

## **Augmenting caregiver in-home safety practices via mHealth: A randomized controlled trial**

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## Augmenting caregiver in-home safety practices via mHealth: A randomized controlled trial

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### **Abstract**

Unintentional injuries among under-fives represent an important cause of preventable morbidity in Dar es Salaam, Tanzania. In-home interventions targeting caregiver safety practices currently show promise in reducing household injury risks. Mobile health (mHealth) is emerging as a potentially cost effective platform for the delivery of critical health information in resource poor settings. The goal of this project is to introduce an mHealth intervention targeting household risk factors for child burn injuries in Dar es Salaam.

## 1 Introduction

Injuries are amongst the leading causes of premature child death globally [1] and the problem is of special importance in sub-Saharan Africa (SSA), which has the world's highest rates of unintentional injuries [2, 3]. Globally, injuries are strongly associated with **socioeconomic disparities** and **resource deprivation** within and between countries. Poverty has a compounding effect on injury circumstances in that resource deprived communities **have limited access to life saving injury treatment** and often live in hazardous locations [1-3]. Injuries often result in significant financial burdens for families who may be driven deeper into poverty by long-term medical costs or suffer a loss of income due to a disability [1, 4]. Children who are left with disfigurement from an injury, are often reluctant to return to school. Without an education these children are more likely to be unemployed as adults. Despite the preventability and importance of injuries as an impediment to healthy growth and development, comparatively little preventive work is carried out in the world's poorest regions [2]. Preventing injuries is important in minimizing a wide range of individual physical and psychological consequences as well as greater social and economic harms [1].

### 1.2 Formative research

Recent research carried out by the Centre for Injury Prevention and Community Safety (CIPCS) suggests that children under 5 years in Dar es Salaam (DES) are **particularly vulnerable** to injuries occurring in and around the home [3] and to those which are life threatening more generally [5, 6]. These younger children lack the experience and capacity to adequately respond to dangers in their environment, and their physical characteristics make them especially prone to devastating outcomes [3]. The types of risks that children are exposed to change with age. For those under five, burns and falls are of particular concern [3]. Caregivers are crucial to the safety of these children who cannot otherwise avoid harm on their own. Thus the focus of prevention should **emphasize increasing household capacity to mitigate risks in the home environment**.

### 1.3 mHealth and injury control

Mobile health or mHealth, has only recently been applied in community-based settings to augment healthcare delivery. The potential benefits of mobile technologies include: a decrease in travel expenses, enhanced continuity of care, and increased access to specialists among medically underserved populations [7]. Research on mobile information transmission in the form of email, video, short message service (SMS) and multi-media message service (MMS) demonstrates that tele-technologies can provide important adjuncts to healthcare decision-making processes. There exists emerging evidence that potentially significant reductions in the mortality and morbidity associated with trauma can be realized by deploying mobile health stations in low-income country and rural settings [8, 9].

## 2 Aim

The aim of this pilot project is to expand on prior formative work of the research group by augmenting and enhancing caregiver safety practices to minimize risks for child burns in DES households.

### 2.1 Secondary aims

- 1) Improve caregiver awareness of the importance and preventability of injuries in the home;
- 2) Increase caregiver knowledge and capacity to enact normative measures in the home environment to minimize burn injury risks to children.

## 3 Methods

This project will involve the delivery of a caregiver assistance program, inspired by community-based home visitation designs for child injury prevention in South Africa [10]. The program will be modified for delivery over a mobile multi-media messaging system (mHealth). Differences between an intervention and two control groups will be observed. Caregivers in the intervention arm (Ia) will

receive targeted information at pre-determined intervals from a central mHealth command station<sup>1</sup>. Messages will consist of short statements about mitigating burn injury risks in the home. The control groups (Ca, Cb) will receive generalized information on child health excluding injury information or other useful information such as weather information or popular topics such as upcoming events. A **randomized controlled trial** design has been selected to examine intervention efficacy (changes in home risk levels over time), changes in caregiver safety practices over time and actual changes in child injury risk at 6, 9 and 12 months. The intervention will target specific risk factors in the home environment such as: safe storage of flammable liquids, separation of cooking fires from play areas, understanding fire behavior, understanding child exploratory behavior, isolation of conductive surfaces, minimizing draft and proper fire extinguishing techniques among other targeted themes.

### 3.1 Setting and target population

Prior research from CIPCS indicates that children living in Ndugumbi, a densely populated low-income ward of 37,429 households in the district of Kinondoni, are disproportionately at risk for [burn] injuries when compared with three other densely populated low-income wards of DES [11]. Intervention and control communities will be chosen from within NDU and neighboring ward Manzese. Manzese and Ndugumbi are both separated by a major east-west highway with heavy thru traffic. The immediate beneficiaries of this project are 240 caregivers and approximately 1,000 children [11].

### 3.2 Sampling

Three hundred households will be selected from within NDU and MAN wards (150 per ward) to be assessed for eligibility. A final sample size of n=240 households will be selected for allocation into an intervention (Ia) and two control (C) groups (Ca, Cb), as is consistent with comparable studies having experimental designs in similar settings [10, 12]. A computer drawn map will assist in the identification of every 20th eligible household to reduce contamination. A prior baseline description of included households will identify if allocation into intervention and control groups is adequate in balancing the groups with respect to possible confounding socio-economic variables such as employment and level of education.

### 3.3 Eligibility

Households will be considered for inclusion if there is at least one resident child between the ages of 0 and 5 under the primary care of a biological parent. Households where the primary caregiver is a minor (<16), homes of research assistants, caregivers planning to move from the area within 9 months and those not having lived in the area for at least 9 months will not be eligible. Caregivers recruited for participation must have a working mobile phone, be familiar with the short messaging system functions of their mobile phones and able to read basic Swahili or English.

### 3.4 Measurements

An intent-to-treat analysis will be conducted for post-hoc measurements of crossover and dropout. Cox proportional hazard models will be used to generate and compare post-intervention event hazard ratios at T1, T2 and T3 (from baseline). We expect statistically significant differences of  $\geq 10\%$  in the effect estimates at T1, T2 and T3 when comparing control and intervention households. This estimate is consistent with interventions in similar settings [10]. Additional variables to be tested by time interaction (Baseline and T3) include: safety practices and household risk levels adjusting for covariates such as caregiver and child age, level of caregiver education, caregiver health and other covariates examined found to be affect the effect estimate. Independent sample t-tests will be used to establish statistically significant changes in safety practices between intervention and control groups and paired t-tests will establish the significance of changes within and between groups. Statistical significance will be indicated at  $p < .05$ .

## 4 Timeline and Framework (CIPCS-DES Child Injury Prevention Initiative)

<sup>1</sup> A mobile station consisting of a computer connected to Internet VOIP service programmed to disseminate between 36 and 48 messages of 144 characters in length over a 12 month period.

	<b>Phase 1</b>	<b>Phase 2</b>	<b>Phase 3</b>	<b>Phase 4</b>
<b>Timeline</b>	January 2009 – August 2016		June 2017 – December 2018	
<b>Aim</b>	<b>Formative work:</b> Describe child injury patterns and significant risk factors for injuries	<b>Formative work:</b> Assess potential for an intervention involving mHealth	<b>Intervention:</b> Design and implementation and process evaluation	<b>Intervention:</b> Monitoring and outcome evaluation
<b>Methods</b>	Community based epidemiological household study	Key informant and caregiver interviews	Trial	Follow-up studies and additional informant interviews
<b>Status</b>	Complete	Ongoing	Planning	Planning

#### 4.1 Project leadership

This project will be carried out under the leadership of Peercorps-CIPCS, a community-based unit of the Tanzanian non-governmental organization Peercorps Trust Fund. Peercorps-CIPCS, founded in 2009 is currently the only community-based center for injury prevention research and training in Tanzania. Peercorps-CIPCS has trained locally more than 40 community health workers in injury prevention with a focus in preventing injuries among children and adolescents and the elderly. It also has a productive research arm including work appearing in peer-reviewed journals, manuals, videos and reports for communities and local government.

#### 4.2 Ethical considerations

An application for ethical review and a research permit will be submitted to the Tanzanian Commission for Science and Technology (COSTECH).

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