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The epidemiology and characteristics of injuries to under 5's in a secondary city in Uganda: a retrospective review of hospital data

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ABSTRACT

Child injuries are largely preventable yet cause significant mortality and morbidity globally. Injury data from low-income countries is limited for children under the age of 5 and therefore the current understanding of the magnitude of injuries in this age group is low. Hospital-based registries are one mechanism by which injury data can be gathered. This paper presents findings from a retrospective hospital record review of 4 hospitals in Jinja, a rural setting in Uganda, involving the extraction of data for children under the age of 5-years who sustained an injury during a 6-month period in 2019. A total of 225 injury cases were retrieved from the hospitals. Over half (57.3%) of the events occurred among males. The majority (92%) suffered one injury per injury event. Most of the injuries occurred among those aged 13 to 24 months (32.9%). Burns (32%) and cuts (20%) were the most common cause of injury. This study presents a hospital-based analysis of injuries amongst under 5's in rural Uganda. It provides information on the characteristics of children entering healthcare facilities in Uganda and highlights the burden of paediatric injuries in the hospital setting.

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Injuries; under-5s; low and middle income countries; hospital data

Introduction

Injuries among children are largely preventable yet cause significant mortality and morbidity globally with Low and Middle-Income Countries (LMIC) facing a disproportionate share of the burden (James et al., 2018; Peden et al., 2008). Research indicates that those child injuries that are serious enough to warrant hospital treatment result in many physical, emotional and financial stresses on both the child and their family (Aitken et al., 2002; Ameratunga et al., 2009, 2010; Bartlett, 2002; Winston et al., 2002). A large proportion of injuries among under 5-year olds occur within the home environment. A combination of their curiosity to experiment and explore together with their inherent lack of ability to perceive risk makes this population extremely vulnerable to injuries (Peden et al., 2008). Risk factors and preventive measures have been identified and explored in high-income settings, but despite the higher rates of injury-related mortality among this age group in LMIC, there is very little policy or indeed research focus on this population. One of the major challenges arises from the dearth of studies from LMIC demonstrating whether or not the preventive measures studied in HIC are translatable or even feasible within LMICs.

Access to healthcare for those living in rural areas remains challenging in much of the Sub-Saharan region with geographical access, limited facilities and transportation being cited as reasons for poor uptake of care (Adugna et al., 2020; Allen et al., 2017; Kiguli et al., 2009). This combination of factors, particularly for mothers of children under the age of 5 years, has led to a reliance on more traditional and community-led sources of care instead of seeking professional care (Allen et al., 2017; Chang et al., 2019). Sources of injury data from LMICs are limited for children under the age of 5 in rural settings and as a result the current understanding of the magnitude and impact of injuries in this age group is low. Hospital-based registries are one mechanism by which injury data can be gathered and some larger cities in LMICs have implemented such systems to capture important data (de Ramirez et al., 2012; Sachdeva & Menon, 2009). These can be very effective in highlighting the burden of injuries and assessing their sequelae. One such registry was implemented in Kampala, Uganda which led to the development of the Kampala Trauma Score – a significant improvement assessing injuries and being able to predict trauma outcomes from injuries (Kobusingye & Lett, 2000). However, despite the growing number of registry based injury surveillance systems, they are very often limited to urban cities with larger tertiary hospitals. In particular, rural hospitals suffer from a lack of human and financial resources to be able to install robust surveillance systems and therefore the ability to accurately assess the burden of injuries among children is extremely challenging.

Uganda has an under-5 child mortality rate of 90 deaths per 1000 live births of which, 5% are attributed to injuries (Nambuusi et al., 2019; Willcox et al., 2018). Studies looking at home injuries among this population report that the majority are as a result of burns and falls (Batte et al.,

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2018), however, other causes including poisoning, drowning, suffocations and road traffic injuries have also been identified (Ssemugabo et al., 2018). Documenting injury characteristics such as cause, nature, location and activity at the time of injury, length of stay, and treatment received is of public health significance in designing and implementing injuries prevention programs among children under 5 years. This paper presents findings from a retrospective hospital record review of 4 hospitals in Jinja, a rural setting in Uganda. It forms part of a larger mixed-methods formative study focussing on developing evidence-based interventions in order to reduce unintentional injuries among under 5 s within the home environment in a LMIC setting.

Methods

This was a cross-sectional retrospective study that involved the extraction and analysis of hospital record data for all children under the age of 5-years who sustained an injury during a 6-month period in 2019. The study was carried out in four health facilities in Jinja, Uganda. The hospitals included were: Jinja Hospital, Mpumudde Health Centre IV, Walukuba Health Centre IV and Whispers Magical Children's Hospital. Jinja Hospital is a regional referral hospital with a bed capacity of 517. It offers specialised medical services including accident and emergency, general surgery, paediatrics, gynaecology and obstetrics, internal medicine, and various other specialties. Walukuba and Mpumudde HC IVs offer a more basic level of care with general outpatient, and inpatient services. Whispers Magical Childrens' hospital is a private health facility with a bed capacity of 30 that treats children and offers maternity services. Jinja city is located in Eastern Uganda, at the source of the Nile River, 87 km from Kampala on the Uganda – Kenya highway and has a population of over 72,900 people living in 18,936 households hence an average household size of 3.8 (UBOS., 2014).

Data were collected between January and February 2020. Nurses and/or records management personnel were identified by the local study team and trained to review hospital patient registries covering a retrospective period of six months from 1 July 2019 to 31 December 2019. All patients under the age of 5 years seen in the Accident & Emergency (A&E) and paediatric wards of Jinja Hospital and general patient registries for Mpumudde Health Centre IV, Walukuba Health Centre IV and Whispers Magical Children's Hospital were included in the study. The lack of electronic records in three of the hospitals necessitated manual searching of hand-written records. For Jinja Hospital, patient file numbers were identified and used to retrieve the patient files from the central records department within the hospital while for Mpumudde Health Centre IV, Walukuba Health Centre IV and Whispers Magical Children's Hospital, the information in the patient registries themselves was used to complete the health facility record review form as access to the full notes was not possible.

The health facility record review form was developed by the study team based on an initial review of the accessible information and indicators from preliminary scoping of records, literature on prevalence, incidence and characteristics of injuries among children (Batte et al., 2018; Mutto et al., 2011; Ssemugabo et al., 2018) and had 3 parts: 1) socio-demographic characteristics, 2) injury characteristics (location, nature, treatment, outcome of the treatment, and outcome of the injury) and 3) admission status and length of stay. The form was digitized using a secure online data management system, Open Data Kit (ODK) on electronic tablets. The health facility record review form was pretested in another hospital not included in the study - Kakira Sugar Works Hospital - and revisions were made based on feedback from the fieldworkers and research team.Five fieldworkers comprising of trained nurses and medical records personnel were trained by the study team (which included medical professionals) to retrieve the necessary information from the medical records. For quality control purposes they worked in pairs and the completed electronic forms were uploaded onto the server daily into a CSV format to enable analysis. If there was an ambiguous case or a disagreement about what constituted an injury, the two fieldworkers would discuss with each other and seek advice from the senior research team. Records which were deemed not to be injuries were excluded from the study. Senior research team members carried out additional quality checks on the uploaded data and fed back to the fieldworkers as required. Additional desirable variables such as cause of injury, intent of injury, supervision of child, other treatments sought, time off work/school etc were not recorded in the medical records and therefore could not be included. Although the larger formative study aimed to look solely at unintentional injuries among under 5 s, the inability to distinguish whether a child had been intentionally or unintentionally injured meant that for the hostpial review component *all* injuries in this age group were extracted. No identifying information was retrieved from the records except the patient ID which was used solely to link the Accident and Emergency (A&E) records with the ward medical records where required.

Data were cleaned and analysed using Stata/SE 16.0 software. Descriptive analysis was carried out and univariate data presented as frequency tables and figures. Bivariate and multivariate analyses were performed to examine associations between socio-demographic and injury characteristics, and length of hospital stay. Incidence ratios and their 95% confidence intervals were used to test for significance.

Ethical approval to conduct this study was obtained from Oxford University Institutional Review Board the Makerere University School of Public Health's Higher Degrees and Research Ethics Committee (HDREC) registration number 752 and the Uganda National Council for Science and Technology (UNCST) registration number SS 5208. Permission was sought from the hospital directors and/or in-charge and approved by their research committees to access and review their records.

Results

A total of 225 injury cases among children under 5 years were retrieved from four health facilities in Jinja. Of these, 141 were

reported from the Jinja Regional Referral Hospital, 68 from Mpumudde and Walukuba Health Centres IV and 16 from Whispers Magical Children's Hospital and Maternity (Table 1).

Patient and injury characteristics

Over half (57.3%) of the injury events abstracted occurred among males. The majority (92%) of children suffered one injury per injury event. Most of the injuries occurred among those aged between 13 to 24 months (32.9%), and 25 – 42 months (27.1%). Burns (32%) and cuts (20%) were the most common cause of injury recorded. Forty seven percent of the injuries were treated in the Outpatient Department (OPD), and almost all (96.9% of patients recovered after the treatment (Table 1).

Nature of injuries by sex

Looking at the nature of injury, it was seen that aside from bruises/superficial injuries, poisoning and dislocations, there was no significant difference between injuries sustained in boys and girls (Table 2).

Table 1. Patient and injury characteristics.

Variable	Frequency (n = 225)	Percentage (%)
Mean Age in Months (±SD)	28.1 (±15.1)	
Age group (Months)		
0 – 6	12	5.3
7 – 12	30	13.3
13 – 24	74	32.9
25 – 42	61	27.1
43 – 59	48	21.3
Treatment Unit		
OPD	106	47.1
Referred out	22	9.8
Inpatients	83	36.9
Others	14	6.2
No. of injuries		
One	207	92.0
More than one	18	8.0
Sex		
Male	129	57.3
Female	96	42.7
Nature of Injury		
Dislocation/Fracture	23	10.2
Cut, bite or another open wound	45	20.0
Bruise or superficial injury	19	8.4
Burn	72	32.0
Poisoning	11	4.9
Concussion/head injury	28	12.4
Others	27	12.0
Facility type		
Referral Hospital	141	62.7
Health Centre IV	68	30.2
Private Health Centre	16	7.1
Patient disposition at OPD		
Absconded	5	2.2
Treated within and discharged from OPD	106	46.7
Referred out	22	9.8
Admitted to ward	82	36.4
Admitted to ICU	1	0.4
Died in OPD	5	2.2
Other	4	1.8
Injury outcomes		
Recovery	218	96.9
Disability	1	0.4
Death	6	2.7

Length of stay in hospital

The average length of stay was 4.4 days with a standard deviation of 16.5 days. The maximum length of stay was 137 days with the minimum being 0 days. Most children (46.7%) did not require admission to a hospital ward.

Facility type and treatment unit had a statistically significant effect on the length of stay. While controlling for confounding variables in the model such as age, sex and nature of injury, the incidence rate ratio (IRR) for the tertiary referral hospital was 0.12 times higher than the IRR for the HCIV, while that of private hospital was 0.40 times the IRR of the HCIV. This implies that patients who were admitted to the HCIV stayed longer compared to those admitted to the regional referral hospital and private hospitals (Table 3). Regression analysis of length of stay and nature of injury showed that sustaining a cut or bite had statistically fewer days spent in the health facility ($p = 0.016$)

Discussion

This study presents a hospital-based analysis of injuries amongst under 5's in rural Uganda. It provides useful information on the characteristics of children entering healthcare facilities in Jinja, Uganda for treatment of injuries, and highlights the burden of paediatric injuries in the hospital setting.

Most of the cases were extracted from the larger regional referral hospital with only 7% from the private children's hospital. These figures are lower than expected given the incidence of injuries reported amongst this population in other studies (Batte et al., 2018). Rural access to healthcare remains a major challenge for much of Sub-Saharan Africa (Oloyede, 2017) with transportation issues, limited availability of hospitals and social determinants being cited as reasons for poor access. The Ugandan Bureau of Statistics cites that up to 48% of rural women between 15-49 years report distance-related barriers to accessing healthcare for themselves and their families (Ugandan Bureau of Statistics, 2016). The restricted access to healthcare facilities forces Ugandans, particularly in rural areas, to seek other forms of healthcare such as traditional healers, drug shops, or family members instead of seeking appropriate healthcare (Kiguli et al., 2009).

Table 2. Nature of injuries by sex.

	Male (n = 129)	Female (n = 96)
Injury Nature	n(%)	n(%)
Sprain or strain	0 (0.0)	2 (2.1)
Internal injury	3 (2.3)	0 (0.0)
Dislocation	1 (0.8)	4 (4.2)
Poisoning	8 (6.1)	4 (4.2)
Fracture (broken bone)	11 (8.4)	8 (8.3)
Bruise or superficial injury	18 (13.7)	5 (5.2)
Concussion/head injury	19 (14.5)	14 (14.6)
Cut, bite or another open wound	27 (20.6)	19 (19.8)
Burn	45 (34.4)	32 (33.3)
Other injury[a]	13 (9.5)	12 (12.2)

[a]– Electric shock; Foreign bodies in ear, eye and throat.

Table 3. Predictors of hospital length of stay for injuries among children under 5 years.

Variable	Frequency (%)	Unadjusted IRR	95% C.I	Adjusted IRR	95% C.I
Age group					
0 – 6 months	12 (5.3)	Ref			
7 – 12 months	30 (13.3)	1.92	[0.322, 11.397]		
13 – 24 months	74 (32.9)	2.97	[0.583, 15.125]		
25 – 42 months	61 (27.1)	2.41	[0.463, 12.556]		
43 – 59 months	48 (21.3)	1.30	[0.240, 7.056]		
No. of injuries					
One	207 (92.0)			Ref	
More than one	18 (8.0)	**0.22**	**[0.059, 0.839]**	0.26	[0.063, 1.094]
Sex					
Male	129 (57.3)	Ref		Ref	
Female	96 (42.7)	0.65	[0.321, 1.301]	0.57	[0.279, 1.154]
Nature of Injury					
Dislocation/Fracture	23 (10.2)	Ref		Ref	
Cut/bite/other open wound	45 (20.0)	**0.23**	**[0.654, 0.825]**	0.64	[0.178,2.315]
Bruise or superficial injury	19 (8.4)	0.25	[0.053, 1.172]	0.80	[0.154, 4.187]
Burn	72 (32.0)	1.59	[0.497, 5.083]	1.71	[0.543, 5.382]
Poisoning	11 (4.9)	0.69	[0.115, 4.141]	0.59	[0.115, 3.047]
Concussion/head injury	28 (12.4)	0.58	[0.148, 2.308]	0.83	[0.227, 3.028]
Others	27 (12.0)	0.49	[0.121, 1.950]	2.33	[0.549, 9.927]
Facility type					
HCIV	68 (30.2)	Ref		Ref	
Private HC	16 (7.1)	4.00	[0.973, 6.438]	0.40	[0.077, 2.031]
Regional Referral Hospital	141 (62.7)	1.44	[0.671, 3.070]	**0.12**	**[0.037, 0.388]**

The results indicate that only 6 patients died as a result of the injury. This relatively low number may, however, reflect the poor record taking and follow-up of patient care after they had entered the emergency room. Another factor may be that pre-hospital mortality was not recorded. Despite efforts to locate records of patients who were declared dead on arrival, the study team were unable to include such cases. Many studies from LMICs which look at paediatric trauma do not include pre-hospital mortality, yet studies from HICs suggest that pre-hospital mortality can account for up to two thirds of paediatric trauma deaths (Kristiansen et al., 2012). Emergency medical services (EMS) which encompass all aspects of care in the pre-hospital and out-of-hospital setting play a pivotal role in improving health outcomes in injured patients and yet many parts of Africa are slow to develop such systems (Mould-Millman et al., 2017). Uganda has a lack of national policy pertaining to the provision of EMS although at the time of writing, plans are underway to develop standards and guidelines. Only a small proportion (30%) of pre-hospital providers in Uganda had standard emergency vehicles with the required equipment and 70% of ambulances do not have the capacity for medical care in pre-hospital settings (Mould-Millman et al., 2017; Ningwa et al., 2020).

As shown by other studies of paediatric injuries in Uganda, the results here highlight the high burden of burn injuries among the under 5 population (Sharma et al., 2018; Ssemugabo et al., 2018; Stewart et al., 2016). A combination of unsteady locomotion and increased curiosity and exploration in this age group mean that they are more prone to burn injuries from hot stoves, paraffin lamps and hot water (Forjuoh, 2006; Olawoye et al., 2014). Only the private hospital within our sample had a specialist paediatric burn unit, however, there was only one patient who was reported to have sustained a long-term disability as a result of a burn injury in the sample. Despite this, our study highlights the need to improve burn treatment facilities and pre-hospital burn care within LMIC given the increased burden. In rural areas access to burn care facilities is minimal and affected by factors such as longer distances to travel, unavailable transport and lack of burn care facilities. Lack of knowledge about burn care, the seriousness of infections resulting from burns and the lack of necessary finances have all been cited as reasons for delayed treatment in other LMIC (Biswas et al., 2018; Hodges et al., 2007).

Previous studies indicate that within the under 5 age group, gender differences in injuries, whilst not as pronounced as in the older age groups, do exist particularly for burn and fall injuries (Bartlett, 2002; Peden et al., 2008; Sharma et al., 2018). Historically this has led to an increased focus on fall injuries amongst boys and burn injuries amongst girls within the home setting. Our study mirrors more recent reviews of injuries within sub-Saharan Africa which indicate that gender differences are not so significant particularly amongst under 5 s (Nthumba, 2016; Tupetz et al., 2020). This is perhaps indicative of the changing nature of exposure and developmental play amongst children with boys being increasingly likely to be around hot stoves and girls taking part in more exploratory play and risk-taking behaviours which may lead to more falls. This relationship between gender and injuries amongst children needs to be explored further in order to begin to tailor interventions to suit both boys and girls within rural settings and not rely on traditional approaches which have perhaps focused on boys and fall injuries or girls and burn injuries.

The study had several limitations. The lack of a formal injury surveillance system or even a formal patient register and note-taking practice within all the included hospitals made data extraction very difficult. The study team had to rely on basic emergency department and ward registers to extract information, a lengthy and difficult (to decipher doctor's handwriting) procedure. The healthcare system in Jinja is fee paying and therefore patients are required to

purchase and supply their own medical supplies which includes a notebook to permit medical note taking. This predictably meant that notes were not taken in a large proportion of cases. In addition, the medical filing system in three of the included hospitals (the general hospital and the healthcare level IV hospitals) was rudimentary at best with medical notes being haphazardly filed by date or by ward. Therefore, even if they had been present, tracing a patient entry in the hospital registers to their specific medical notes was near impossible. An initial scoping of the available registers highlighted that there were many patient entries for which critical data such as the reason for admission or age of patient was missing and therefore it is possible that there was a significant amount of under-reporting. In addition, useful variables such as cause of injury, severity of injury, and location of injury, were not reported. The team therefore had to simplify the data extraction forms and rely solely on hospital registers rather than medical notes to gather data. Improving the quality of medical care requires that patient care inputs and processes be linked to outcomes which would be extremely difficult to achieve without good documentation. Implementing the WHO Injury Register would eradicate some of these limitations and should be considered in these hospitals.

This study was limited by the quality of data available and the lack of any formal trauma registry in the hospitals in Jinja. This highlights a critical lack of trauma registries within rural settings in LMICs. Implementing and maintaining a trauma registry system, particularly one that captures paediatric cases, is costly both in terms of financial and human resources. Over the past decade, trauma registries in LMIC have begun to take hold with more novel, cost-effective solutions to implementing such data collection systems in resource-limited settings. However, numerous developmental and operational challenges still exist particularly with regards to paediatric injury registers and specific issues surrounding more severe injuries such as burn injuries (O'Reilly et al., 2012; Rosenkrantz et al., 2019). Implementing such a system where huge challenges in documentation, operational flow processes and human resources exist will be a difficult task. It remains an important issue which needs to be addressed through future studies focusing on the barriers to implementing trauma registries in such healthcare facilities and capitalising on any facilitators that may be present through incentivised interventions (Sawe et al., 2020).

The information provided by this study is critically important within the clinical setting in helping to address gaps in knowledge on the burden of injuries among under 5 s who seek medical treatment and as such can aid in redirecting resources towards age-appropriate clinical treatment and longer term rehabilitation needs of this much neglected population. The absence of an adequate triage system in many LMIC health care facilities for the paediatric population often leads to a failure in objectively determining the severity of illnesses and injuries and can lead to the wasteful use of already scarce resources. There is a need for the provision of good paediatric triage and basic emergency training at all health facilities with a focus on child injuries. Such a systematic approach, developing locally appropriate resources that address the triage, primary assessment and initial stabilisation of injured children will result in lives saved.

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Author contributions

PP helped to conceptualise the study, develop the study design including the data collection forms and contributed to manuscript preparation. CS and BE both were involved in training of the field workers, development of the digital data collection platform and aided in data analysis. OK was the local lead PI in Uganda and oversaw the study on the ground utilising her medical background to help train the fieldworkers. RI provided expert review and guidance throughout the study and helped to write the manuscript. MP was the overall study PI and conceptualised the various components of the study, reviewed the study protocols, gained ethical approvals and provided critical feedback to the study team in the analysis and write up of the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

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