compared to HIC, and time of trauma presentation during off hours when these resources are even less can have effect on care and outcome of trauma patients.

To the best of our knowledge no study has been done in LMIC to ascertain the differences in trauma patient at acuity and receiving patients' areas.

3. Rationale.

There is evidence of significant reduction of mortality in trauma since establishment of Emergency Medicine Department. In Tanzania, Emergency Department of Muhimbili National Hospital and Muhimbili Orthopaedic Institute provides an opportunity to evaluate the management of trauma patients and to evaluate the existence of this phenomenon ('Off-hour' effect), to highlights the ascertain causes of existence of the phenomenon as it is the only fully capacity emergency open for 24 hours and serves as the highest trauma facility in the country with availability of trauma and neurosurgeon in the country respectively.

Characterizing the comparison of clinical characteristics, care and outcome of trauma patients presenting to the Emergency Department of Muhimbili National Hospital, will provide vital data on existence of off hour effect to the care and outcomes of trauma patients in limited resource settings. Data from this study not only will answer this debatable question especially in limited resource settings but also will show if could be further reduction of mortality and morbidity if there is adequate staffing and will highlights the need of establishing dedicated trauma centers and teams in LIC and ensure task force at all times especially during off hours for prevention of trauma such as road traffic accidents during off hours i.e night.

4. RESEARCH QUESTION

4.1 Primary research question.

Is there difference in clinical characteristics, care and outcomes of adult trauma patients presenting between ‘regular’ and ‘off hours’ at Emergency Medical Department, Muhimbili National Hospital?

4.2 Secondary research questions

1. Is there ‘off-hour’ effect on clinical characteristics, care and outcomes of adult trauma patients presenting at Emergency Medical Department, Muhimbili National Hospital?
2. Is there ‘weekend effect’ on clinical characteristics, care and outcomes of adult trauma patients presenting at Emergency Medical Department, Muhimbili National Hospital?

5. OBJECTIVES

5.1 Broad objective:

To compare the clinical characteristics, care and outcomes of adult trauma patients presenting between 'regular hours' and 'off hours' at Emergency Medicine Department of Muhimbili National Hospital.

5.2 Specific objectives:

1. To compare the proportions of adult trauma patients presenting between off hour and regular hours presenting to the EMD –MNH between July and December 2017.
2. To compare the clinical characteristics of adult trauma patients presenting between off hours and regular hours' presenting to the EMD –MNH between July and December 2017.
3. To compare 24 hour management of adult trauma patients presenting between off hours and regular hours presenting to the EMD –MNH between July and December 2017.
4. To compare the outcome of adult trauma patients presenting between off hours and regular hours presenting to the EMD –MNH between July and December 2017.

6. STUDY HYPOTHESES

Null Hypothesis: There is no difference in clinical characteristics, care and outcomes of adult trauma patients presenting between regular and off hours at Emergency Medical Department of Muhimbili National Hospital

Alternative Hypothesis: There is a difference in clinical characteristics, care and outcomes of adult trauma patients presenting between regular and off hours at Emergency Medical Department of Muhimbili National Hospital

7. METHODOLOGY

7.1 Study design

This was a prospective comparison cohort study of consecutive sample of adult who sustained injury presenting to Emergency Medical Department of Muhimbili National Hospital (EMD MNH) Acuity receiving areas between July 2017 and December 2017. A consecutive convenience sample of patients were recruited for this study.

7.2 Study area:

This study was conducted at the Emergency Medicine Department of Muhimbili National Hospital (MNH). MNH is the National and only public super-specialty hospital, located in Dar es salaam, Tanzania. The hospital is the only training site for the emergency medicine residency program in Tanzania. MNH serves as a national referral hospital and has a 1500 bed capacity with around 1,200 inpatients admission per week. The hospital has more than 300 doctors including specialists and super-specialists, and more than 900 nurses and supporting staff.

The Emergency Medicine Department at Muhimbili National Hospital is the only 24/7 full-capacity public emergency department in Tanzania and specializes in providing emergency care and resuscitation, serving an average of 200 patients per day. Nearly all admissions to the hospital go through the emergency medicine department.

7.3 . Study population

7.3.1 Target population:

Adult (Defined by Age ≥18years) Trauma patient attending acute receiving areas in Low Income countries (Limited resources setting).

7.4 Study population:

Adult Trauma patients that attended at Emergency Medical Department of Muhimbili National Hospital from July 2017 to December 2017.

7.4.1 Accessible population:

Adult Trauma patients that attended at Emergency Medical Department of Muhimbili National Hospital and have agreed to the informed consent, from July 2017 to December 2017.

7.5 Sampling design:

Consecutive sample of adult trauma patients that presented to the emergency medicine department of Muhimbili National Hospital and who's they or their relatives or next of kin did consent to participate in the study at the time the researcher or his assistant(s) are available to collect data.

7.6 Subjects

7.6.1 Inclusion criteria

a. Adult trauma patient $\geq$ 18years
b. Injured patient presented to the Emergency Medicine Department of Muhimbili National Hospital.

7.6.2 Exclusion criteria:

a. Trauma patients that presented during mass casualty event during the period of the study (Could over project the reality of actual presentation of trauma patients during on/off hours)
b. Adult trauma patient who have met inclusion criteria but have refused to consent for the study.

7.6.3 Variables of Interest

Primary objective of this study was to determine, the difference in clinical characteristics, care and outcome of Trauma patient during regular and off- hours, and variables of interest are:

i. Independent / Predictor variables

a. Demographic data: Age, Sex, physical address
b. Referral status: Self-referral / Hospital referral
c. Mode of payment
d. Glasgow Coma Score
e. Severity of injuries
f. Staffing level
g. Management strategies in the referring hospital: Intravenous placement, Intravenous fluids, Anti-pain, Antibiotics.
h. Vital signs on arrival to the ED
i. Pre-EMD MNH course of illness: pre-existing illness or an acute illness
j. Management strategies at EMD: provisional diagnosis, length of stay in the ED, investigation(s) done during at ED (If available)

ii. Dependent / Outcome variables

a. ED length of stay
b. Mortality at ED
c. Disposition
d. 24h mortality

7.7 Sample size

Primary outcome of the study will be in-hospital mortality. From a recent study on Trauma by PL Chalya *et al* of 2013, had a mortality difference of 63.9% night vs. 36.1% day with p value of ($P < 0.001$) → ~50% increase in mortality during the night.

In this study, two tailed test will be used and thus alpha ($\alpha = .05$) and will power the study with 80% $\beta = 0.2$ → power 80%. And thus the minimum sample size calculations for adult trauma patient presenting to the Emergency Medicine department during on and off hours of Muhimbili National Hospital will be calculated as follows;

The sample size of this study was estimated from the formula below:

$(Z_{\alpha/2}+Z_{\beta})^2 * (p_1(1-p_1)+p_2(1-p_2)) / (p_1-p_2)^2$,where by

$Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96)

Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84)

$p_{1=}$ proportion of trauma patients presenting during regular hours

$p_{2=}$ proportion of trauma patients presenting during off hours are the expected sample proportions of the two groups.

Thus

$(Z_{\alpha/2}+Z_{\beta})^2 * (p_1(1-p_1)+p_2(1-p_2)) / (p_1-p_2)^2$

$(1.96 +0.84)^2 * (0.639(1-0.639)+0.361(1-0.361)) / (0.639-0.361)^2$

Thus minimum sample size of this study was 128 in each group.

7.8 Patient recruitment and data collection

Adult trauma patient presenting to the EMD of MNH who were eligible for enrollment were approached for provision of consent in the participation of the study, and next of kin was asked for consent in the setting of eligible patient but unable to provide consent. Consented and/ or waived trauma patients was obtained by consecutive enrolled until the desired sample was reached.

7.8.1 Standardized data collection tool

A structured questionnaire (Refer Appendix I and II) was used to obtain information on:-

-Demographic characteristics: (sex, age, address, marital status, Occupation)

- Referral status
- Payment Modality (Cash /Insurance/Cost sharing)
- Behavioral risk factor: Alcohol use
- Clinical characteristics (Vital signs, physical examination findings, ISS),
- Management strategies at EMD (Imaging, Point of care laboratory results, Intravenous Fluids, Blood transfusion, Analgesics, Antibiotics)
- Disposition (ICU, Ward, Theatre, Mortuary)
- Outcome (Disposition, ED mortality, 24 h mortality, ED length of stay,)

7.9 Data analysis

The collected data from the written questionnaire was transferred and entered into Excel spreadsheet (Microsoft Corporation, R1edmond, WA, USA) and then imported into Statistical Package for Social Science (SPSS) (version 22.0.0, IBM, LTD, Carolina, USA). All information contained in the filled questionnaires was kept strictly confidential. The data was stored in protected computer files and paper records stored in locked filing

cabinet. Only study staff had access to the information. Procedure, frequency and univariate functions was performed to check for any outliers and clean the dataset. Frequency distribution tables of trauma patients with demographic characteristics of the patients, referral patterns, mode of arrival, mode of payment, vital signs and injury severity score, EMD management, co-morbid condition, and outcomes were analyzed including mean, median. Student's t test (t-test) was used for comparison of mean and Chi-square test (X^2) was used for categorical variables and P values <0.05 will be considered statistically significant.

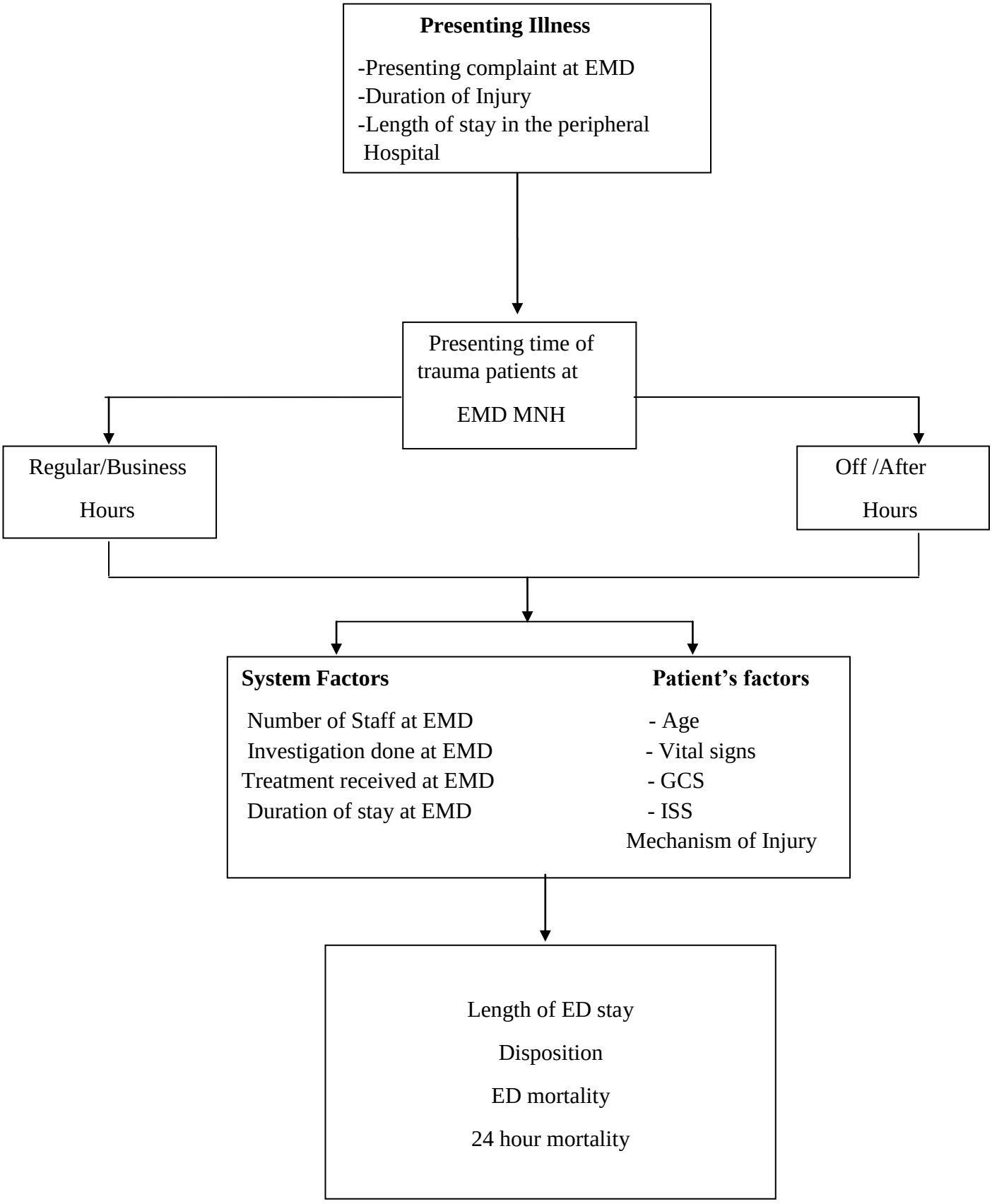
The data was crosschecked daily for correctness and accuracy.

7.10 Ethical consideration

Ethical clearance to conduct this study was sought from MUHAS Senate of Research and Publication Committee of MUHAS. Permission to collect data was sought from respective authorities at MNH. All adult trauma patients that presented to the EMD were enrolled after obtaining a signed informed consent from patients or next of kin. The data was number coded to hide patient's identity and stored in computer with password known by researchers only. The written forms were kept in a safe locker accessed by researchers only. The investigator also received/obtained a need for the waiver of consent from the MUHAS Institutional Review Board for patients who could not make consent such as unconscious patients or absence of relatives to provide consent.

8 CONCEPTUAL FRAMEWORK

The sketch below summarizes the conceptual framework



CONCEPTUAL FRAMEWORK DESCRIPTION

The study enrolled all adults trauma patients who had/sustained injury presented at EMD-MNH and information on their age, sex, address, and mode of arrival to the hospital, duration of injury and if referred or not referred were recorded along with their presenting complaint(s) in the Emergency Medical Department of Muhimbili National Hospital. Information on investigation and treatment and duration of stay at EMD were also recorded. Admitted patients were followed up, for 24 hours survival which was also recorded.

9 RESULTS

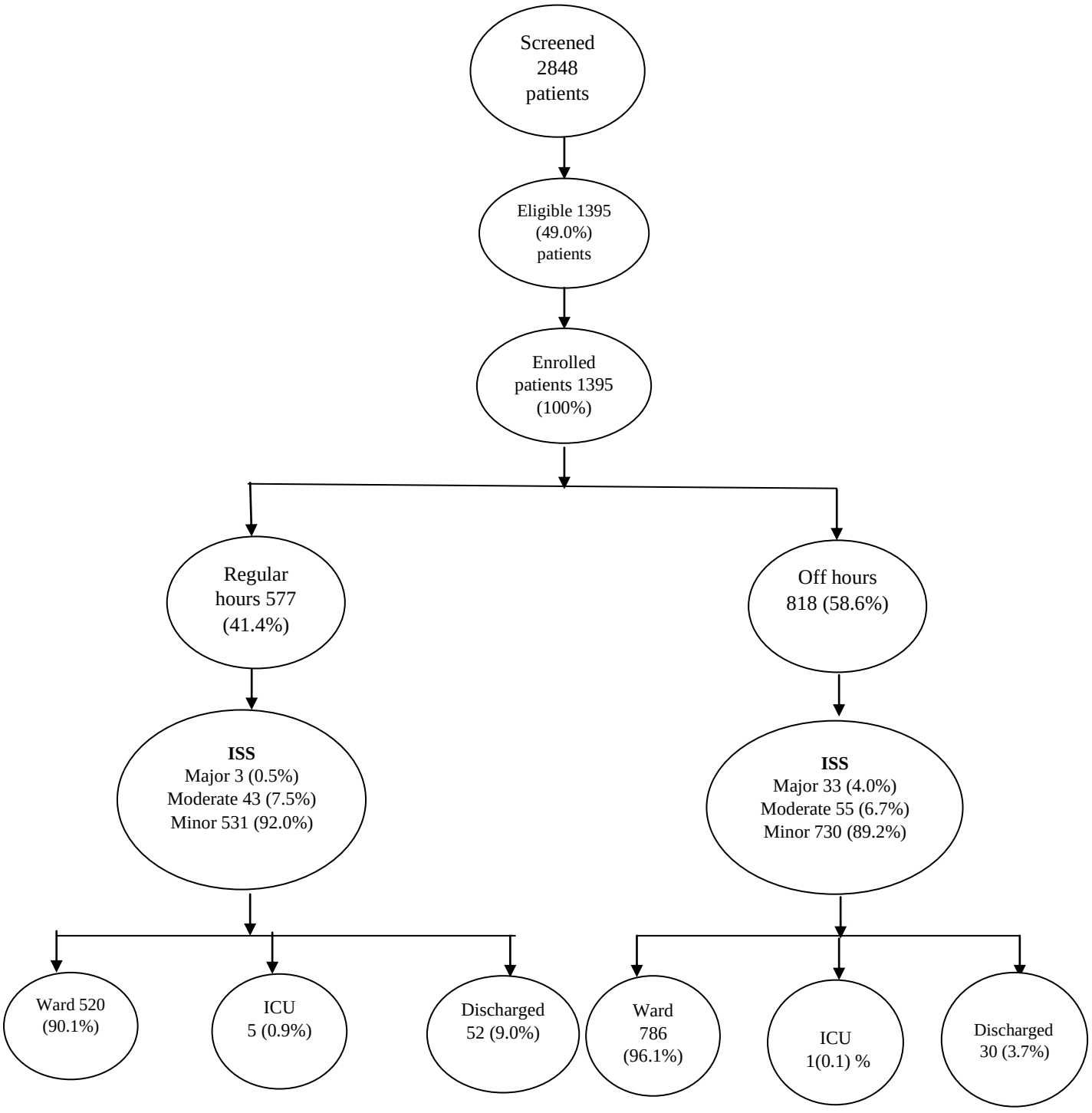


Figure 1; Screening, enrolment, pain assessment and medications and disposition of adult trauma patients presenting to the ED-MNH

9.7 Demographics.

A total of 1395 trauma patients were enrolled during the study period with 577 (41.4%) presenting during regular working hours and 818 (58.6%). The median age was 33 years (Interquartile range 26-44 years). Overall 1069 (76.6%) were male with overall male to female ratio of 3:1. This ratio was higher during off hours 4:1 versus 3:1 during regular hours. The overall majority of patients presented were unemployed. **(Table 1)**

Table 1: Demographics of trauma patients by the time of presentation

	All N=1395	**Regular hours** n=577	**Off hour** n=818	***p*-value**
Sex				**.002**
Male	1069 (76.6%)	418 (72.4%)	651 (79.6%)	
Female	326 (23.4%)	159 (27.6%)	167 (20.4%)	
Age groups				
18-30	595 (42.7%)	230 (39.9%)	365 (44.6%)	**.234**
31-45	477 (34.2%)	198 (34.3%)	279 (34.1%)	
46-54	128 (9.2%)	57 (9.9%)	71 (8.7%)	
54-65	105 (7.5%)	52 (9.0%)	53 (6.5%)	
>66	90 (6.5%)	40 (6.9%)	50 (6.1%)	
Marital status				**.121**
Single	645 (46.3%)	262 (45.4%)	383 (46.9%)	
Married	682 (49.0%)	286 (49.6%)	396 (48.5%)	
Divorced	15 (1.1%)	5 (0.9%)	10 (1.2%)	
Widowed	39 (2.8%)	22 (3.8%)	17 (2.1%)	
Unknown	12 (0.9%)	2 (0.3%)	10 (1.2%)	
Education level				**.477**
No formal education	22 (1.6%)	11 (1.9%)	11 (1.3%)	
Primary level	897 (64.4%)	375 (65.1%)	522 (63.9%)	
Secondary level	300 (21.5%)	114 (19.8%)	186 (22.8%)	
College	119 (8.5%)	49 (8.5%)	70 (8.6%)	
Unknown	55 (3.9%)	27 (4.7%)	28 (3.4%)	
Occupation				**.384**
Public/private sector	315 (22.6%)	141 (24.4%)	174 (21.3%)	
Unemployed	918 (65.9%)	363 (62.9%)	555 (68.0%)	
Petty trader	101(7.3%)	47(8.1%)	54 (6.6%)	
Student	40 (2.9%)	17 (2.9%)	23 (2.8%)	
Other	19 (1.4%)	9(1.6%)	10(1.2%)	

9.2 Characteristics of trauma patients on arrival

The most common mode of arrival was ambulance 727 (52.1%), with higher arrivals during off hours 500 (61.1%) compared to off hours 227 (39.3%). The emergency arrivals were higher during off hours compared to regular hours 362 (44.3%) versus 184 (31.9%) respectively. 40(2.9%) of all patients were under the influence of alcohol with higher proportion presenting during off hours 35(4.3%) than during regular hours 5(0.9%). No differences were observed in mode of payment and patients comorbidities regarding time of arrival. **(Table 2)**

Table 2: Socio-clinical characteristics of trauma patients by time of presentation

	All N=1395	**Regular hours n=577**	**Off hour n=818**	***p*-value**
Referral status				**.084**
Referred	824 (59.2%)	325 (56.5%)	499 (61.2%)	
Not Referred	567 (40.8%)	250 (43.5%)	317 (38.8%)	
Mode of arrival				**.000**
Ambulance	727 (52.1%)	227(39.3%)	500 (61.1%)	
Bajaj	33 (2.4%)	12 (2.1%)	21 (2.6%)	
Bus	212 (15.2%)	133 (23.1%)	79 (9.7%)	
Motorcycle	6 (0.4%)	3 (0.5%)	3 (0.4%)	
Private car	253 (18.1%)	108 (18.7%)	145 (17.7%)	
Police car	43 (3.1%)	19 (3.3%)	24 (2.9%)	
Taxi	63 (4.5%)	41 (7.1%)	22 (2.7%)	
Walking	27 (1.9%)	19 (3.3%)	8 (1.0%)	
Other	31 (2.2%)	18 (3.1%)	13 (1.6%)	
Unknown	8 (0.6%)	5 (0.9%)	3 (0.4%)	
Mode of Payment				**.070**
Public	1085 (77.8%)	434 (75.2%)	651 (79.6%)	
Insurance	185 (13.3%)	88 (15.3%)	97 (11.9%)	
Cost Sharing	52 (3.7%)	31 (5.4%)	21 (2.6%)	
Private (IPPM)	52 (3.7%)	21 (3.6%)	31 (3.8%)	
Unreported	21 (1.5%)	5 (0.9%)	16 (2.0%)	
Queue	65 (4.7%)	28 (4.9%)	37 (4.5%)	
Unreported	15(1.1%)	5(0.9%)	10(1.2%)	

9.3 Clinical characteristics by time of presentation

Nearly 40(2.9%) patients had used alcohol precedent to trauma, significantly higher proportions of these presented during off hours 35 (4.0%) versus that of regular hours 5 (0.9%). Regarding motive of injury, unintentional injuries by far most accounted for the majority of cases 1113 (80.5%). No difference was observed regarding to motivation of injury by time of presentation. Overall, over half of presented patients sustained RTA 779 (56.5%) followed by fall 256 (18.6%) and none of these mechanisms seem to differ by time of presentation. **(Table 3)**

Table 3: Table of clinical characteristics by time of presentation

	All N=1395	**Regular hours n=577**	**Off hours n=818**	***p*-value**
Motive of Injury				**.2689**
Intentional	147 (10.6%)	54 (9.5%)	93 (11.4%)	
Unintentional	1113 (80.5%)	469 (82.6%)	644 (79.0%)	
Unknown	123 (8.9%)	45 (7.9%)	78 (9.6%)	
Unreported	12 (0.9%)	9 (1.6%)	3 (0.4%)	
Mechanism of injury				
RTA	779(56.5%)	302 (53.4%)	477 (58.7%)	**0.470**
Fall	256 (18.6%)	116 (20.5%)	140 (17.2%)	
Assault	20(1.5%)	08 (1.4%)	12 (1.5%)	
Burn	21(1.5%)	10 (1.8%)	11 (1.4%)	
Others	206(14.9%)	90 (15.9%)	116 (14.3%)	
Unknown	97(7.0%)	40 (7.0%)	57 (7.0%)	
Unfilled	16(1.2%)	11 (1.9%)	05 (0.6%)	
Alcohol use				
Confirmed by patient	40 (2.9%)	5 (0.9%)	35 (4.3%)	**.000**
Confirmed by test	9 (0.6%)	3 (0.5%)	6 (0.7%)	
Provider suspicion	7 (0.5%)	0 (0.0%)	7 (0.9 %)	
Suspected by relative	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Unknown	1329 (96.0%)	564 (98.6%)	765 (94.1%)	

9.4 Clinical characteristics of patients by time of presentation

Over half of patients were triaged as priority patients while of 546 (39.1) in emergency category, 362 (44.3%) presented during off hours and 184 (31.9%) arrived during on hours. 375 (27.4%) had either bradypnea or tachypnea, off hours was associated with poor vital signs 237 (29.5%) compared to on hours 138 (24.3%). Furthermore 48 (3.6%) of all patients had severe head injury, with higher proportions during off hours 39 (4.9%) than during on hours 9(1.7%). **(Table 4)**

Table 4: Table of clinical characteristics by time of presentation

	All N=1395	**Regular hours n=577**	**Off hours n=818**	***p*-value**
Type of Acuity				**.000**
Emergency	546 (39.1%)	184 (31.9%)	362 (44.3%)	
Priority	769 (55.1%)	360 (62.4%)	409 (50.0%)	
Queue	65 (4.7%)	28 (4.9%)	37 (4.5%)	
Vital signs				
SPO2 <91%	22 (1.6%)	9 (1.6%)	13 (1.6%)	**.968**
RR (<8 or > 20)	375 (27.4%)	138 (24.3%)	237 (29.5%)	**.034**
HR (<60 or > 100)	378 (27.5%)	143 (24.9%)	235 (28.9%)	**1.28**
MAP (<60)	25 (1.8%)	8 (1.4%)	5 (2.1%)	**.332**
SBP (<90)	29 (2.1%)	5 (0.9%)	24 (2.9%)	**.008**
GCS				**.000**
13 -15	1224 (91.5%)	521 (95.8%)	703 (88.5%)	
9 – 12	66 (4.9%)	14 (2.6%)	52 (6.5%)	
3 -8	48 (3.6%)	9 (1.7%)	39 (4.9%)	
Unreported	57 (4.1%)	33(5.7%)	24(2.9%)	
Primary Survey				
Compromised airway	7(0.5%)	3 (0.5%)	4 (0.5%)	**0.020**
Compromised breathing	384 (27.5%)	140 (24.3%)	244(29.8%)	**0.024**
Compromised circulation	462 (33.1%)	178 (30.8%)	284 (34.7%)	**0.029**

9.5 Injury severity score by the time of presentation

The majority of patients 1261 (90.4%) that presented during study period had minor Injury Severity Score (ISS ≤8), while 36 (2.6%) of presented patients had major injury (ISS ≥15), with significant proportion presenting during off hours 33 (4.0%) compared to 3 (0.5%). that presented during regular hours. Overall off hour presentation was associated with higher ISS. **(Table 5)**

Table 5: Table of injury severity score by time of presentation

	All N=1395	**Regular hours n=577**	**Off hours n=818**	***p*-value**
ISS				**.001**
Minor	1261 (90.4%)	531 (91.1%)	730 (89.2%)	
Moderate	98 (7.6%)	43 (7.5%)	55 (6.7%)	
Major	34 (2.6%)	3 (0.5%)	33 (4.0%)	

9.6 Staffing level by the time of presentation

The staffing allocation were categorized according to their cadres. We found that all cadres were associated with short staffing during off hours. On average 37 nurses work daily, with about 26 nurses during regular hours and 11 during off hours. Similarly about 22 medical attendants are scheduled daily with more attendants during regular hours 15 than during off hours 8. This difference was also seen in other ranks among doctors. **(Table 6)**

Table 6: Average number EMD staffing level by the time of presentation

Variable	All	Regular Hours	Off hours	*p- value*
Staffing level				
EM Physician	3	2	1	0.04
Resident	27	3	2	0.01
Registrar	4	3	1	0.02
Nurse	37	26	11	0.000
Medical attendant	22	15	8	0.001

9.7 EMD Care by time of presentation

Among all patients 326 (23.4%) had received oxygen therapy, with slight 207(25.3%) of patients during off hours than during regular hours 119(20.6%). One third of patients had compromised circulation with 284 (34.7%) during off hours and 178 (30.8%) during regular hours. There was no significant difference in management of airway, breathing and circulation except for oxygen therapy. **(Table 7)**

Table 7: EMD care by time of presentation

	All N=1395	**Regular hours n=577**	**Off hour n=818**	***p*-value**
Airway Management				
Intubation	3 (0.2%)	2 (0.3%)	1(0.1%)	0.373
Neck collar	114 (8.4%)	23 (7.8%)	91(11.1%)	0.346
Breathing management				
Oxygen therapy	326 (23.4%)	119(20.6%)	207(25.3%)	0.030
Tube thoracostomy	1(0.1%)	0(0.0%)	1(0.1%)	0.401
Circulation Management				
IVF Fluids	612(43.8%)	232 (40.2%)	380 (46.5%)	0.777
Blood Transfusion				
Other				
Splinting	460 (32.9%)	180 (31.2%)	280 (34.2%)	0.234

9.8 Trauma outcomes by time of presentation

Overall the majority of patients were admitted to normal wards 1306 (93.6%), with higher proportions of admission seen during off hours than regular hours 520 (90.1%). Regular hour presentation was associated with higher proportions of discharge and ICU admission compared to those who presented during off hours. Patients that presented during regular hours had shorter ED stay 90±4.13 compared to those who presented during off hours 240±5.85. Overall mortality at ED was 1 (0.1%) and none of patients that presented during regular hour's succumbed death at ED, and this was also observed in 24h mortality 2(0.1%) and none of the patients that presented in regular hours died. **(Table 8)**

Table 8: Disposition, Length of stay and mortality by the time of presentation

Variable	All N=1395	Regular hours n= 577	Off hours n= 818	*p*- value
ED LoS				
Minutes Mean (SD)	195±1.47	90±4.13	240±5.85	.000
Disposition				
Discharged	82 (5.9%)	52(9.0%)	30 (3.7%)	.000
Floor admission	1306 (93.6%)	520 (90.1%)	786 (96.1%)	.000
ICU Admission	6 (0.4%)	5(0.9%)	1 (0.1%)	
Mortality				
ED mortality	1 (0.1%)	0 (0.0%)	1 (.0.1%)	0.401
24h mortality	2 (0.1%)	0 (0.0%)	2 (0.2%)	0.235

10. DISCUSSION

Trauma constitutes substantial volume of patients that are attended at ED-MNH accounting about for about one third of patient's population. (31) This is the first study in LIC to describe the timing of presentation and impact on outcome. Overall there was higher male to female ratio and this ratio was even higher during off hours, similar finding of male predominance was obtained from a study by Chalya et al in Northern Tanzania. (14) We believe that the slight higher male predominance observed in this study during off hours in comparison to regular hours could be contributed by males working during both regular and off hours as they are mainly responsible to take care of the family but also female being protected during off hours due to restrictions due to sociocultural reasons during these hours such as night hours. Similar finding was found in several studies in Asia, North America and Europe, and this shows no difference/similar pattern on sex presentation during regular and off hours between higher income countries and Low and middle income countries. (20–24)

Furthermore, the nearly half of patients being most productive age presenting age group with stable presentation in off hours calls for more preventive measures in off hours in LIC such as due to disproportionate trauma burden in LIC compared to HIC.

We found that over half of all patients were referred from other health facilities. This is contrary to the finding from Tanzania Lake zone by Chalya and his colleagues. (14) We believe that overall significant number of referral cases observed was due to our center is the tertiary and serves as trauma center in the country. Furthermore there was higher proportion of referrals from other lower facilities during off hours compared to regular hours and we believe this was largely contributed by less staffing and fewer resources seen during off hours than during regular hours as have been reported several in number of

studies.(25–27) Urgent measures should be taken not only to improve resources during off hours, but also to establishment of other specialized trauma centers in the country.

Over half of patients of the patients brought to the hospital came by an ambulance. We observed twice as much ambulance arrivals during off hours compared to regular hours. Ambulance transfer shows maturation of inter-facility transfer system and improved care. (11,18,20,28). It should be noted that in our study even though nearly sixty percent of all patients were referred from other health facilities only half of all presented patients arrived to the hospital by an ambulance. This demonstrate the under developed of prehospital system in LIC and difference in off hour phenomenon in LIC compared to that of HIC, hence a need of strengthening of prehospital system in the country. (20)

Overall, more than one third of all presented patients were triaged as emergency acuity, higher proportion was of these was observed during off hours than during regular hours. This shows that the proportion of patients that arrived during off hours were sicker and requiring immediate attention compared to that which arrived during regular hours. The finding of this study in acuity category are interesting and provides an opportunity of quality improvement, as an eye opener to the department management to that off hours calls for more attention than regular hours in LIC unlike evidence form HIC. (20)

Alcohol use is common in trauma patients especially those who have been involved in RTA. (38) Overall there was small proportion of patients under influence of alcohol in this study, nevertheless it was found that among these, and significantly eight times more were the proportion of alcohol use during off hours than during regular hours. The finding is consistent to that done in South Africa in LIC. (39) We thought off hour presentation was associated with alcohol more than regular hours due social events that are associated in off hours. The higher proportions of trauma patients under influence of alcohol in LIC during

off hours is also demonstrated as those of HIC. (14,39,41,42) More strict policies and police task forces should be deployed during these hours.

Unintentional injury was by far most common motivation of injury of injury among all trauma patients in this study. There was no significant difference observed regarding the intent of injury between trauma patients that presented between regular and off hours. This finding is consistent with findings of Chalya et al in Northern Tanzania and many and we thought that this finding is due to less violence seen in this region compared to other parts of LIC where intentional injuries are higher during off hours.(39,43)

We also noted that over half of patients presented to the hospital had sustained road traffic accident (RTA). This is consistent in both HIC and LIC and global scale.(4,56) This pattern of mechanism did not seem to differ by the time of presentation.

This was thought to be due to overspread of motorcycle use as means of transport is available during both hours and some of the motorcyclist are not licensed to ride them, hence contributing to similar proportion, but also due to the fact that task force such as policemen that could ensure safety are minimally or not available during off hours.

Among the vital signs implicated to be useful in setting of trauma is SBP by measuring MAP.(19)We found that (MAP <60mmHg) were 1.8% and the relatively there was no difference seen in mean arterial pressure despite that significantly the off hour presentation was associated with hypotension. This finding is consistent with other studies and shows similar comparison among high income countries to low and middle income countries. (19,23,43)

GCS has widely been used to categorize the severity of injury, and commonly in head injury, this study found that the overall, the majority of patients had mild head injury followed by moderate injury and smaller proportion had minor head injury. This trend was

also found by Respicious *et al* with higher mortality been observed in patients with severe head injury urging attention should be focused in this group of patients with severe head injury/GCS.(60) Notably in this study higher proportions of patients with severe head injury presented during off hours compared to regular hours. Contrary to HIC studies that found no differences in severity of GCS regarding to time of presentation further studies in LIC should be done to explore this phenomenon. (20,23,39)

We used ISS to document the degree of injury severity in this study. Overall ninety percent of all trauma patients presenting to ED had minor ISS. Smaller proportion 36 (2.6%) sustained major trauma (ISS≥16). It was further noted that of those who sustained major trauma (ISS≥16), the higher proportion of these presented during off hours than 33 (4.0%) than regular hours 3(0.5%), this shows that the proportion of patient which had sustained major trauma was higher during off hours. This is the most likely risky group to succumb and furthermore it is in these hours that less staffing is found in the majority of health facilities including the study center. (15,25–27)

The overall mean ED length of stay was around 3 hours, and we noted that on average trauma patients that presented during off hours had one hour longer in the ED stay longer ED stay compared to those who presented during off hours. We believe this was contributed to severe acuity, poor vital signs and major injuries that was observed in these patients that presented during off hours owing further resuscitation and stabilization compared to those who presented during regular hours. Similar findings by Ono *et al* in Asia had similar findings, showing similarity between HIC and LIC. (23) This may suggest the longer ED care among off hour trauma patients in this region is comparatively the same as that of HIC.

The majority of patients in this study period were admitted to respective specialized wards. Higher proportions of admission were seen during off hours compared to regular hours. We believe the higher admission rates observed during off hours was contributed by severity of injuries markedly found in off hours than timing of presentation. There was significant lower discharge rate during off hours and this was thought due to low acuity that was observed in proportion of patients presenting during regular hours than those who presented during off hours.

Overall, one patient died at EMD, this patient presented during off hours and had an ISS of (ISS≥50). As a result of only one death, we were unable to detect a significant difference in mortality between on and off hour's presentation. Larger sample size over longer period of time, and follow-up might be needed to ascertain the mortality difference between the two presentations.

The overall twenty four hour mortality was found that out of all patients that presented during off hours 2 of them died. Upon further evaluation of these patients died we noted that these patients had multiple system injuries and had brain herniation and despite best available emergency and neurosurgical care received they succumbed. None of the patients that presented during regular hours succumbed death at 24 hours. The mortality observed in this study which may reflect the LIC suggest to mortality observed due mainly due to severity of injury than time of presentation alone. Controversial evidence exist in Asia, North America and Europe. (14,20,21,23) This calls for further bigger study for evaluation of this phenomenon after understanding its scope presented in this study

10.1 Study limitations

i. This was a single centered study, and this may affect the generalizability, however MNH-EMD is a referral center for the country and receives referral from all over the country, and hence we believe that our study might cast a picture of the general presentations in regional hospitals that refer patients to MNH, in addition, efforts were made to enroll a large sample size, to ensure a maximum number of patients are enrolled.

ii. Despite keen follow up of patients there was missing data from trauma registry and missing data from referral forms on intervention done, this was mitigated by daily follow up in the admission patient charts, research assistant communication with escorting nurse and escorting relatives

11. CONCLUSION

In a cohort of adult patients presenting to EMD-MNH after sustaining injuries, off-hour presentation was associated with substantial volume of patients than regular hours, also off hour was associated with higher acuity, higher injury severity score, with more patients under influence of alcohol and understaffing. This shows that the proportion of patients that arrived during off hours were sicker and requiring immediate attention compared to that which arrived during regular hours. Clinical care during off hours was similar to that which was provided during regular hours despite understaffing. This was the first the first study LIC to determine the impact of time of presentation in trauma and the finding of this study in acuity category are interesting and provides an opportunity of quality improvement, as an eye opener to the department management to that off hours calls for more attention than regular hours in LIC unlike evidence form HIC.

11.1 RECOMMENDATIONS

1. Providers in acute care settings should be made aware of how critical in severity trauma patients in off hours presents since the off hour group is more likely to succumb.
2. Administrators in acute care settings should ensure enough staffing during off hours same or close to that number that exist during off hours
3. Task force should be placed in highways and streets for regular check of driver, riders who in off hours similar to those in regular hours.
4. Documentation should be improved among health care provider, not only for research purposes but avoid medicolegal purposes.
5. Further identification of gaps in research is needed to identify gaps in management of adult trauma patients and a clear protocol should be established on management of pain.

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13. APPENDIX 1: DATA COLLECTION SHEET

INCLUSION CRITERIA: All adult trauma patients who present to the Emergency Medicine Department of Muhimbili National Hospital and whose by themselves or their relative/next of kin have consented to participate in the study during the study period of July to December 2017.

Enrollment and Demographics

Record ID _____

ENROLLMENT

MR Number _____

Last Name _____

First Name _____

Address _____ Date of Birth _____ (Use the calendar or DAY-MONTH-YEAR)

Age (if no age, adult or child) _____

Sex Male ◯ Female ◯

Marital status Single Married Divorced Widowed Unknown Date of EMD Care _____ (Use the calendar or DAY-MONTH-YEAR)

Time of EMD Care _____

Patient phone number _____

Relative phone number _____

Referral Yes ◯ No ◯

Name of the referring facility _____

Level of referring facility

Dispensary ◯

Health center ◯

District Hospital ◯

Regional hospital ◯

Police hospital ◯

Military hospital ◯

Private hospital ◯

Private clinic ◯

Reason for referral _____

Chief Complaint # 1 _____

Chief Complaint # 2_____

Chief Complaint # 3 _____

Mechanism of Injury _____

Chief Complaint Category

Assault (Any complaint described as an assault) ◯

Limb Injury (any injury of legs or arms or toes or fingers or other unspecified) ◯

Wound (any complaint of wounds including lacerations or cut) ◯

Stab wound (Any complaint of stab wound) ◯

MVC (Any injury from motor vehicle crash) ◯

Fall (any complaint of injury from fall) ◯

Animal Bite (any complaint of animal bite) ◯

Burn (Any complaint of burn injury) Head Injury ◯

GSW (Any complaint of of gunshot wound) ◯

Misc injury (all other unclassified injury) ◯

MOI category

Car/Truck- driver ◯

Car/Truck- passenger ◯

Car/Truck- unknown position ◯

Pedestrian struck by car/truck ◯

Motorcycle-driver ◯

Motorcycle- passenger ◯

Motorcycle- unknown position ◯

Pedestrian struck by motorcycle ◯

Daladala-driver ◯

Daladala-passenger

Pedestrian struck by Daladala

Bajaj- driver

Bajaj- passenger

Pedestrian struck by bajaj

Long distance bus- driver

Long distance bus- passenger

Pedestrian hit by long distance bus

Other blunt injury

Knife wound

Gunshot wound

Other penetrating injury

Fall

Unknown

Burn

Motorbike-driver

Motorbike- passenger

Bicycle/ pedal cycle

Pedestrian struck by motorbike

Pedestrian struck by train

Other

Other, description _____

Date of Injury _____(Use the calendar or DAY-MONTH-YEAR)

Time of injury _____ hours

Motive of Injury

Intentional Unintentional Unknown

Alcohol use

Confirmed by patient Confirmed by alcohol test

Suspected by care provider Suspected or reported by relative/accompanying pers

Unknown ◯

Head of household? Yes ◯ No ◯ Unknown ◯

At work? Yes ◯ No ◯

If applicable, helmet use? Yes ◯ No ◯

Seat belt use, Yes ◯ No

If, seat belt use Shoulder ◯ Lap ◯ Both ◯

Air bag deployment Yes ◯ No ◯

VITALS

SBP ____ DBP _____ PULSE _____ RR_____ SPO2 (RA) _____ TEMP_____

PRIMARY SURVEY

Airway assessment

Not done ◯ Normal/ Patent ◯ Abnormal ◯

Compromised Management of compromised airway

Suctioning ◯ Positioning ◯ Oral airway ◯ Nasal airway ◯ ◯
Intubation Neck collar Other

Breathing assessment

Not done ◯

Normal ◯ Abnorm ◯

Management on abnormal breathing

Oxygen therapy ◯ Manual ventilation ◯ Needle decompression ◯ Chest ◯
tube Pleural tap Other

Circulation assessment

Not done ◯ Norm ◯ Abnor ◯

Management on abnormal Circulation IV fluids Blood transfusion
Other ◯ ◯ ◯

Disability assessment

Not done ◯ Normal ◯ Abnormal ◯

Management on disability

IV mannitol ◯ IV dextrose ◯ Burr hole ◯ Other ◯

Exposure assessment

Not done ◯ Normal ◯ Abnormal Management of exposure

Splinting ◯ Pain medication ◯ Debridement ◯ Stitching ◯ ◯
Dressing ◯ Tetanus toxoid Other

GCS AT EMD

GCS Eye opening _____ GCS Verbal response _____ GCS Motor Response _____

Total GCS at EMD _____

EMD INVESTIGATIONS

FAST/ EFAST ◯ Not done ◯ Normal ◯ Abnormal

EFAST results _____

POC RBG _____ (if not done enter "x")

ISTAT Not done ◯ Done ◯

Hemoglobin level _____

Creatinine level _____

DIAGNOSIS

Final Diagnosis 1 _____ Final Diagnosis 2 _____

EMD Diagnosis 3 _____ EMD Diagnosis 4 _____

SEVERITY OF INJURY

Head or neck - including cervical spine Yes ◯ No ◯

Specific injury-Head or neck - including cervical spine

_____

Injury severity-Head or neck-including cervical spine

◯ Minor (superficial laceration)

◯ Moderate (Example: fractured sternum)

◯ Serious (Example: open fracture of humerus/femur etc)

◯ Severe (Example: Perforated trachea or Perforated oesophagus)

◯ Critical (Example: Ruptured internal organs such as liver with tissue loss)

◯ Maximal (Example: Total severance of aorta)

◯ Not further specified

Face-including the facial skeleton, nose, mouth, eyes and ears Yes ◯ No ◯

Specific injury-Face - including the facial skeleton,

_____ nose, mouth, eyes and ears

Injury severity-Face - including the facial skeleton,

◯ Minor (superficial laceration) nose, mouth, eyes and ears

◯ Moderate (Example: fractured sternum)

◯ Serious (Example: open fracture of humerus/femur etc)

◯ Severe (Example: Perforated trachea or Perforated oesophagus)

◯ Critical (Example: Ruptured internal organs such as liver with tissue loss)

◯ Maximal (Example: Total severance of aorta)

◯ Not further specified

Chest-thoracic spine and diaphragm ◯ ◯

Specific injury-Chest - thoracic spine and diaphragm

_____

Injury severity-Chest - thoracic spine and diaphragm

◯ Minor (superficial laceration)

◯ Moderate (Example: fractured sternum)

◯ Serious (Example: open fracture of humerus/femur etc)

◯ Severe (Example: Perforated trachea or Perforated oesophagus)

◯ Critical (Example: Ruptured internal organs such as liver with tissue loss)

◯ Maximal (Example: Total severance of aorta)

◯ Not further specified

Abdomen or pelvic contents - abdominal organs and lumbar spine Yes ◯ No ◯

Specific injury-Abdomen or pelvic contents - _____
abdominal organs and lumbar spine

Injury severity-Abdomen or pelvic contents –

◯ Minor (superficial laceration) abdominal organs and lumbar spine

◯ Moderate (Example: fractured sternum)

◯ Serious (Example: open fracture of humerus/femur etc)

◯ Severe (Example: Perforated trachea or Perforated oesophagus)

◯ Critical (Example: Ruptured internal organs such as liver with tissue loss)

◯ Maximal (Example: Total severance of aorta)

◯ Not further specified Extremities or pelvic girdle - pelvic skeleton

Yes ◯ No ◯

Specific injury-Extremities or pelvic girdle - pelvic _____ skeleton

Injury severity-Extremities or pelvic girdle - pelvic

◯ Minor (superficial laceration) skeleton

◯ Moderate (Example: fractured sternum)

◯ Serious (Example: open fracture of humerus/femur etc)

◯ Severe (Example: Perforated trachea or Perforated oesophagus)

◯ Critical (Example: Ruptured internal organs such as liver with tissue loss)

◯ Maximal (Example: Total severance of aorta)

Not further specified

External Yes ◯ No ◯

Specific injury-External _____

Injury severity-External

◯ Minor (superficial laceration)

◯ Moderate (Example: fractured sternum)

◯ Serious (Example: open fracture of humerus/femur etc)

◯ Severe (Example: Perforated trachea or Perforated oesophagus)

◯ Critical (Example: Ruptured internal organs such as liver with tissue loss)

◯ Maximal (Example: Total severance of aorta) Not further specified

EMD Disposition

- ◯ Home
- ◯ MNH Ward
- ◯ MNH HDU
- ◯ MNH ICU
- ◯ Transfer to MOI Transfer to ot
- ◯ Death

If MNH ward, which one? _____

If MNH HDU, which one? _____

If MNH ICU, which one? _____

If transfer to MOI?

- ◯ Admitted
- ◯ Discharged

If transfer to other, description _____

MOI HRN _____

Hospital

Outcome after 24 hours

Alive ◯ Dead ◯

Outcome after 7 days

Alive ◯ Dead ◯

Outcome after 30 days

Alive ◯ Dead ◯

Outcome at hospital discharge

Alive ◯ Dead ◯

Final diagnosis at Hospital discharge: .....

13.1 APPENDEX 2: CONSENT FORM (English version)

STUDY TITLE: TO DETERMINE IF THE CLINICAL CHARACTERISTICS, CARE AND OUTCOMES OF TRAUMA PATIENTS DIFFERS BETWEEN OFF HOURS AND BUSINESS HOURS PRESENTING AT EMERGENCY MEDICAL DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM

Introduction

Greetings, my name is Dr. Elly Mulesi, a second year resident in the course of Emergency Medicine at Muhimbili University of Health and Allied Sciences (MUHAS).

I am conducting a study with the above title as part of my study program. I hereby request your participation and cooperation in my study once I or my research assistant approaches you. Your decision to/not to participate will have no effect on the care and management or harm to your patient or beloved one whatsoever.

Please ask questions if there is anything about this study you do not understand.

Aim of the study

The purpose of this study is to describe the comparison of clinical characteristics, care and outcome of adult trauma patients presenting between 'off hours' and 'business hours' at Emergency Medical Department, Muhimbili National Hospital.

Benefits

There will be overall benefit after knowing the results and its implication to the hospital. There will be no payment for participation in the study.

Risks

There is no risk in participating in this study.

What does this study involve?

This study involves the research assistant or principal investigator asking structured questions to the informant or relatives and filling the responses in the prepared questionnaire. Also information about the patient will be obtained from the patients file.

Consent

Your consent/Consent for your patient to be involved in the study is completely voluntary and agreeable by signing the consent form. If you are not free you are allowed not to consent and this will not affect the care and management offered to your patient you brought for treatment. You may choose to stop taking part in this study at any time for any reason.

Confidentiality

The information you provide is highly valued and will be kept strictly confidential. The study information will be stored in protected computer files and in paper records stored in locked filing cabinet. Only study staff will have access to the information.

Access of information

By signing this form, you allow the research team to use the information and give it to others involved in the research. The research team includes the researcher, facilitators plus others working on this study at MUHAS and MNH.

For further information, questions or queries, you can contact:

1. The Principal Investigator,
   Dr. Elly Mulesi
   Department of Emergency Medicine,
   MUHAS,
   P. O. Box 65001,
   Dar es Salaam, Tanzania.
   Tel: +255 683 583232
   Email: ellymulesi@gmail.com

2. Dr. Hendry Sawe
   Department of Emergency Medicine,
   MUHAS/MNH,
   P. O. Box 65001,
   Dar es Salaam, Tanzania.
   Tel: +255 754 885658
   Email: hendry_sawe@yahoo.com

3. Prof. Bruno F.P Sunguyo,
   Director of Research and Publications,
   MUHAS,
   P.O. Box 65001,
   Dar es Salaam, Tanzania.
   Tel no; 2150302-6, 2152489.

Signature:

I, _____ have read/been told the contents of this form. My questions have been answered. I agree to participate in this study.

Signature of participant _____

Date of signed consent _____

13.2 CONSENT FORM (Swahili version)

FOMU YA RIDHAA YA KUSHIRIKI KATIKA UTAFITI

Utangulizi

Jina langu naitwa Dkt.Elly Musime Mulesi, mwanafunzi wa udaktari bingwa wa magonjwa ya dharura (Emergency Medicine) katika Chuo Kikuu Cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Ninaomba ushiriki wako kwa niaba ya mgonjwa wako katika utafiti huu endapo mimi ama msaidizi wangu atakapokufuata ili kukuuliza taarifa muhimu za mgonjwa wako.

Madhumuni ya utafiti:

Utafiti huu unalenga kuangalia tofauti ya siha, tiba na matokeo ya matibabu wanayopata wagonjwa wa ajali waliiofika katika idara ya dharura wakati wa muda wa saa za kazi na muda usio saa za kazi.

Ushiriki katika utafiti:

Mgonjwa yeyote wa ajali aliyefika idarani kwa ajili ya matibabu.

Hatari:

Hatutarajii kuwepo na athari/hatari yeyote itokanayo na ushiriki katika utafiti huu.

Faida za utafiti:

Kwa kutoa ridhaa ya mgonjwa wako kushirikishwa katika utafiti huu, tutaweza jua ni sababu zipi na hatari zipi zinaweza kupelekea mgonjwa moyo kusimama/kufa, tiba zinazoweza kuokoa mgonjwa, na hatma za wagonjwa hawa baada ya tiba ya dharura.

Usiri:

Taarifa zote zitakazokusanywa katika utafiti huu zitakuwa siri, hivyo ushiriki wako hautajulikana na mtu. Taarifa hizi zitajulikana kwenye timu ya watafiti tu.

Malipo:

Kwa kushiriki kwenye utafiti huu, hautalipwa wala hautalipa ghrama yeote..

Ukiwa na swali au tatizo lolote, unaweza kuwasiliana na wafuatao:

1. Mkuu wa Utafiti
Dkt. Elly Musime Mulesi,
Idara ya Magonjwa ya Dharura na Mahututi (Emergency Medicine),
MUHAS,
S.L.P 65001,
Dar es Salaam, Tanzania.
Simu: +255 683 583232
Barua pepe: ellymulesi@gmail.com

2. Dkt. Hendry R Sawe
Idara ya Magonjwa ya dharura na Mahututi,
MUHAS/MNH,
S.L.P 65001,
Dar es Salaam, Tanzania.
Tel: +255 754 885658
Barua pepe: hendry_sawe@yahoo.com

3. Prof. Said Aboud
Mkurugenzi wa utafiti,
MUHAS,
S. L. P. 65001,
Dar es Salaam, Tanzania
Simu: 2150302-6, 2152489.

Kuweka sahihi ya makubaliano:

Mimi, _____, nimesoma/nimesomewa maelezo yote yaliyomo kwenye fomu hii na nimeelewa. Maswali yangu yamejibiwa vizuri na niko tayari kushiriki.

Sahihi ya mshiriki _____

Sahihi ya Mtafiti _____Tarehe _____