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Mobile telephone follow-up assessment of postdischarge death and disability due to trauma in Cameroon: a prospective cohort study

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ABSTRACT

Objectives In Cameroon, long-term outcomes after discharge from trauma are largely unknown, limiting our ability to identify opportunities to reduce the burden of injury. In this study, we evaluated injury-related death and disability in Cameroonian trauma patients over a 6-month period after hospital discharge.

Design Prospective cohort study.

Setting Four hospitals in the Littoral and Southwest regions of Cameroon.

Participants A total of 1914 patients entered the study, 1304 were successfully contacted. Inclusion criteria were patients discharged after being treated for traumatic injury at each of four participating hospitals during a 20-month period. Those who did not possess a cellular phone or were unable to provide a phone number were excluded.

Primary and secondary outcome measures The Glasgow Outcome Scale—Extended (GOSE) was administered to trauma patients at 2 weeks, 1 month, 3 months and 6 months post discharge. Median GOSE scores for each timepoint were compared and regression analyses were performed to determine associations with death and disability.

Results Of 71 deaths recorded, 90% occurred by 2 weeks post discharge. At 6 months, 22% of patients still experienced severe disability. Median (IQR) GOSE scores at the four timepoints were 4 (3–7), 5 (4–8), 7 (4–8) and 7 (5–8), respectively, ($p<0.01$). Older age was associated with greater odds of postdischarge disability (OR: 1.23, 95% CI: 1.07 to 1.41) and mortality (OR: 2.15, 95% CI: 1.52 to 3.04), while higher education was associated with decreased odds of disability (OR: 0.65, 95% CI: 0.58 to 0.73) and mortality (OR: 0.38, 95% CI: 0.31 to 0.47). Open fractures (OR: 1.73, 95% CI: 1.38 to 2.18) and closed fractures (OR: 1.83, 95% CI: 1.42 to 2.36) were associated with greater postdischarge disability, while higher Injury Severity Score (OR: 2.44, 95% CI: 2.13 to 2.79) and neurological injuries (OR: 4.40, 95% CI: 3.25 to 5.96) were associated with greater odds of postdischarge mortality.

Conclusion Mobile follow-up data show significant morbidity and mortality, particularly for orthopaedic and neurologic injuries, up to 6 months following trauma discharge. These results highlight the need for reliable follow-up systems in Cameroon.

Strengths and limitations of this study

- This study contains one of the largest prospective follow-up cohorts for trauma patients in a lower middle-income country to date, and the first of its kind in Cameroon.
- Although the prospective nature of this study provides a longitudinal view of postdischarge outcomes and avoids the recall bias of community studies, it is limited to individuals who seek formal medical care and hospitalisation.
- By combining functional outcome data collected via mobile phone with patient and injury characteristics from our national trauma registry, we identified characteristics associated with death and disability post discharge.
- We demonstrate the feasibility of using mobile phones as a method of contacting patients for follow-up and re-engagement with medical care in settings with limited follow-up infrastructure.
- Due to the ongoing nature of the study, a larger portion of this cohort had reached the earlier follow-up timepoints compared with later timepoints when data were analysed.

INTRODUCTION

Injury accounts for about 10% of deaths around the world each year. Low-income and middle-income countries (LMICs) are disproportionately affected by trauma-related mortality, incurring over 90% of the deaths.[1] By 2030, road traffic injuries alone are predicted to be the seventh leading cause of death, rising above HIV/AIDs.[1] However, injury mortality is only a fraction of the impact; many more individuals who survive

suffer from disability due to injury and contribute to the overall burden of disease. The Global Burden of Disease Study estimates that over 237 million disability-adjusted life years are lost each year from injury, of which 40 million are years lived with disability.[2]

As defined by the WHO, 'injuries are caused by acute exposure to physical agents such as mechanical energy, heat, electricity, chemicals and ionising radiation interacting with the body in amounts or at rates that exceed the threshold of human tolerance. In some cases (eg, drowning and frostbite), injuries result from the sudden lack of essential agents such as oxygen or heat'.[3] Multiple studies in high-income countries (HICs) have used follow-up tools to characterise injury-related disability following discharge.[4–8] For example, the Functional Outcomes and Recovery after Trauma Emergencies project, a multicenter collaboration between three Boston level-one trauma centres in the USA, showed that low levels of education and income are associated with poor long-term outcomes following injury.[8] Meanwhile, injury-related disability in LMICs is poorly characterised, in part due to insufficient follow-up infrastructure for patients after hospital discharge.[9–11] As a result, characterisation of disability in LMICs largely relies on community-based surveys that are limited by their cross-sectional designs and subjective participant recall.[12] Comprehensive follow-up mechanisms are needed in LMICs to improve capacity to identify opportunities to reduce the burden of injury.[13]

In Cameroon, trauma accounts for nearly half of all emergency department visits. Moreover, patients do not routinely seek formalised medical follow-up after discharge despite having clear indications for return.[9] Pilot data from a single Cameroonian trauma centre demonstrated significant ongoing illness and disability in trauma patients 2 weeks after discharge—27% of post-discharge participants needed continued assistance with activities of daily living (ADLs).[9] For vulnerable populations that are already at increased risk for injury, delays in returning to income-generating activities can lead to significant financial instability.[1 9 14]

Cameroonian demographic statistics have shown that cellular telephones are widely used and growing in prevalence.[15] In a community-based survey in Southwest Cameroon, 95% of patients reported household ownership of a mobile phone. In a pilot mobile telephone follow-up study in Cameroon, 75% of patients who provided functional mobile phone numbers were ultimately reached for complication and disability evaluation in the pilot study.[9 16] Thus, mobile telephone post-discharge follow-up for trauma patients in Cameroon has been shown to be a feasible, effective system for re-engaging patients for return to receive formalised medical care.

In this study, we characterise trauma death and disability after hospital discharge in Cameroon using a mobile phone follow-up tool. In doing so, we seek to determine risk factors associated with death and disability during the postdischarge period and identify vulnerable groups that may require targeted early interventions or follow-up protocols.

METHODS

Setting and study design

Cameroon is a lower-middle-income Central African country with annual gross domestic product per capita of US$1533.7 (2018).[17] The country currently uses a fee-for-service healthcare system in which 70% of healthcare expenditures are accounted for by out-of-pocket spending at the point of service delivery.[18]

The present study builds on an existing hospital-based registry—the Cameroon Trauma Registry (CTR)—at four medical centres in the Littoral and Southwest regions of Cameroon, with populations of 3.3 and 1.5 million inhabitants, respectively.[19] In the Littoral region, these included Pouma Catholic Hospital; a small capacity mission hospital; Edea Regional Hospital, a medium capacity regional referral hospital; and Laquintinie Hospital, a large urban tertiary hospital. Limbe Regional Hospital is a medium capacity regional referral hospital in the Southwest region. Detailed data on patient demographics, hospital course and injury characteristics are recorded in the registry on an ongoing basis. For this study, a cohort of patients who were hospitalised for traumatic injuries in these four hospitals participating in the study were prospectively followed after being discharged.[20 21]

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Study sample

The prospective cohort in this study included all patients who were discharged after being treated for traumatic injury at each of the four participating hospitals from July 2019 to March 2021. Participation in the study required the possession of a cellular phone in the household. Those who were unable to provide a cellular phone number, either due to altered mental status without a surrogate representative available or lack of cellular phone ownership in the household, were excluded from the study.

Mobile follow-up procedure

Patient and/or surrogate contact cellular phone numbers are routinely collected in the CTR for patients presenting to the four hospitals for trauma care. Obtaining phone numbers and surrogate contacts was performed by trained research assistants who administered the survey. For patients below the age of 18, a surrogate contact number of a parent, guardian or caretaker was also obtained, if available. During the 20-month study period, trained research assistants contacted patients and/or surrogates via mobile phone at 2 weeks, 1 month, 3 months, and 6 months post-discharge for verbal informed consent

to participate in the study. Those who consented to the study were administered the Glasgow Outcome Scale—Extended (GOSE) interview at each post-discharge timepoint. At each timepoint, patients or their surrogate were contacted up to three times via phone and one time via SMS until the patient or surrogate was successfully reached. During each mobile encounter, patients or their surrogates were administered the GOSE to evaluate their level of disability. Although there was no formal process for evaluating the patient or surrogate's capacity to respond to survey questions, research assistants used their judgement as to whether patients were coherent and sufficiently oriented to complete the questionnaire. In situations where a surrogate was reached rather than the patient, the respondent was asked if they were together and could respond in conjunction. If they could not respond together, another number was requested to directly contact the patient. If the patient was unable to respond, but the surrogate contact was knowledgeable of the patient's condition, then the surrogate was administered the survey.

Study instruments

The GOSE Score is an 8-point outcomes measurement tool used to assess functional outcomes following discharge from hospitalisation due to trauma at all four timepoints following discharge.[22] Though originally developed to evaluate functional traumatic brain injury (TBI) outcomes, the score has also been shown to effectively assess disability due to bodily injury.[23] GOSE includes questions regarding survival, consciousness, independence at home (ability to perform ADLs), independence outside of home (ability to shop and travel), personality changes, ability to return to work, and ability to return to social and leisurely activities. Lower GOSE scores indicate greater disability; a GOSE Score of 1 indicates death, 2 indicates vegetative state, 3–4 indicate severe disability, 5–6 indicate moderate disability and 7–8 indicate good recovery (table 1).

The Injury Severity Score (ISS) was used in the CTR as an anatomical injury scoring system to assess the overall injury severity in patients with multiple injuries. The ISS is derived from abbreviated injuries scores (AIS), which are assigned to individual injuries across six anatomical locations (head and neck, face, extremities, chest, abdomen and pelvis) on a 6-point scale. The three anatomical locations with the highest AIS scores are squared and summed to obtain an overall 75-point ISS Score.[24] ISS scores have previously been shown to have a reliable area under the receiver operating characteristic curve across different races and genders.[25] To account for the lack of linearity in ISS scores in the study population, ISS was further categorised by mild injury (ISS 1–8), moderate injury (ISS 9–15), severe injury (ISS 16–24) and very severe injury (ISS>25), which are considered to be potentially fatal.[25]

Table 1 Glasgow Outcome Score—Extended (GOSE) breakdown[52]

GOSE	Category	Description
1	Dead	Dead
2	Vegetative state	No evidence of responsiveness
3	Lower severe disability	Requires daily assistance with ADLs, needs someone to be home
4	Upper severe disability	Requires daily assistance with ADLs, cannot shop or travel locally, can be at home alone
5	Upper moderate disability	Cannot resume normal work, school, social activities, has constant personality issues
6	Lower moderate disability	Can partially resume work, school, social activities, has frequent personality issues
7	Lower good recovery	Still has problems related to injury that affect daily life, occasional personality issues, participates in >50% of social activities
8	Upper good recovery	Full recovery or minor symptoms that do not affect daily life

ADLs, activities of daily living.

Economic clusters model

Patients were stratified by socioeconomic status (SES) using five variables: cell phone ownership, residence status (owned, rented or free residence), setting (urban or rural), agricultural land ownership and cooking fuel source (credit given to the most expensive fuel used). Patients were scored given their responses to these variables and assigned to one of two rural SES clusters: rural poor, rural wealthy; or four urban SES clusters: urban poor, urban middle class homeowners, urban middle class tenants and urban wealthy. This algorithm was previously developed, optimised and validated in the Cameroonian context using the nationally representative Demographic Health Survey Wealth Index, a process that facilitates health disparities research within LMICs through a more systematic accounting of an individual's assets.[26 27]

Data analysis

Statistical analysis and data management were performed using STATA/IC V.16.1. Patient demographic and injury data from CTR were merged with mobile follow-up data by linking data sets through CTR patient identification numbers. Median GOSE scores were calculated for each postdischarge timepoint and compared using the Kruskal-Wallis test.

Logistic regression analyses were performed to determine the association of patient and injury characteristics with postdischarge functional outcomes and mortality across all follow-up timepoints. Because the dependent variable, GOSE Score, is an ordinal categorical

variable, multivariate ordinal logistic regression analyses were performed to determine proportional ORs for a unit increase in disability. Standard multivariate logistic regression was used to determine the ORs for the binary dependent variable of mortality. In order to mitigate potential skew due to larger numbers of patients in earlier timepoints, multivariate analyses were clustered by postdischarge timepoint. Independent variables listed in table 2 with p<0.1 on univariate analysis were selected for inclusion into multivariate regression models. An alpha of 0.05 was used for significance in the multivariate models. This method of selecting variables to include in the multivariate model was used as an iterative process that avoids overfitting the regression and optimises readability and interpretation of the regression output. Additionally, variables that were selected in this process also align with published literature regarding patient and injury characteristics associated with postdischarge death and disability.[4–7 28 29] This approach was chosen over automated or stepwise processes that can often falsely highlight noise in the dataset and fit models that vary depending on the order of variables included or excluded.[30–32] ORs in the disability analysis can be interpreted as the odds of having a unit of worsening disability given a unit increase in or presence of the independent variable. ORs for mortality can be interpreted as the odds of death given a unit increase in or presence of the independent variable.

RESULTS

Patient demographics and injury characteristics

Across four sites, a total of 1914 patients were contacted for mobile phone follow-up and 1304 (68%) patients were successfully surveyed for least one follow-up timepoint. The numbers of patients included and excluded from the study are detailed in a flowchart (figure 1). Due to the ongoing nature of the study, not all patients had reached the later postdischarge timepoints when data were exported from the registry and were therefore not yet eligible for contact. Of the 1914 patients eligible for 2 week follow-up, 1090 (57%) were successfully reached. At 1 month, 812 (86%) of 946 eligible patients were successfully reached. Overall, 645 (88%) of 734 patients were reached for 3-month follow-up, and 471 (91%) of 514 patients were reached for 6-month follow-up. The cohort's median age was 32 years (IQR: 24–43) and the majority of participants were men (table 2). In terms of ISS categories, moderate injuries were most common, followed by minor injuries, severe injuries and very severe injuries. The most common injury mechanisms were road traffic injuries, followed by fall and strike injuries. Injuries occurred mostly in the extremities, followed by the face and the head and neck. For injury types, bruises or abrasions were the most common, followed by superficial lacerations and closed fractures. The largest SES cluster was comprised of urban wealthy patients.

Table 2 Demographic and injury characteristics of participants (n=1304)

Patient characteristic	n	%
Age group (years) (n=1301)		
<15	102	7.8%
15–44	888	68.3%
45–59	206	15.8%
≥60	105	8.1%
Median: 32	IQR (24–43)	
Sex (n=1302)		
Male	922	70.8%
Female	380	29.2%
Education (n=1211)		
≤Primary school	380	29.1%
≥Secondary school	831	63.7%
SES Clusters (n=1100)		
Rural poor	5	0.5%
Rural wealthy	97	8.8%
Urban poor	13	1.2%
Urban middle-class homeowner	113	10.3%
Urban middle-class tenants	354	32.2%
Urban wealthy	518	47.1%
Injury Severity Score (n=1289)		
Mild injury (ISS 0–8)	353	27.4%
Moderate injury (ISS 9–15)	475	36.9%
Severe injury (ISS 16–24)	256	19.9%
Very severe injury (ISS≥25)	205	15.9%
Injury mechanism (n=1272)		
Road traffic injury	923	72.6%
Fall	120	9.4%
Strike	97	7.6%
Stab/cut	94	7.4%
Animal bite	18	1.4%
Other*	20	1.6%
Injury location†		
Extremities	231	17.7%
Face	153	11.7%
Head and neck	92	7.1%
Chest	33	2.5%
Pelvis	12	0.9%
Abdomen	5	0.4%
Injury type†		
Bruise or abrasion	612	46.9%
Deep laceration	364	27.9%
Superficial laceration	356	27.3%
Closed fracture	353	27.1%
Hematoma	183	14.0%

Continued

Table 2 Continued

Patient characteristic	n	%
Open fracture	152	11.7%
Sprain or strain	95	7.3%
Degloving	35	2.7%
Avulsion/amputation	26	2.0%
Neurological deficit	26	2.0%
Dislocation	25	1.9%
Other*	33	2.5%
Total patients reached	1304	

% calculated over total n=1304 (multiple injury types and locations exist per individual patient).
*Injury characteristics with <1% of total n were grouped into 'Other'.
†Calculated over the total number of patients with data available for the variable category.
ISS, Injury Severity Score; SES, socioeconomic status.

Postdischarge death and disability

In total, there were 71 postdischarge deaths in our cohort with an overall mortality rate of 5.4%. The majority of total deaths (n=64, 90%) occurred by 2 weeks post discharge. A total of 17 patients were in a vegetative state at 2-week follow-up. The proportion of patients experiencing severe disability (GOSE 3–4) was 51.5% at 2 weeks, 46.8% at 1 month, and 29.6% at 3 months (figure 2). At 6 months post discharge, 22.1% of patients were still experiencing severe disability. The proportion of patients experiencing moderate disability (GOSE 5–6) was 14.1% at 2 weeks, 13.3% at 1 month, 8.8% at 3 months and 7.2% at 6 months. Meanwhile, 27.3% of patients experienced good recovery (GOSE 7–8) at 2 weeks, 39.7% at 1 month, 60.2% at 3 months and 70.3% at 6 months. Median GOSE scores were 4 (IQR: 3–7) at 2 weeks, 5 (IQR: 4–8) at 1 month, 7 (IQR: 4–8) at 3 months and 7 (IQR: 5–8) at 6 months. Median scores were significantly different among postdischarge timepoints (p<0.01).

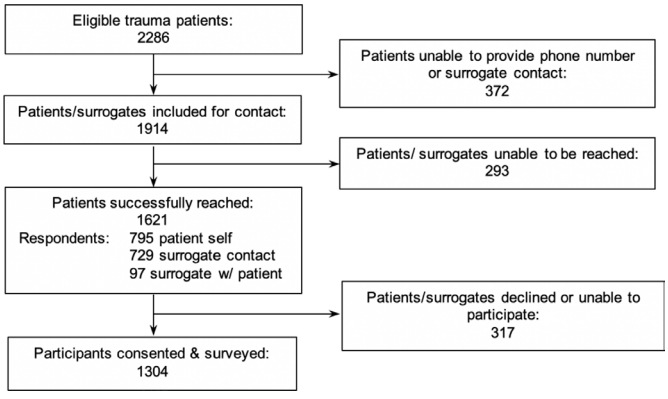

Figure 1 Flow diagram of patients included in the follow-up study.

Factors associated with death and disability

Univariate regression was performed on demographics and injury characteristics variables with GOSE Score or death as the dependent variable. On ordinal multivariate regression analysis, increased age group and female sex were significantly associated with greater odds of disability (lower GOSE Score) post discharge (table 3).

Higher education (≥secondary school) was associated with decreased odds of disability. With regard to injury mechanism, animal bites were associated with lower odds of disability. Injury types associated with greater odds of disability included closed fractures, open fractures, deep lacerations and dislocations, while bruise or abrasion injuries were associated with decreased odds of disability. With regard to location, injuries to the extremities were associated with greater odds of disability.

When looking at mortality independent of GOSE Score, standard multivariate logistic regression showed that increased age group, female sex, greater ISS category, falls and injuries resulting in neurological deficits were associated with greater odds of death post discharge (table 4). Higher education, road traffic injuries and closed fractures were associated with decreased odds of death post discharge.

DISCUSSION

Much of what we know about trauma-related disease burden in LMICs is limited to mortality, in-hospital data and condition at the time of discharge.[33–35] Studies that have looked into postdischarge death and disability have largely taken place in HICs that have substantial follow-up infrastructure.[4–7 36] In this study, we used mobile phone follow-up to shed light on the lesser-known details regarding disability due to trauma following discharge in the lower-middle-income country of Cameroon. As a crucial step in building a comprehensive, formalised follow-up system, we have scaled up efforts from our initial single-institution pilot study to include four hospitals and over 1300 patients. In our prospective cohort, we found substantial trauma-related mortality shortly following discharge from the hospital and persistent severe disability at the final endpoint of 6 months. By determining demographic and injury factors significantly associated with death and disability post discharge, we will be able to identify patients that may be particularly vulnerable in the postdischarge period and provide more targeted follow-up interventions.

We found that the median age (32 years, IQR: 24–43 years) and the male-to-female ratio (2.4:1) of our patient population closely parallels published data from large-scale trauma registries from LMICs.[37] Our cohort had substantial morbidity and mortality at 2 weeks post discharge, as 5.8% of the patients reached at 2 weeks had died while 51.8% were severely disabled and in need of assistance with ADLs. Close to 90% of total deaths occurred within the first 2 weeks post discharge, suggesting that the immediate postdischarge time period may be the most

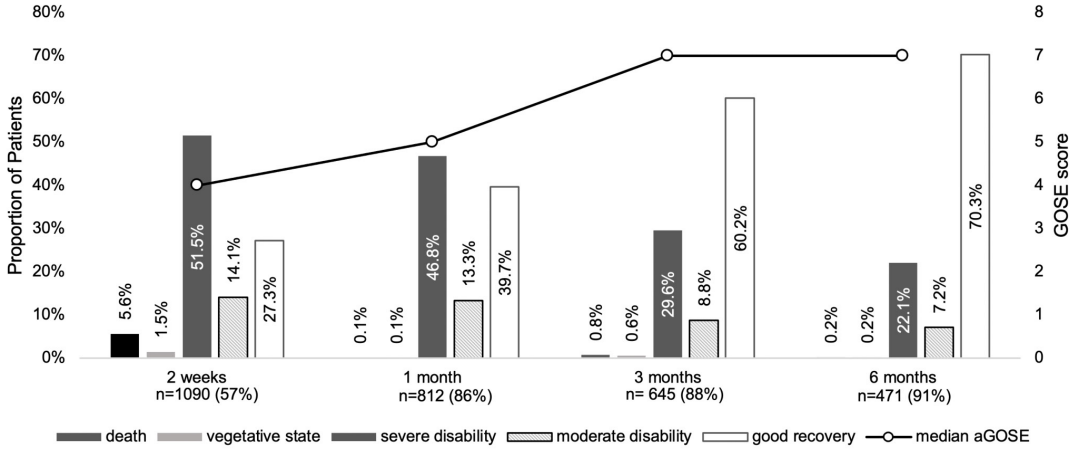

Figure 2 Distribution of death and disability ny post-discharge timepoint. GOSE, Glasgow Outcome Scale—Extended.

crucial for re-engaging patients to formal medical care. Additionally, if the large majority of injury-related deaths can be captured 2 weeks post discharge, there may be less need for extensive investment into longitudinal follow-up in future mortality studies. Patients experiencing good recovery increased with each timepoint, but only 70% of patients experienced good recovery at 6 months post discharge. Although the proportion of patients having

Table 3 Ordinal multivariate logistic regression of patient and injury characteristics associated with disability (GOSE Score) (n=1304)

Patient characteristic	OR	Std. Err.	P value	95% CI
Age group†	1.23	0.09	<0.01*	1.07 to 1.41
Female sex†	1.30	0.07	<0.01*	1.18 to 1.44
≥Secondary school education‡	0.65	0.04	<0.01*	0.58 to 0.73
Urban SES cluster	0.99	0.04	0.73	0.92 to 1.06
Injury mechanism				
Fall	1.28	0.19	0.10	0.95 to 1.71
Strike	1.08	0.09	0.33	0.92 to 1.26
Stab or cut‡	0.60	0.03	<0.01*	0.55 to 0.66
Animal bite‡	0.16	0.08	<0.01*	0.06 to 0.43
Injury location				
Extremities†	1.51	0.10	<0.01*	1.32 to 1.72
Injury type				
Bruise or abrasion‡	0.63	0.05	<0.01*	0.54 to 0.72
Sprain or strain	1.19	0.12	0.08	0.98 to 1.45
Superficial laceration	0.93	0.04	0.15	0.85 to 1.02
Deep laceration†	1.06	0.03	0.04*	1.00 to 1.12
Closed fracture†	1.83	0.24	<0.01*	1.42 to 2.36
Open fracture†	1.73	0.20	<0.01*	1.38 to 2.18
Dislocation†	1.63	0.40	0.04*	1.01 to 2.66
Degloving	1.03	0.05	0.62	0.93 to 1.13
Neurological deficit	1.11	0.15	0.43	0.85 to 1.46

Variables with p<0.1 on univariate analysis were included in the multivariate regression model presented in this table.
Reference values for independent variables are lower age group, male sex, ≤secondary school education, lower urban socioeconomic cluster or the absence of the injury characteristic, respectively.
*P<0.05.
†Significant association with OR>1.
‡Significant association with OR<1.
GOSE, Glasgow Outcome Scale—Extended; SES, socioeconomic status.

Table 4 Standard multivariate logistic regression of patient and injury characteristics for mortality (n=1304)

Patient characteristic	OR	Std. Err	P value	95% CI
Age group†	2.15	0.38	<0.01*	1.52 to 3.04
Female sex†	0.56	0.11	<0.01*	0.38 to 0.81
≥Secondary school education‡	0.38	0.04	<0.01*	0.31 to 0.47
Injury Severity Score category†	2.44	0.17	<0.01*	2.13 to 2.79
Injury mechanism				
Road traffic injury‡	0.33	0.07	<0.01*	0.21 to 0.51
Fall†	1.38	0.13	<0.01*	1.15 to 1.65
Strike	0.76	0.16	0.19	0.51 to 1.14
Injury type				
Bruise or Abrasion	0.91	0.15	0.58	0.67 to 1.25
Closed fracture‡	0.64	0.08	<0.01*	0.50 to 0.82
Avulsion or amputation	1.01	0.27	0.97	0.60 to 1.69
Neurological deficit†	4.40	0.68	<0.01*	(3.25 to 5.96

Variables with p<0.1 on univariate analysis were included in the multivariate regression model presented in this table.
Reference values for independent variables are lower age group, male sex, ≤secondary school education or the absence of the injury characteristic, respectively.
*P<0.05.
†Significant association with OR>1.
‡Significant association with OR<1.

severe disability decreased with each timepoint, 22% still experienced severe disability at 6 months. This finding closely parallels a similar, smaller scale study conducted in a low-income country, Ethiopia, where 22% of patients still had severe disability by 6 months post discharge.[28] Such a persistence of severe disability at 6 months suggests a need for more coordinated re-engagement with formal medical care to address potential complications in the postdischarge period.

Significant and persistent disability due to injuries can have substantial socioeconomic consequences for families.[38] A community-based survey of 8065 participants in Southwest Cameroon showed that 34% of households experienced severe financial hardship after injury, the greatest occurring in those who sought formal medical care.[39] Poverty is a significant consequence of seeking formal medical care in Cameroon and patients from lower SES households are especially vulnerable. In the present study, patients of lower SES comprise only a small minority of the population that sought formal medical care for trauma in our cohort (0.5% rural poor, 1.2% urban poor), presumably due to foresight of the significant financial consequences. Meanwhile, 47.1% came from the urban wealthy. We also found that even after adjusting for SES, higher education was associated with lower odds of postdischarge death and disability due to injury. The protective effect of higher education can potentially be explained by greater literacy surrounding ideal practices for enhanced recovery from injury. Additionally, there is evidence that among patients recovering from TBI, those with greater educational attainment have greater odds for disability-free recovery with a dose–response relationship.[40] Higher health literacy rates in individuals with higher education have also been shown to be associated with greater self-reported physical and mental health.[41] Such findings highlight the importance of education on health outcomes and the potential positive impact that the development of health education programmes can have on recovery from disability due to injury.

Although the large majority of patients in this cohort were male, female sex was associated with greater postdischarge disability. This association has also previously been reported in several countries,[4 5 7 29 42] although other studies have also shown males to have higher long-term disability due to injury.[23] It is likely that the association of sex with postdischarge disability is dependent on a variety of social considerations unique to the study context that are currently not clearly defined. One multi-centre study in the USA showed that women may at be greater risk for worse functional and psychological outcomes after major trauma than men.[43] Another consideration is that caregivers for disabled persons in LMICs are largely female (74%), suggesting that injured female patients may not receive adequate household support during their recovery process post discharge.[44] On the other hand, female sex was associated with decreased odds of postdischarge mortality due to injury. This finding that has been consistently replicated in past studies and attributed to the higher rates of homicide, suicide and unintentional injury among males.[45–47]

In terms of injury type, closed fractures were associated with the highest OR for postdischarge disability, followed by open fractures. These findings were expected

as orthopaedic injuries directly impair mobility, often requiring extensive follow-up and physical therapy to achieve functional improvement over a long period of time. This explanation is additionally corroborated by our finding that extremity injuries and dislocations are also associated with greater postdischarge disability. Re-engagement with formal medical care can be crucial to monitor bone healing and progress in rehabilitation.

Injuries resulting in neurological deficit had the highest OR of death with a postdischarge mortality rate of 23%, all of which occurred in the first 2 weeks. High postdischarge mortality rates due to neurological injury are well documented in HICs, and our findings also closely parallel data on postdischarge mortality due to TBI in other LMICs.[48–51] Successful management of patients with neurological injuries requires close monitoring and re-evaluation, availability of neurocritical care and neurosurgical expertise, and accessibility of neuroimaging technology. Therefore, formalised medical follow-up systems are crucial to providing neurotrauma patients with appropriate, specialised care and connections to resources for follow-up studies.

Limitations

This mobile follow-up assessment of postdischarge death and disability is made possible by near-ubiquitous use of personal or household cellular phones. However, our study likely underestimates mortality rates in our cohort because a large portion of patients provided personal cellular phone numbers, and deceased patients can no longer be reached via cellular phone. The same issue may also occur with patients in a vegetative state. However, these patients with families who still possessed the patient's cellular phone and patients who provided surrogate contacts were still captured in our dataset.

Another limitation is the decrease in patients contacted at each follow-up timepoint. This is due to the ongoing nature of the study—patients included near the end of the study period had not reached the later follow-up dates by the time the database was analysed for this study. When looking at attrition rates for patients that were more than 6 months post discharge, we found that a larger proportion of patients were successfully reached than in the more immediate postdischarge time period. However, it is also important to consider that attrition rates may be greater for patients who do not have the support of caregiver or family member surrogates, or those who lose access to mobile devices during the course of follow-up as a result of the physical or financial consequences of their injury.

Additionally, as this study represents data from four institutions in the Littoral and Southwest regions of Cameroon, it may not be generalisable to the entirety of the country. Furthermore, individuals from rural areas constitute 43.6% of the Cameroonian population, but only 9.3% of patients in our study. Although these results may not generalise to the entire socioeconomic and geographic population of Cameroon, they provide a snapshot of death and disability in patients who seek medical attention for injury in a region of Cameroon with limited follow-up infrastructure and financial resources for medical care.

Future directions

By building a mobile telephone follow-up tool on the foundations of the existing CTR, we continue to grow our cohort of follow-up patients. Traditionally, trauma registries have been limited to reporting in-hospital patient and injury data. Through mobile follow-up, we have expanded our database to include the long-term functional outcomes in our patient population. In future studies, we will also use this mobile follow-up tool to evaluate long-term economic disability in our patient cohort and understand the relationship between financial risk and care-seeking behaviours. Additionally, we have ongoing initiatives to use mobile follow-up for postdischarge trauma patients and assess their need to return to the hospital. By cross-validating mobile phone triage with in-person assessments, we plan to create a feasible, effective system to identify patients who would benefit from further medical care.

CONCLUSION

The creation of a formalised system for routine postdischarge follow-up care is ultimately critical for the reduction of injury-related death and disability in Cameroon.

Such a system must be optimised to provide accessible, formal follow-up for patients across incomes and education levels. In this study, we present large-scale, prospective cohort data regarding postdischarge death and disability due to injury in the lower-middle-income country of Cameroon. We found that mortality is the greatest within the first 2 weeks post discharge and that there is significant long-term disability remaining at 6 months post discharge. The study identified significant contributors to postdischarge death and disability including orthopaedic and neurological injuries. The data provide us with a more complete understanding of the true burden of disease due to injury and highlight opportunities for the development of systems level follow-up interventions.

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Ethics approval This study involves human participants and was approved by This study involves human participants and was approved by the University of California, Los Angeles Institutional Review Board (ID#19-000086) and the University of Buea Institutional Review Board (ID#2020/868-11/UB/SG/IRB/FHS). Participants gave informed consent to participate in the study before taking part. Verbal informed consent was obtained from all patients ab initio at the time of inclusion into the CTR. At each post-discharge timepoint, verbal informed consent was also obtained via mobile phone for all participants in this study. For minors, informed consent was obtained from a parent or guardian decision maker. Those that declined to participate in the study were excluded and no longer contacted.

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