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Prehospital Factors Associated with Injury Severity of Motorcycle Related Femoral Fractures at Mbarara and Kampala International University Teaching Hospitals in Uganda

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Abstract:*Prehospital determinants of motorcycle related femoral fracture injury severity remain a poorly documented trauma entity in Uganda. Knowledge of most at risk of poor injury outcome in resource limited settings with no formal prehospital care system is not only mandatory for evidence based preventive policy formulation but also guidance of clinical practice. This cross sectional descriptive and analytical hospital based study determines prehospital factors associated with injury severity of motorcycle related femoral fractures at the accident and emergency departments of two university teaching hospitals in Uganda, using the Kampala Trauma Score II (KTSII). Ethical clearance was obtained from Mbarara University of Science and Technology Research and Ethics Committee (IRB No.19/10-16). We consecutively recruited patients between December 2016 and June 2017, using investigator-administered questionnaire, to obtain data including history, clinical examination and radiological findings. Multiple logistic regression analysis and Odds ratios were computed using IBM SPSS 20.0. statistics for windows (Armonk. NY: IBM Corp) at 95% Confidence Interval and P<0.05 as statisticaly significant.*

Of 230 patients, the mean age was 32 years (Std. Deviation 18.5 years), with male to female ratio of 2.4:1.Being a passenger on a motorcycle (OR 1.636; 95% CI [1.261-3.417; P=0.007) and receiving no first aid before arrival (OR 2.106; 95% CI [1.818-2.495]; P<0.001)were pre-hospital factors significantly associated with a severe Kampala Trauma Score II amongst patients sustaining femoral fracture secondary to motorcycle accidents. There was no association between means of arrival, prehospital time; pre-existing comorbidities and severity of KTSII in this patient category. Road traffic legislative efforts should protect the passenger in the same manner as for riders and pedestrians. There is need to strengthen prehospital care system in Uganda through training motorcyclists, police officers and taxi drivers on basic long bone fracture splintage.

Key words: *Accident, Femur fracture, Injury severity, KTSII, Motorcycle, Prehospital factors, Uganda*

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I. Introduction

In this study, prehospital factors refer to those events around an accident that can potentially influence injury outcome from the time of injury to the time when the patient reaches the hospital's emergency department. These include: road user category (passenger, pedestrian, motorcyclist); mechanism of collision (motorcycle-pedestrian, motorcycle-motorcycle, motorcycle-car); mode of arrival to health facility (by ambulance, taxi/motorcycle), access to first aid before arrival, arrival time interval from the time of accident and pre-existing medical illness before the accident. Pre-hospital care refers to care given to the injured patient, in this case with motorcycle related femoral fractures, by a health worker or any bystander before the patient arrives to the accident and emergency departments. We present an overview of the existing literature on the quality of prehospital care in Uganda and compare our current study findings on how prehospital factors impact on injury severity of motorcycle attributable femur fractures in resource limited settings.

II. Literature Review

Out of the hospital care has been shown to be a significant determinant of trauma outcome, particularly a core tool in addressing prehospital hypotension, hypoxemia and hypothermia[1]. However the concept of prehospital care and prehospital factors affecting injury outcome remain controversial even in the world's best

trauma Centres [1]. Part of the controversy and variability of evidence arises from differences in resource availability, since post traffic accident mortality is negatively correlated with the individual country's income status and governance indicators [2]. The other controversy arises from different research methodical contextsand definition of key terms such as prehospital time in the various trauma Centres [3]. Whereas such average prehospital time may be a few minutes in countries with emergency air crafts, one may talk of days in resource constrained countries where trauma patients use public transport to arrive at the few trauma Centres (if any).

Thus whereas factors such as prehospital time have not recently correlated with severity of injury outcome in a Swiss study; where the average prehospital time is reported to be 50 minutes [1], this evidence might not be reproducible in a Ugandan context where there is no formal prehospital care system. Scarcity of ground ambulance system in Uganda guarantees public taxis and motorcycles, which are not exempted, from traffic jam, to ferry trauma patients to emergency departments. Comparable studies in India, that has the most highest reported number of road traffic accidents worldwide have shown that major trauma patients arrive to trauma Centres even after 24 hours as opposed to the golden hour norm in developed countries[4].

There is paucity of data to compare Uganda's average prehospital time to the rest of the world, which the study seeks to address. However a multi country study in Kenya, Tanzania, South Africa, Ghana, German and United States has shown that for high energy trauma, the earlier a patient receives standardized management the better the post injury outcome [5]. This multicentre study demonstrated significant differences amongst these countries between injury admission interval, arrival surgery interval and surgery discharge interval for patients who sustained femoral fractures [5]. As such, these intervals particularly for isolated femoral fractures have been shown to be good predictors of effectiveness of trauma management in a given health system [5]. Late arrival beyond one hour post injury is particularly associated with poor outcome [6]; as often there is no opportunity to resuscitate the patient to avert life-threatening injuries in the golden hour.

Means transportation to the emergency department by ambulance versus taxi/motorcycle becomes yet another important prehospital variable, since police officers in Uganda, who are often the first responders and assist in the ferrying of injured patients to hospitals are also assigned other pressing responsibilities such as national security but also do not undergo specialized prehospital care training. Arrival of the injured patients by motorcycles or taxis cannot be without risks since drunk and drug riding is not routinely assessed among commercial motorcycle riders [7], yet use of psychoactive substance in this road user category is well documented [8]; [9]. This aspect is relevant for Uganda because commercial motorcyclists often respond to such emergencies and are the most accessible means of transport compared to taxis and ground ambulances in the early morning and late evening hours when most accidents are reported to occur[10]. At such times however, motorcycles are likely to suffer complications of fatigue [11] and sleep deprivation during such critical hours [12], particularly to ride on old and ill maintained roads [13] where no certification of road worthiness of motorised vehicles has been largely legitimised to simulate the developed world [14].

Whereas elsewhere studies are comparing impacts of physician versus paramedic administered first aid as a prehospital predictor of injury outcome [2], or paramedics versus lay bystanders [3], Uganda's uniqueness is that not even trained bystander rescue teams do exist. It is economically feasible to have such trainings instituted than changing the long-term country's income and governance indicators. Studies have shown that observed trained bystanders' first aid is comparable to that of paramedics without analysing the impact on patients' outcome [15]. This study however, seeks to compare the injury severity outcome of self-reported basic first aid administered by non-trained bystanders versus health workers as an action point since such trainings have not largely been undertaken in Uganda, with exception of a few city based pilot studies that have attempted training lay people [16]; [17].

Since taxi drivers and motorcyclists have no basic training in prehospital care and life support, it is not clear whether such first aid administered by lay bystanders improves or worsens injury outcome and as such should be embraced or abandoned. Despite the fact that standard prehospital care system has been shown to reduce morbidity and mortality amongst trauma patients, based on experience from Iraq [18], to date, Uganda does not have an existing formal prehospital care system. This indirectly translates into morbidity and mortality that is economically devastating to the country [19]. Experience from South Africa and European Union show that once a femoral fracture has occurred, the standard operative procedures and cost of care required remains the same despite individual country economic differences [20].

Although motor vehicular studies in the developed world have shown no association between mechanism of injury and injury severity in prediction of mortality [2], this might arguably not be valid for two wheelers with no protective casing, as such exposing the rider or passenger to directly absorb the high impact energy in the event of an accident. Also contrary to four wheeler vehicles where front seat occupants have been shown to suffer fatalities than rear seat passengers [4], the hind passenger on a two wheeler might be sacrificed in the event the rider attempts to save themselves of head-on collisions. In Uganda, it is common for a motorcycle to carry more than one passenger. On the other hand, pedestrians might be the ones more at risk of

serious injuries when directly struck while crossing the roads or walking on the pavements. This study thus examines who is most at risk of injury severity of the road user category as motorcycle rider, passenger, or pedestrian and how injury severity might vary by nature of collision as motorcycle-to-motorcycle, motorcycle to pedestrian, motorcycle to car crash or motorcycle hitting a static object. Whereas mechanism of injury might determine outcome [21], once fracture of the femur has occurred, concurrent trauma such as head injury [22], depending on nature of helmet used [23], have been associated with higher case fatalities. This study uses the Kampala Trauma Score II to cater for such additional injuries.

Pre-injury comorbidity has been shown to influence outcome of severely injured patients in trauma setting [24]. However there are concerns regarding reliability and variability in levels of agreement of the pre-injury morbidity grading using the American Society of Anaesthesiologists (ASA) classification based on Norwegian experience [24], since particularly in orthopedic trauma which this study evaluates, patients' functional status scores cannot be obtained prior to the injury [25]. This makes it difficult to ascertain if patients have returned to their pre-injury level of function in the short-term post injury period. To avoid this bias, only chronic medical comorbidities that could be validated by patients' records and reconfirmed by readily available standardized diagnostic tests including diabetes, hypertension, HIV/AIDS, and Tuberculosis were hypothesized to influence the injury severity and immediate mortality outcome. Such medical conditions may not only potentially influence hospital stay but also have anaesthetic implications.

The other controversy regarding reliability of prehospital factors, as predictors of injury severity and mortality could also be ascribable to differences in injury severity scores used at different trauma Centres. These include the Injury Severity Score [26] and New Injury Severity Score [27]; [28] used in developed world; versus the Kampala Trauma Score II, well validated and adopted in developing countries [29]. However, attempts have been made continuously to harmonize these differences by comparison of these tools [29]; [30]; [31]. Thus, the present study makes use of the Kampala Trauma Score II and death to determine immediate injury severity outcome for patients sustaining motorcycle related femoral fractures.

Research into appropriate traffic accident preventive strategies has been recommended in Uganda [32], but data on injury severity characteristics is required evidence to estimate the associated health and economic burden in order to advocate for the establishment of institutional and regional trauma registries and for policy formulation. The existing studies are retrospective with record bias and have been conducted in Kampala Capital where there might be easier access to ground ambulances. Such studies do not reflect the burden of motorcycle related injuries in remote settings where motorcyclists are more likely not to have attained post-primary education and standard riding training and as such unlikely to comply by the road safety regulations [33]. Experience from Rwanda show that in remote settings, surveys similar to the current study provide reliable and inexpensive data useful to mitigate accident occurrence compared to police reports [34].Determining prehospital factors associated with injuryseverity of motorcycle related femoral fractures in the present study, does not only act as evidence adjunct to policy formulation and implementation of preventive safety precautions but also guide establishment of local treatment protocols for prehospital factors characteristically associated with a severe Kampala Trauma Score II.

III. Materials and Methods

Conceptual Framework and Study Variables

The study entails dependent variable(s) (severity of Kampala Trauma Score II) amongst patients sustaining fracture of the femur following motorcycle related accidents, that is likely to depend on pre-hospital factors (independent variables) here coceptualised as road user category, mechanism of injury, mode of transportation of the patient to the hospital, arival interval time, access to first aid before reaching the hospital and underlying medical illness before the incident; although the different anatomical sites of femoral fracture may have a bearing on the injury severity oucome (intervening variables) as described in fig.1. The sociodemographic, agent and evironmental factors contributing to injury severity are beyond the scope of this study.

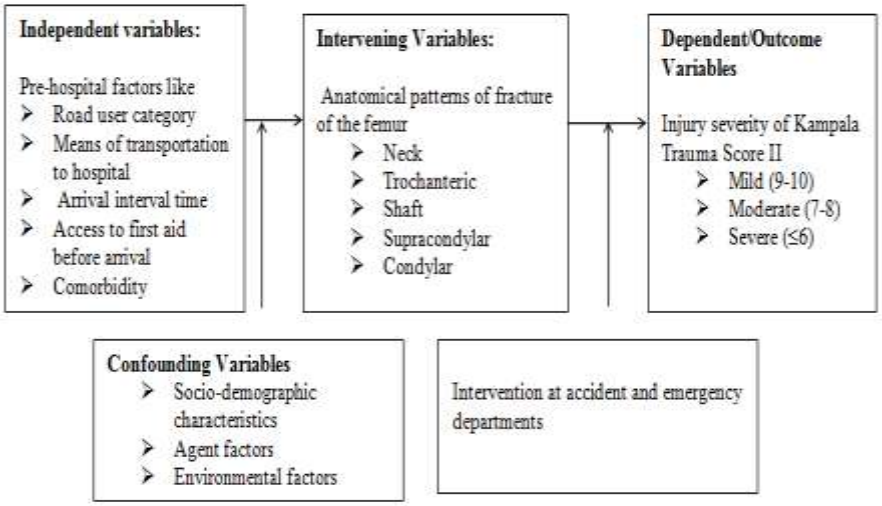

Figure 1: Conceptual framework showing interaction of study variables

2. Sample Size Calculation

The sample size was calculated using the Keish and Leslie (1965) formula as below;

$N=Z^2PQ\div D^2$; Where N=Minimum sample size required, Z is the standard normal deviate at α=5% (1.96 at 95% confidence interval), P and Q are the population proportions, where P=Probability of sustaining fracture of the femur secondary to motorcycle, Q is (1-P) and D is the level of precision desired (margin error rate of 0.05). Based on the prevalence of road traffic accident related femoral fracture from a Tanzanian survey [35] reported to be 18%; then substituting P=0.18;

$$N=\frac{(1.96)^2 x 0.18 x 0.82}{(0.05)^2} = 227$$

The minimum sample size for validity of the study was 227 patients. A total of 230 patients were recruited by the end of the six months study period from the time of commencement, generating a sample size large enough to generalise the findings.

III. Study SitesAnd Duration

We conducted the study at the accident and emergency departments of two specialised tertiaryteaching hospitals in Western Uganda, including Mbarara Regional Referal Hospital which is government aided teaching Hospital for Mbarara University of Science and Technology (http://www.health.go.ug/content/mbarara-regional-referral-hospital) and Kampala International University Teaching Hospital, that is privately owned (http://ameca.org.uk/directory/listing/kampala-international-university-teaching-hospital-uganda), from 5/12/2016 to 5/06/2017.

IV. Study Design

This was a cross sectional descriptive and analytical study. We consecutively recruited eligible patients with motorcycle related femoral bone fractures, presenting within 24 hours following the incident. We used a precoded and pretested investigator-administered questionnare designed purposely for this study,tocollect data on prehospital factors, clinical examination findings covering parameters of Kampala Trauma Score as shown in (Table I)and findings of radiological assessment of the femur bone fractures based on X-rays at the time of admission to the accident and emergency departments. We then conducted a short term assessment of physical and functional morbidity based on the Kampala Trauma Severity ScoreII, categorised as mild (9-10), moderate (7-8) and severe injury (≤6) and assesed mortality as immediate injury outcome with in 24 hours.

Table 1: Showing parameters covered by the Kampala Trauma ScoreII, adapted from [29].

Category	Clinical Parameters	Description	Score
A	Age (Years)	5-55	1
		<5>55	0
B	Systolic BP on admission	>89mmhg	2
		89-50	1
		<=49	0
C	Respiratory rate on admission	10-29bpm	2

		>=30	1
		<=9	0
D	Neurological status	A	3
		V	2
		P	1
		U	0
E	Score for serious injuries	None	2
		One	1
		>one	0

Inclusion Criteria (Case Definition)

In this study, an accident was deemed motorcycle related if the patient reported within 24 hours after sustaining fracture of the femur and: was a passenger on motorcycle, a motorcycle rider, and pedestrian hit by a motorcycle, motorcyclist colliding with static objects or a patient of motorcycle-motor vehicle collision. Since any one can get involved in a road traffic accident, these patients were recruited irrespective of gender, age and level of consciousness. This inclusion criterion had been earlier shown to be effective in screening motorcycle related injuries [36].

Exclusion Criteria

1. Passengers or drivers in motor vehicles.
2. Referrals from tertially hospitals whose specialist care had been already initiated.
3. Patients dying on arrival before radiological assessment. These were excluded to ensure completeness of the data tool (KTS II and X-ray result sections).

Study Procedure

Eligible participants were recruited after primary survey and resuscitation in acccordance with the American College of Surgeons' Advanced Trauma Life Support (ATLS) protocol [37]; [38]. This was to ensure thourough detection of life threatening injuries and that they were treated based on the presumed danger they posed. The safety of this method was earlier validated in similar studies that used questionnares [39]. Every respondent or legalised representative were explained to the purpose of the study in order to endorse an informed consent document with a signature or thumb print. A pretested coded check list of parameters of interest specially designed for this purpose was then administered by the investigators, with the help of staff on duty at the accident and emergence departments. A complete history, physical examination and radiological assessment of the fractured limb(s) by use of X-ray was conducted and findings of interest were recorded on the data tool.

Ethical Considerations

The study strictly followed the National Institute of Health guidelines on research involving use of human subjects and ethical clearance was obtained from Mbarara University of Science and Technology (MUST) Research and Ethics Review Committee (IRB No.19/10-16). Permission to collect data was sought from Kampala International University Teaching Hospital and Mbarara Regional Referral Hospital. The official Mbarara University of Science and Technology Rresearch Ethics Committee consent form document was adopted. Permission and informed consent/assent were sought from study participants and or legally authorised representative who were asked to indicate their consent and or assent by endorsing predesigned consent and or assent forms using their signatures or thumb print (mark) in the presence of the Principal Investigator or doctor on duty at the accident and emergency departments. Where an adult legally authorised representative had consented on behalf of unconscious, informed consent was re-obtained from the patients themselves upon regaining consiousness. For emancipated minors, consent was obtained from the patient. The respondents had the right to decline from participation or withdraw from the study at any time if they wished without explaining their actions. Patients' confidentiality and privacy was highly prioritised. Data was kept in password protected files only known to the investigators until final stages of dissemination. Data records were kept centrally in lockable shelves and were destroyed at the end of the study period to avoid retrieval by non investigators. Study participants were educated on the potential benefits from the study when recommendations are made and implemented to increase vigilance in pre-hospital care for patients sustaining motorcycle related accidents. No radiographs were requested without a clear valid indication of diagnosing a fracture. This investigation was done at the cost of participants because X-rays are standardised procedure for diagnosing fractures with or without the research intervention, but no payment was a prerequisite to partcipate in the study. Readiness to receive disclosure regarding the nature of injuries was assessed by the disclosing physician to minimise distressig post traumatic memories sorrounding the circumstances of road traffic accident that would be

triggered by such disclosure. Referrral to psychiatric and counselling services was made to all patients or immediate relatives taking care of the injured patients who were suspected to re-live traumatic experiences.

Quality Control

Pre-tested questionnaire in English were translated into local languages (Runyankole/Rukiiga) by a professional teacher of english well versed with the native language. The questionnare were pre-tested and validated at Ishaka Adventist Hospital, in a similar patient category to minimize errors. Research Assistants [Doctors on duty (roster) at the Accident and Emergency Departments] were trained on emergency resusciation and use of the data collection tool including the Kampala Trauma Score during a one day workshop at begining and middle of study period. Proper patient identification by use of unique out patient and in patient numbers was emphasized to avoid any duplication in recording in case one sustained multiple accident incidents during the study period. All data tools were re-checked for completeness prior to patient discharge.

Data analysis

We sorted, coded, entered and analysed our data using IBM SPSS 20.0. statistics for windows (Armonk. NY: IBM Corp) under technical supervision of a Biostatician. We computed percentages for patients with femur bone fracture, sustaining severe Kampala Trauma Score (KTS) II of($\leq$ 6), moderate KTS II score of(7-8), and mild KTSII score of(9-10) as described by Mutooro et al[29]. After adjusting for anatomical sites of femoral fracture that were presumed to have sigificant bearing on the morbidity and theoretical impact on the severity of KTS II, we correlated prehospital factors with severity of injury, using Chi sqare (X^2) and Likelihood ratio tests for paired data, and multiple logistic regression analysis and odds ratios at 95% confidence interval, setting ($p<0.05$) as statistically significant; in order to determine prehospital factors independently and significantly associated with a severe KTS II of ($\leq$ 6).

V. Results

Of the 230 participants, 56.5% (n=130) were recruited from Mbarara Regional Referral Hospital whereas 43.5% (n=100) were from Kampala International University Teaching Hospirtal. Majority 70.9% (n=163) were males giving a male to female ratio of 2.4 : 1. Majority 49.6% (n=114) had a moderate Kampala Trauma Score II, whereas 24.3% (n=56) had a severe Kampala Trauma Score as shown in fig.2.

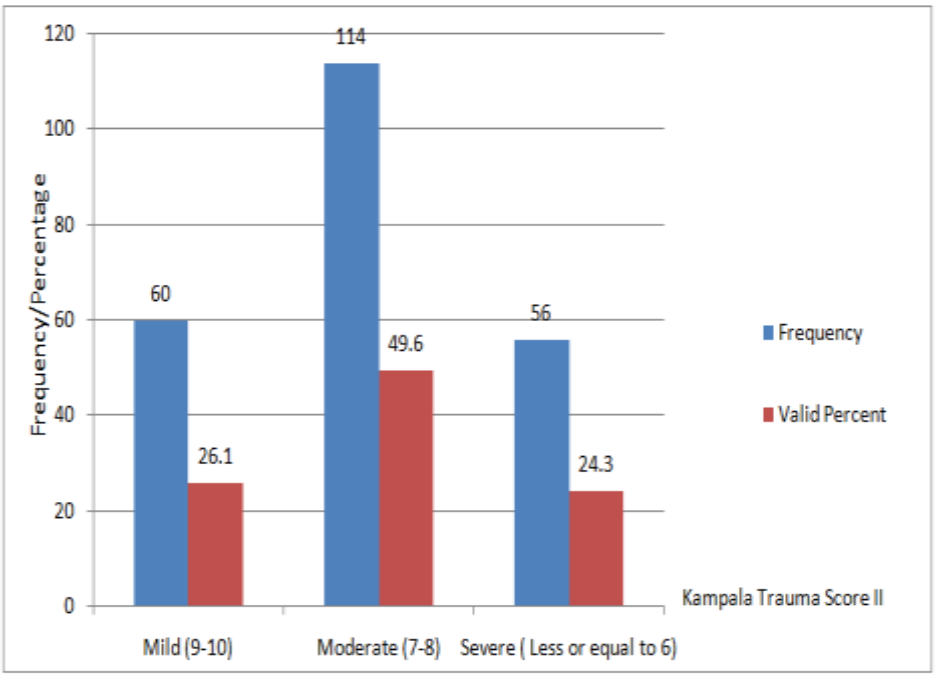

Figure 2showing severity of Kampala Trauma Score II amongst patients with femoral fractures secondary to motorcycle related accidents

The motorcycle to motorcycle accident was the most common mechanism of femur bone fracture 51.3% (n=118) followed by motorcycle-car crash and motorcycle-pedestrian in that order as shown in fig.3. Motorcycle-car crash was associated with higher odds for a severe KTS II (OR 1.193; 95% CI [1.010-3.104]; P=0.017).

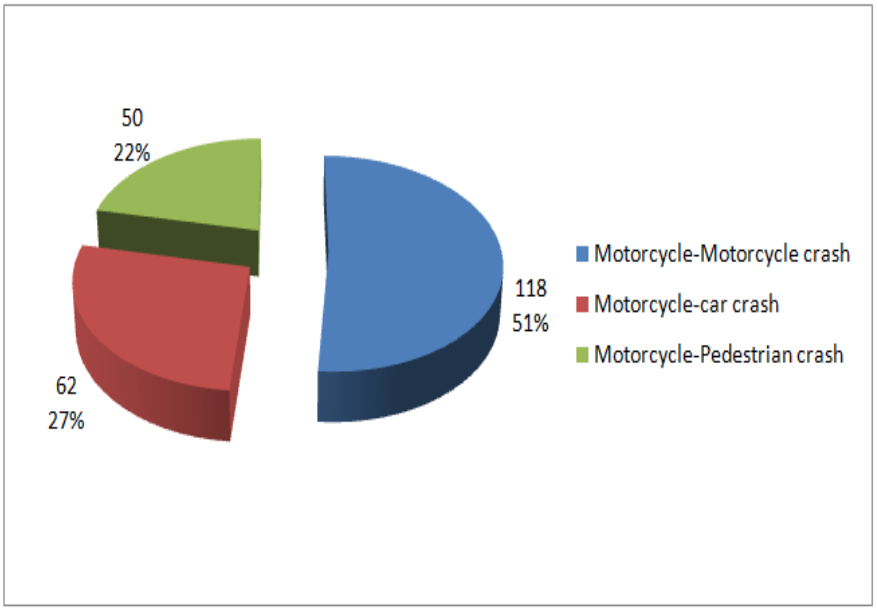

Figure 3: Summarizing mechanism of collision amongst patients presenting with femoral fracture secondary to motorcycle related accidents

The most commonly fractured road user category was the passenger on the motorcycle 48.3% (n=111) followed by motorcycle rider and pedestrian in that order (fig.4). The passenger on motorcycle also had higher odds for sustaining a femoral bone fracture associated with a severe KTS II (OR 1.636; 95% CI [1.261-3.417]; P=0.007).

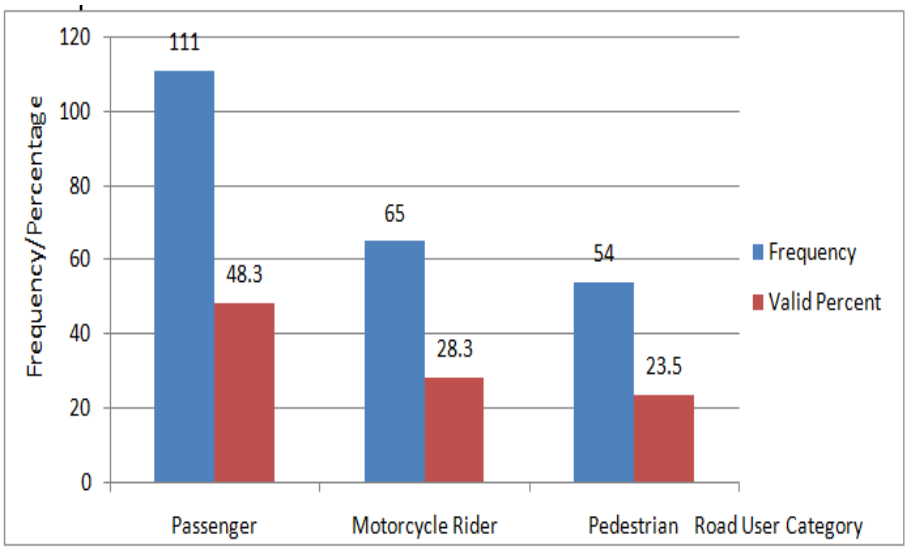

Figure 4: Showing Road User Category amongst Patients Sustaining Femoral Bone Fracture Following Motorcycle Related Accidents

Of the 230 participants, only 47.4% (n=109) arrived to the health facilities by ambulance whereas majority 52.6% (n=121) arrived by taxi/motorcycle. Arrival by a taxi/mortorcycle was associated with higher odds for a severe KampalaTrauma Sore II compared to those who arrived by ambulances (OR 1.270; 95% CI [0.915-1.764]) Vs. (OR 0.791; 95% CI [0.595-1.052]) respectivey, however this was not statistically significant (P=0.127).Of the 230 participants, only 63.5% (n=109) arrived to the health facilities within one hour from the time of accident incident. The mean travel interval estimate from time of accident incident to arrival at the health facilities was 4.13 Hours (Std. Deviation 3.52 Hours). Arrival to the Hospital beyond one hour was associated with higher odds for a severe KTS II amongst patients with femoral bone fractures secondary to motorcycle related accidents (OR 1.448; 95% CI [0.916-2.290]), however this did not reach statistical significancy (P=0.115). Patients who used ambulances were 3 times more likely to arrive to the hospital within

one hour compared to their counterparts who used public transport (OR 2.939; 95% CI [1.667-5.180]; P<0.001) (fig.5).

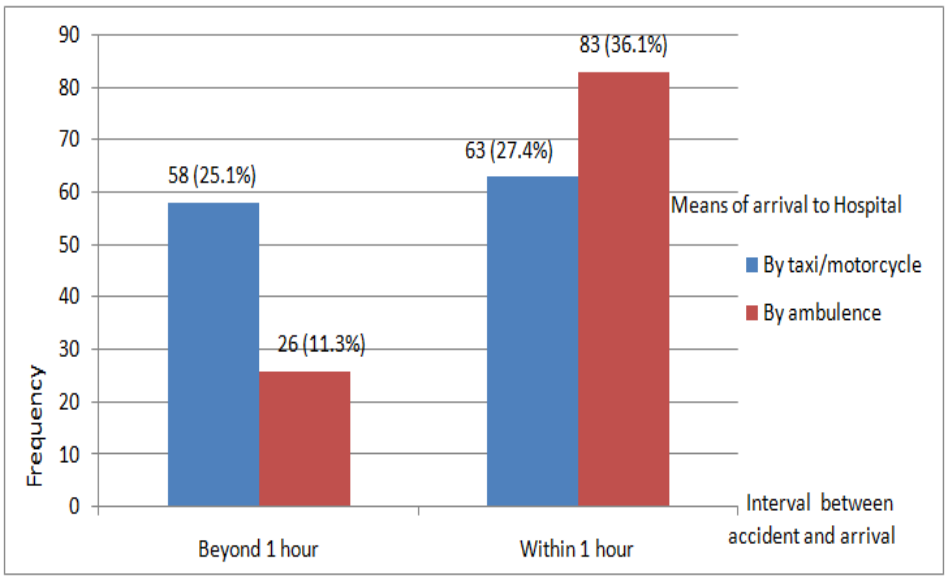

Figure 5: Showing relationship between means of transportation of patients with femoral bone fractures and prehospital arrival interval

Of the 230 participants, only 47.0% (n=108) received first aid before arrival to the health facilities, of which 70.4% (n=76), the first aid was administered by a health worker whereas 29.6% (n=32) by non trained lay bystanders. Patients who did not receive first aid were more likely to sustain femoral fractures associated with a severe KTS II (OR 1.231; 95% CI [1.067-2.259]; P=0.040); however there was no statistically significant association between who administered the first aid (Health worker Vs. Lay bystander) and severity of KTS II (OR 0.89; 95% CI [0.661-1.219] p=0.573).Of the 230 participants, 9.1% (n=21) reported having a pre-existing medical illness prior to the accident incident that were validated. The most commonly reported comorbidity was Hypertension followed by a combination of Hypertension and Diabetes Mellitus as shown in fig.6. There was no statistically sigificant association between pre-existing medical condition and severity of Kampala Trauma Score II (OR 0.596; 95% CI [0.228-1.562], P=0.288).

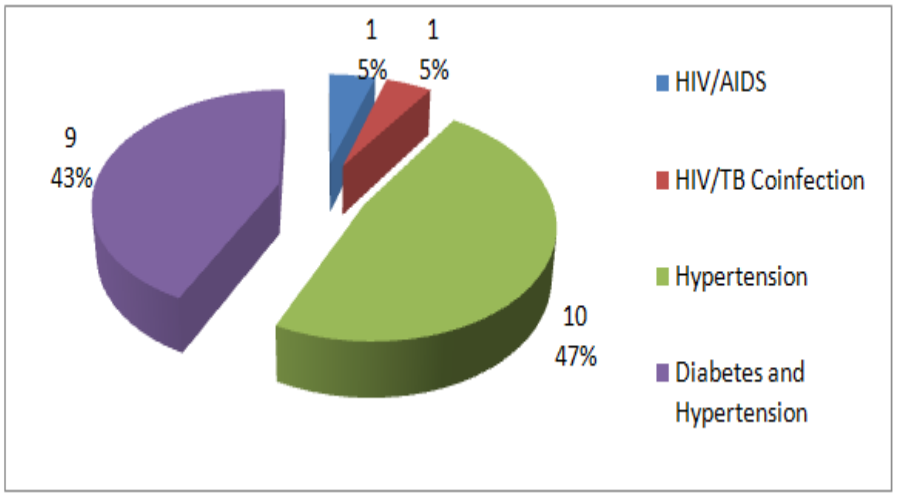

Figure 6: showing comorbidities of patients presenting with femur fracture secondary to motorcycle accidents

The immediate mortality rate within 24 hours in the present study was 3.0% (n=7). Patients with a severe KTS II were twice more likely to die compared to those with mild or moderate KTS II (OR 2.466; 95% CI [1.535-3.376]; P=0.001). The individual differences in health facilities where patients sought care (Kampala International University Teaching Hospital vs. Mbarara University Teaching Hospital) had statistically no significant effect on the odds for severity of KTS II (OR 1.101; 95% CI [0.921-2.0401]; P=0.530) and

immediate treatment outcome within 24 hours (OR 1.633; 95% CI [0.869-3.066]; P=0.126). The Kampala trauma score II was thus a good tool in predicting early morbidity and mortality in this patient category.

Table 2: Summarizing the likelihood effect of study variables on severity of Kampala Trauma Score II amongst patients with motorcycle related femur bone fractures

Likelihood Ratio Tests (95% CI)(Null hypothesis is that there is no effect of exposure variables on severity of KTS II *P<0.05 **P<0.001				
Effect of study variables on KTS II	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	329.503[a]	.000	0	.
Road user category	343.474	13.971	4	.007*
Mechanism of injury (nature of collision)	341.502	11.999	4	.017*
Prehospital Interval (≤ 1hr Vs. > 1hr)	331.190	1.687	2	.115
Mode of arrival to hospital (taxi Vs. ambulance)	334.401	4.898	2	.086
First aid status before arrival (Yes Vs. No)	344.847	15.344	2	.000**
First aid administered by health worker vs. lay	342.730	1.114	1	.573
Immediate outcome of injury in 24hours (Alive Vs. Dead)	336.973	7.470	2	.024*
Medical history (comorbidity) (present Vs. Absent)	330.035	1.127	1	.288
Hospital (KIUTH vs. MRRH)	330.771	1.268	2	.530

V. Discussion

Study findings revealed that the most commonly fractured road user was the passenger on the motorcycle 48.3% (n=111) followed by the motorcycle rider and pedestrian in that order. This is noticeably in contrast to an earlier study that evaluated knee injuries amongst road users in which motrocyclists were the most vulnerable [40]. There was an association between road user category and severity of KTS II amongst patients who sustained femoral fractures secondary to motorcycle related accidents (X^2=13.971, P=0.007, df=4). Although carrying a passenger was shown to be protective from motorcycle accidents in earlier studies outside Uganda [41], the present study shows that the most at risk for a motorcycle related femoral fractures associated with a severe KTS II was a passenger on the motorcyle (OR 1.636; 95% CI [1.261-3.417]; P=0.007). This is because its not uncommon in a Ugandan context, for a motorcycle to carry more than one passenger along with heavy laguage, particularly where the riders attempt to protect themselves from fatal accidents, "sacrificing" the hind passenger to fall off in the event of a collision. Of the 111 passengers studied, 70.3% (n=78) reported being knocked from behind of which 29.5% (n=23) had been knocked by cars. An earlier study[32] showed that sharing a motorcycle amongst passengers was an independent risk factor for motorcycle related accidents. Strong regulation on overloading and use of pritective gear for passengers could avert such catastrophic consequences.

Majority of patients 52.6% (n=121) arrived to the emergency epartments by taxi/motorcycle. Arrival by a taxi/mortorcycle was associated with higher odds for a severe KTS II compared to those who arrived by ambulances (OR 1.270; 95% CI [0.915-1.764]) Vs. (OR 0.791; 95% CI [0.595-1.052]) respectively, however this difference did not reach statistical significant (P=0.127). Due to cost of fuel implications, it is not uncommon that junior clinicians in remote Ugandan settings would refer only critically sick patients by ambulance (if available) whereas they would "just send off" those who are not critically sick to a tertiary facility using public means. Junior clinicians in Ugandan lower health facilities tend to fear attending to polytrauma patients and often refer them immediately to tertiary centres without initiating treatment, possibly in fear of litigation in the event such mortality of major trauma cases occured in lower level health facilities, yet to the authors' knowledge, there are no trained paramedics to be sent along with the ambulances in Uganda. As such standard prehospital surveillance and care may not have been executed despite arrival by ambulance. Thus in the present study, majority 75.2% (n=82) of patients who arrived by ambulance did not receive first aid compared to 21.4% (n=26) who arrived by taxi/motorcycle (OR 11.097; 95% CI [6.004-20.510]; P<0.001).Studies have shown that transfer delay does not increase in-hospital mortality among trauma patients who received basic emergency trauma rescusitation care at lower centres [42]. Designing rural trauma team development courses for junior clinicians have shown promising results in gaining self confidence regarding decision to initiate care and timely decision to transfer of emergency trauma patients to definitive tertiary centres [43].

Only 63.5% (n=109) of study participants arrived to the health facilities within one hour from the time of accident incident. The mean travel interval estimate from time of accident incident to arrival at the health facilities was 4.13 Hours (Std. Deviation 3.52 Hours). This was comparable to the 4.7 Hours reported in a Pakistanian study [42]. Arrival to the Hospital beyond one hour was not significantly associated with a severe KTS II amongst patients sustaining femoral fractures secondary to motorcycle related accidents (OR 1.448; 95% CI [0.916-2.290]; P=0.115). These findings are consistent with those of the Pakistanian study [42]. In a similar study[44], there was no association between prehospital time and outcome after adjusting for confounders, for which the author called for redefining the golden hour, although higher mortalities were reported for patients with arriving after one hour [44]. Although aggressive resuscitation averts hypothermia, hypoxia and hypotension in major trauma patients [45], a North American study found no association between emergency medical services intervals and mortality among physiologically abnormal injured patients in field settings, after control for field confounders [46]. Thus for the present study, field factors like road user category, first aid status and mechanism of injury were better predictors of a severe KTS II than arrival interval itself. A multi country study has shown that for high velocity trauma, the earlier a patient receives treatment the better the outcome [5], although there was no comparison between injury admission interval and arrival surgery interval to ascertain if the later interval is a better predictor of injury outcome. It is thus imperative to note that whereas the out of major trauma is very time dependent, it is arbitrary to apply the golden hour rule to every patient, given the unique nature of trauma presentation in remote settings with no standard prehospital care systems.

For example, whereas a patient with a gunshot injury to the femoral vessels may have golden minutes, conversely, a patient who sustains an isolated stable femoral fracture secondary to motorcycle accident may have a golden day or two [47]. A systematic review has shown that quick prehospital transportation is beneficial for patients suffering neuro and the haemodynamically unstable penetratingly injuries otherwise increased on-scene-time and total prehospital time does not increase odds for death [48]. Thus for haemodynamically stable trauma patients, emphasis should be on the type and quality of care delivered prehospital instead of rapid transportation to tertiary Centres. In the near future, Rogers et al[47] recommend that we look at the evidence-based medicine that either supports or refutes our widely held beliefs. We therefore need to design trauma care systems are patient centred and country specific in our local contexts; as it is unlikely that patients arriving by taxis or motorcycles will reach a referral trauma care Centre in one hour.

Only 47.0% (n=108) received first aid before arrival to the health facilities, of which 70.4% (n=76) received first aid from a health worker whereas 29.6% (n=32) received first aid from non trained lay bystander, who mainly included police officers, taxi drivers and motorcyclsists. Health worker administered first aid included fluids, analgesics, and temporary fracture immobilisation whereas lay person administered first aid included temporary fracture splintage using locally available materials like wood and pressure to control external bleeding. Patients who did not recieve first aid had higher odds for a severe KTS II (OR 2.106; 95% CI [1.818-2.495]; P<0.001), however there was no statistically significant association between who administered the first aid (Health worker Vs. Lay person) and severity of KTS II (OR=0.89; 95% CI [0.661-1.219]; P=0.573). This implies that all what may be necessary first aid in isolated femoral fractures is fracture splintage (immobilisation) and control of external haemorrhage. Splintage of fractures has been shown to control both haemorrhage and pain [49], alleviating discomfort and limiting further injury that could result from painful inflammatory cascade, shock, hypothermia and metabolic acidosis [50], while concurrently eliminating the need for local anaesthetic blockage of fascia iliaca compartment [51] and femoral nerves [52].

The concern for lay person's control of external haemorage is limited knowledge of the tourniquet time in a setting of prolonged prehospital arrival interval, risking compartment sysndrome and inadvertent limb loss. In a Norwegian study, bystanders gave first aid in up to 97% of trauma cases, in which they correctly protected the Airway (76%), correctly controlled external bleeding (81%), and prevented hypothermia for (62%) of patients [15]. Although the Norwegian investigators did not assess the effect of bystanders' first aid on patients' outcome, which the present study attempts to address, they noted that among the first-aid providers, 35% had some training in first aid and that bystanders with documented first-aid training gave better first aid than those whose first-aid training status was unknown [15]. Since there was no difference between health work and lay bystander administered first aid on the severity of Kampala Trauma Score II outcome, capacity building through formal training of bystanders, police officers , taxi drivers and commercial motorcyclists who are usually the first responders to trauma patients in Ugandan settings where prehospital transport time is long, could significantly improve survival of these patients. Earlier studies have shown a potential for reduction in mortality of trauma patients in which immediate lay first aid is administered [53]; [54]; [55].

Of the 230 participants, 9.1% (n=21) reported having a pre-existing medical illness prior to the accident incident. The most commonly reported comorbidity was Hypertension followed by a combination of

Hypertension and Diabetes Mellitus. Although there was no association between pre-existing cormorbidities and severity of KTS II among femoral fractured patients in the immediate post injury period (OR 0.596; 95% CI [0.228-1.562]; P=0.288), it is important for clinicians to routinely assess for these medical conditions as these not only have anaesthesia implications [56] but also significantly affect the cost of hospitalisation, length of hospital stay and the long term out come of trauma patients [57]. Hypertension could not have been a good predictor of severe KTS II in the present study since the score partly relies on systolic blood pressure and generally these patients were younger (mean age 32 years). Where Tuberculosis and HIV/AIDS are highly prevalent for example in Uganda where the prevalence of HIV is reported to be 7.5% amongst motorcyclists [58], routine screening should be performed not only for precautions of the attending trauma surgeon but also to predict cross contamination and consider HIV post exposure prophylaxis for patients sustaining open fractures.

Motorcycle to motorcycle accident was the most common mechanism of injury 51.3% (n=118), followed by motorcycle-pedestrian and motorcycle-car accident in that order. There was an association between mechanism of injury and severity of the KTS II amongst patients with femoral fractures secondary to motorcycle related accidents (X^2=11.991, P=0.017, df=4), with those involved in a high energy impact motorcycle-car crash having higher odds for a severe KTS II (OR 1.193; 95% CI [1.010-3.104], p=0.017). Motorcyclists do not turn their heads to look for vehicles when entering roads with low volume traffic and often do not comply with the stop line rule, when they approach traffic lights, thus knocking vehicles from the sides, subjecting the passenger to a motorcycle-car crash, as demonstrated in a Malaysian study [59]. Most trauma interventions do not primarily focus on motorcyclists, passengers on motorcycles and pedestrians who constitute majority of road traffic accident burden in developing countries and globally, contributing to failure in comprehensively addressing motorcyle related accident dilemma [60].

VI. Conclusion(s)

Being a passenger on a motorcycle and receiving no first aid before arrival were pre-hospital factors significantly associated with a severe Kampala Trauma Score II amongst patients sustaining femur bone fractures secondary to motorcycle related accidents. There was no association between means of arrival, prehospital arrival interval; pre-existing comorbidities and severity of Kampala Trauma Score II in this patient category.

VII. Recommendation(s)

This study has established determinants of injury severity of motorcycle related femur bone fractures in our setting. These findings are crucial to establish specific road safety measures that are affordable and applicable in resource-limited settings including road-safety education campaigns and legislative efforts to protect the passengers who are more at risk of injury severity. Such awareness campaigns targeting vulnerable groups have shown promising results in compliance with safety regulations, in Ghana [61] and Nigeria [62]and could be adapted for Uganda. Since the present study demostrates no severe injury outcome associated with lay bystanderadministered first aid, there is need to embrace this as measure to stregthen the prehospital care system in Uganda, through capacity bulding to extend it beyond pilot studies that were earlier conducted [16]; [17]. This can be made feasible by training teams of motorcyclists, taxi drivers and police officers through their professional associations, on basic life support, basic long bone fracture splintage and immobilization using locally available resources, in order to design local trauma rescue teams to minimize delay in initiating quality care for patients with femoral bone fractures secondary to motorcycle related accidents.Embracing use of data from further robust epidemiological research including valuable hospital based surveys and police accident statistics is paramount in preventive policy formulation. Future research should be prospective studies to shade light on how the current prehospital determinants of injury severity would influence long-term outcome of motorcycle related femur bone fractures.

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