

CELLULAR TELEPHONE FOLLOW-UP IN SOUTHWEST CAMEROON

ABSTRACT

Despite a heavy burden of disease attributable to traumatic injury in low and middle-income countries (LMIC), there is a paucity of research characterizing the epidemiology and long-term outcomes of injury. In high-income countries, traumatic injury is known to be associated with considerable long-term disability in a young, productive segment of the population, but little is known about non-mortality outcomes in LMIC. One contributing factor to this knowledge gap is the difficulty of obtaining outcomes data when patients do not return for subsequent care. A potential solution to this problem is utilization of the increasing prevalence of cellular telephones as a means of following-up on patients after injury in resource limited settings.

This study proposes to use cell phone numbers collected at the time of injury in conjunction with a recently established trauma registry to contact patients after injury 1) to evaluate the ability of cellular phone follow-up to assess need for further care after discharge and 2) to collect long term data regarding the impact of traumatic injury on functional, financial and health status on patients in Limbé Cameroon. The specific aims of this project are: 1) to assess the feasibility of cellular telephone as a short-term triage modality and a long-term epidemiologic tool in this setting; 2) to establish an understanding of the epidemiology and impact of traumatic injury on patients shortly after discharge, 6 months, and 1 year following presentation; and 3) to correlate long term outcomes with potentially modifiable predictors in the emergency room and hospital setting, thereby identifying possible targets for intervention.

This study will be conducted at Limbé Regional Hospital, a regional referral hospital serving a mixed urban/rural population where a formal trauma registry has recently been established. Cell phone data collected at presentation will be used to contact patients at 2 weeks, 6 months, and 1 year following injury. Data regarding success of phone contact and duration of interviews will be collected at each timepoint. At the 2 week timepoint, trained research assistants will contact patients living within 5 km of Limbé Regional Hospital. Patients will be asked to complete a novel brief phone survey designed to identify persons who have not recovered according to a normal post-injury trajectory and may be in need of further care. To assess the utility of the survey instrument, all patients will undergo physical exam by a licensed Cameroonian physician within 1 week of the phone interview. At the 6 months and 1 year timepoints all patients providing cellphone information will be contacted. Research assistants will administer a previously validated survey instrument designed to assess functional status in social and professional spheres, activities of daily living, health status and economic hardship. All data will be added to the existing electronic trauma database and evaluated in correlation with presenting trauma registry data including demographics, injury severity (KTS), and disposition from the emergency department. If successful, telephone contact could be established as a feasible means of following up on injured patients in a resource limited setting. This method could potentially provide detailed information about long-term death, disability and financial impact of injury, which could subsequently be used to inform decisions about resource allocation, identify vulnerable populations and potential modifiable predictors as targets for individual and systems level interventions.

SIGNIFICANCE

Trauma remains the leading cause of death and disability between the ages of 1 and 44 eclipsing ischemic heart disease, cerebrovascular diseases and HIV/AIDS [1]. Approximately 9% of the world's deaths, more than 5 million deaths annually, are due to injury. In high-income countries, where the epidemiology and outcomes of traumatic injury have been better characterized, trauma has been found to be a disease affecting young, productive members of the population and is associated with significant long-term disability [2]. Although low and middle-income countries (LMICs) bear a disproportionately great burden of the global morbidity and mortality attributable to trauma, the specific epidemiology and outcomes of injured patients in LMICs are largely unknown. The reasons for this are multifactorial, however one significant contributing factor is the difficulty of documenting follow-up in contexts where patients do not return to seek care and medical record keeping is limited [3]. Taking advantage of existing and developing technologies, such as the increasing prevalence of cellular telephone use, may provide one tool to help address this knowledge gap and obtain critical information regarding post-injury recovery and long-term outcomes following injury. If known, this data would be able to inform interventions at the trauma system level. Specifically, understanding of the burden of disease attributable to traumatic injury would provide a fundamental basis for appropriately triaging allocation of limited resources toward injury prevention and support systems. It would help to identify modifiable predictors of disability after injury as potential targets for intervention and recognize patients particularly vulnerable to poor outcomes following trauma. If validated as a feasible follow-up method, routine scheduled contact via cellular telephone could provide a means for identifying and engaging patients who may benefit from additional medical care. This study proposes to use cell phone data collected at the time of injury in conjunction with a newly established trauma registry to collect feasibility data on cell phone use as a method for short-term recovery triage and an epidemiologic tool for collecting long-term data regarding the impact of traumatic injury on functional, financial and health status in Limbé Cameroon.

BACKGROUND INFORMATION

Injury rates in sub-Saharan Africa are among the highest in the world[1]. Although it is estimated that more than 90% of global mortality due to injury occurs in LMIC and morbidity among survivors leads to considerable unemployment and disability [4-5], quality data regarding the epidemiology of injury and trauma care in sub-Saharan Africa remains extremely limited [8].

Specifically, the Republic of Cameroon is estimated to have a death rate of 101.8/100,000 persons and 4,430 Disability Adjusted Life Years (DALYs)/100,000 persons attributable to trauma [6-7]. However, these estimates are generated based on limited retrospective administrative and medical records which often lack sufficient information on potential risk factors, demographics, mechanism of injury and patient outcomes [3]. Reliance on these records for injury surveillance in this setting likely results in gross underreporting of injuries and inadequate information for injury prevention policy or trauma care quality improvement efforts.

In view of the limitations of retrospective data, a pilot trauma registry was designed to describe patterns of injury and emergency clinical trauma care at a busy tertiary center in Yaoundé, Cameroon. Over a 6-month period 2,855 injured patients presented to the Central Hospital of Yaoundé. Prospective data was collected on patient demographics, mechanism and severity of injury, disposition, and mortality in the emergency department. Traumatic injury was found to comprise nearly half of all emergency presentations, accounting for a greater than expected burden of disease. Among the demographic data collected, cell phone numbers for follow-up contact were obtained at the time of presentation, however, to date, no long-term outcome data have been collected on the initial pilot population [9].

Registry results were presented to the Ministry of Health in Cameroon, prompting the

formation of a National Injury Committee. On the basis of this pilot study a permanent trauma registry system was mandated in Yaoundé as well as 4 additional hospitals sites throughout Cameroon. These include three centers anticipated to have large burdens of road traffic injury, and an additional hospital representing a mixed urban/ and rural catchment population. Over the past 14 months, three registry sites have been fully operational including Laquintinie Hospital in Douala and Regional hospitals in Pouma and Limbé. To date, demographics, injury, and outcomes data have been collected on over 5,000 injured patients. However, one ongoing limitation of this registry is the lack of infrastructure to collect data on outcomes once patients leave the hospital.

Through this proposal, we propose to expand the scope and impact of this trauma registry by establishing cellular telephone follow-up as a feasible method for triaging post-injury recovery and obtaining data on long-term outcomes after injury. To do this we will initiate a trial of using telephone numbers collected in the emergency department to contact patients at 2 weeks, 6 months and 1 year after initial presentation. Patients who are successfully contacted at the two week timepoint, will be evaluated using a brief novel triage survey designed to identify injured persons in need of further medical intervention; the utility of this tool will be measured against physical exam by a licensed Cameroonian physician. Patients successfully contacted at the 6 month and 1 year timepoints will be asked to complete a validated survey instrument assessing multi-domain functional, health, and economic status. Feasibility and outcomes data from all timepoints will be added to the trauma registry data and conventional and machine learning statistical approaches will be used to correlate long-term outcomes with potential predictors.

HYPOTHESIS

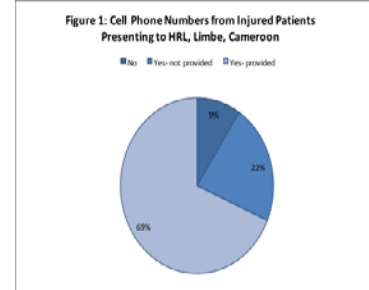
We hypothesize that 1. cellular telephone interviews are an effective and feasible mechanism for short-term recovery triage and long-term epidemiologic follow-up in the mixed urban/rural catchment region of Limbé, Cameroon and 2. corroboration with data collected at the time of injury will demonstrate that the burden of physical disability and financial hardship at 6 month and 1 year following traumatic injury is greater than previously anticipated.

PRELIMINARY DATA

Use of cellular telephones is increasingly prevalent throughout sub-Saharan Africa. According to the 2011 Cameroon Demographic and Health Survey, in the southwestern region of Cameroon, 89% of individuals in towns and urban areas and 64% of individuals in rural areas use cellular telephones [10]. It is reasonable to expect that cellular telephone use has increased further since these survey results, making telephone follow-up a promising candidate method for assessing patient outcomes in this population.

Preliminary unpublished data from the Limbé Regional Hospital trauma registry indicates that of persons presenting with injury, over 91% endorse having access to a household cellular telephone (Table 1). Exploratory analysis of patients with and without access to cellular telephones suggests that patients with cellphones do not differ statistically with regard number of serious injuries, injury mechanism, or seeking-care at non-formal settings prior to presentation compared to their counterparts without cellphone access (Figure 1). However, patients without cellular telephones did have different patterns of transport to the hospital. It will be important to continue to consider differences between

	p-value
Serious injury Number	0.282
Injury Mechanism	0.98
Intentional	0.135
Prehospital Transport	0.01
Sought Care Elsewhere	0.155
Rural	0.784
Urban	0.455



these groups throughout this study, as patients without cellphones may represent a particularly vulnerable segment of the injured population which will be excluded from outcomes analysis by this methodology. Sixty-nine percent of all patients presenting to Limbe Regional Hospital or patient surrogates were willing to provide telephone numbers for follow-up (Table 1), corroborating the potential feasibility of cellular telephone use as a follow-up method and highlighting the need for formal study.

The Glasgow Outcomes Scale- Extended (GOSE) is a metric of multi-domain functional status initially targeted for patients following neurologic trauma that since been validated in a variety of locations and broader clinical contexts, including internationally [11-12]. Specifically, the GOSE survey has been utilized as an effective instrument to assess long-term outcomes following injury via a telephone follow-up method [13].

EXPERIMENTAL PLAN

Methods and Materials

Study Design and Population

This is a prospective, observational study to be performed in conjunction with a developing trauma registry program. The proposed study will initiate a cellular telephone follow-up protocol for patients initially presenting for traumatic injury to the Limbé Regional Hospital, a 170-bed government public hospital serving a mixed urban/rural catchment region of approximately 130,000 people in the Southwest Region of Cameroon. The University of California San Francisco Committee on Human Research has previously granted institutional review board approval for the 5-site Cameroon regional trauma registry, including the Limbé site. This approved protocol specifies that cellular phone data will be collected for further use as a follow-up mechanism.

Data collection

Data will be extracted from the existing trauma registry at Limbé Regional Hospital. Information extracted will include variables pertaining to patient demographics, clinical course, injury severity, disposition, and patient cell phone numbers. Cameroonian research assistants with proficiency in English, Pidgin English, and French will undergo training in patient privacy compliance, informed consent procedures and patient interviewing. Research assistants will contact patients at 2 weeks, 6 months, and 1 year following discharge after presentation for injury. For telephone contact at all time points, attempts will be made to contact patients at a minimum of 3 times over a 1-week interval; both SMS and telephone contact will be attempted. Informed consent for telephone contact by study personnel is included in the trauma registry consent process. Additional consent for administering either the triage tool or the GOSE questionnaire on disability will also be obtained at each time of contact. All patients, including those who are not successfully contacted, will be re-contacted at the subsequent time intervals. It is anticipated that the majority of interviews will be conducted in English, Pidgin English, or French. Any patients or patient surrogates who do not speak one of these languages will be contacted by a trained translator in their native language and these conversations will be audio recorded, translated into English, and back translated for fidelity with cross-validation of survey instrument answers.

Feasibility Assessment

For all timepoints data will be collected regarding the number and method of attempts made to contact each patient, and whether or not contact is successful. Interview time at each contact point will be recorded.

Recovery Triage Instrument Validation

For reasons of study feasibility, the 2 week contact will be restricted to only those patients who provided cellular telephone numbers AND list addresses within a 5km radius of the medical center. Successfully contacted patients (or patient surrogates) at the two week

timepoint will be asked to complete a novel brief telephone survey designed to identify persons not recovering appropriately after injury. Regardless of survey results, ALL patients who receive phone interviews will be asked to return to Limbe Regional Hospital for a follow-up examination by a licensed Cameroonian physician within one week of phone contact. Patients indicating willingness to participate in the study but who are unable to return to the hospital due to financial, physical, or time restraints will be asked permission to be examined in their homes. All physician examiners will be licensed Cameroonian physicians who have completed residency in a surgical specialty. The physician examiners will be blinded to the patient's triage survey results at the time of their evaluation. Based on history and physical exam, physician examiners will be asked to render an assessment of whether they feel the patient warrants further medical evaluation or treatment. As a part of this study, patients will receive a free follow-up surgical consultation and will be provided with the physician examiners medical recommendation. Patients will be financially responsible for any further evaluation, hospitalization, or procedures that they choose to undergo on the basis of this recommendation or otherwise. If the physician examiner recommends additional evaluation or treatment, the patient will be directed to a location where those services can be obtained.

Long-term Outcomes Assessment

Research assistants will contact all patients who provided cellular telephone numbers in the emergency department at the six months and one year time points following discharge from Limbé Regional Hospital. If successfully contacted, patients or patient surrogates will be asked to participate in follow-up interviews using the previously validated GOSE survey. Information collected will include information regarding overall health status, ability to complete DALYs, functional status in social and professional settings, financial hardship following injury and need for subsequent medical care.

Statistical Analysis

Telephone Feasibility

Frequencies and proportions of successful patient contact and means, medians, and standard deviations for personnel time required to conduct interviews will be calculated to estimate the overall feasibility of cell phone interviewing as a long-term follow-up method. Descriptive and comparative analyses will be used to evaluate characteristics of contacted and unreachable groups. Continuous variables such as age, Kampala Trauma Score, etc. will be described with mean, medians, inter-quartile ranges and standard deviations. Categorical variables, such as injury type and admission status after presentation, will be described with proportions and frequencies. Fisher's exact test and chi-squared analysis, Wilcoxon-rank sum, and one way analysis of variance tests will be used to compare groups for categorical, parametric, and non-parametric parameters respectively. Logistic regression models will be constructed to test associations between independent variables including patient demographics and injury characteristics and successful contact at follow up. Separate models will be built for each timepoint (2 week, 6 month and 12 month), which will be treated as dichotomous outcomes (unsuccessful or successful).

Recovery Triage Instrument Validation

Performance of the Recovery Triage Instrument in identifying patients in need of additional medical evaluation or care will be evaluated against licensed physician exam as a gold standard. Sensitivity, specificity, positive and negative predictive value will be calculated.

Long-term Outcomes Assessment

In patients who successfully complete 6 month and 1 year follow-up interviews, frequencies and proportions of death, disability and deleterious financial impact will be calculated. In conjunction with initial trauma registry data, logistic regression models will be constructed to test the associations of independent variables and critical dichotomous outcomes

such death, disability, and economic hardship. Candidate predictors include socioeconomic status, mechanism of injury, injury severity (Kampala Trauma Score), and disposition from the emergency department. In collaboration with the biostatistics department at the University of California at Berkeley causal inference statistics and machine learning techniques will be utilized in parallel with traditional statistical approaches to identify predictors of poor outcomes after injury.

Potential limitations and pitfalls

It is possible that there will be a substantially lower proportion of patients who are accessible for follow-up via cellular telephone than would be expected according to recent socioeconomic data. Reasons for failure of contact could include dis-use of the cellular phone, relocation or death. The survey instrument will not capture non-contact attributable to death and therefore it is possible that death may be under-represented in the cohort. It is possible that persons will be unwilling or unreachable for physician exam after recovery triage follow-up. This may extend the time necessary to obtain sufficient data to understand the utility of the instrument. Additionally, as mentioned previously this study will not capture data regarding patients who fail to provide cellular telephone numbers, which may select out the most socio-economically disadvantaged or rural patient population. Regardless, the utility of cellular telephones as a follow-up tool will be evaluated and the demographics of groups that are and are not successfully contacted will be compared to identify ideal target populations and potential barriers for this modality.

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