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Road traffic injury incidence and crash characteristics in Dar es Salaam: A population based study

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ABSTRACT

Road traffic injuries (RTI) are a public health threat and a major source of disability in developing countries. A population-based analysis of RTIs in a testimonially high-risk area of Dar es Salaam, the largest city in the East African country of Tanzania, was carried out with the goal of establishing an RTI incidence and to identify RTI characteristics that may be used for a targeted injury prevention program in these communities.

Geographic cluster sampling was completed in 2 adjacent wards of Dar es Salaam with household surveys administered in person to determine a denominator. Any household members involved in an RTI within the previous 12 months received an in-depth questionnaire. Demographics, incident characteristics, medical attention, injuries and disability days were noted. These are described and compared to injury severity and age specific tendencies.

Within the 30 clusters, 6001 individuals were interviewed. Of them, 196 were involved in non-fatal RTIs within the previous 12 months, resulting in a non-fatal incidence rate of 32.7 RTIs per 1000 person years. There were 4 deaths noted. Injuries resulting in a fracture correlated with a disability of more than 30 days. Children were injured as pedestrians 93% of the time and were more likely to be injured on small, unpaved side streets than adults. Most RTIs occurred on a highway and affected the lower extremities, required treatment at a hospital, and resulted in a police report being filed 50.2% of the time.

In conclusion, RTIs in this urban East African setting are a major source of disability. This study provides incidence data and crash characteristics that may be used to construct prevention programs and could validate secondary data sources.

1. Introduction

Road traffic injuries (RTI) are a major public health threat and without preventative measures are projected to increase significantly worldwide over the next 20 years (Peden et al., 2004). RTIs account for the largest proportion of unintentional injuries and are increasingly recognized in low-income countries as a major cause of morbidity and mortality (Chandran et al., 2010; Peden et al., 2004, 2009). The World Health Organization (WHO) projects that RTIs worldwide will be one of the leading causes of disability adjusted life years (DALYs) in 2030 (Peden et al., 2004). Despite discouraging statistics such as these, an increase in attention and research may be able to alter the increasing rate of RTIs. For example, the safe communities' model has demonstrated an injury reduction in some studies (Spinks et al., 2005). Certainly, speed bumps and infrastructure development have also demonstrated promise, as have seatbelt and motorcycle helmet legislation (Dinh-Zarr et al., 2001; Macpherson and Macarthur, 2002; Redelmeier et al., 2003; Servadei et al., 2003; Shults et al., 2001). However, there are serious obstacles that question the feasibility of these strategies in developing countries. A lower cost option, such as childhood education, may prove a successful approach in such countries.

A tool for gathering research, such as creating a successful injury surveillance system, is needed to provide accurate data for public health interventions and prevention measures. These surveillance systems provide the numbers and types of injuries that occur as well as the circumstances of the injuries. While this information is readily available in most developed countries in the form of regionally aggregated trauma registries, its implementation requires significant investment. This high cost leaves low-income countries' surveillance systems extremely limited or non-existent. In addition, the secondary data that are available in

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Key messages
What is already known about the subject:

- Road traffic injuries are a major source of morbidity in developing countries.
- Secondary data sources are of inconsistent value.
- Children are particularly vulnerable to RTIs.

What this study adds:

- A population based RTI incidence, which can be used for comparison to other communities.
- Specific crash and injury characteristics valuable for constructing a targeted public health intervention.
- Children and adults have different crash characteristics.
- 50% of RTI victims filed a police report.

low-income countries rarely have population based data to validate them (Dandona et al., 2008).

A population-based study on injuries by Moshiro et al. (2001) found that between 1992 and 1998 transport related accidents were the leading cause of injury in Dar es Salaam, Tanzania. Despite RTIs being shown as the leading cause of injuries in Dar es Salaam, few studies have illustrated specific RTI incidence and crash characteristics (Moshiro et al., 2005). Since RTIs are a leading cause of injury, it is important to quantify the RTI incidence and understand specific crash characteristics.

Amend is a non-governmental organization with the goal of decreasing road traffic injury rates though advocacy, education, social marketing, and scientific research in Africa. Amend was responsible for funding this study, though all the authors participated on a voluntary basis. This study was conceived and designed to provide objective information for the development of an injury prevention strategy in this testimonially high-risk area of Dar es Salaam. Understanding Dar es Salaam's RTI impact and identifying specific crash characteristics is important in recognizing its subsequent impact on the community and may provide valuable information for constructing prevention measures.

2. Methods

2.1. Study setting

The study took place in the Azimio and Mtoni wards of Dar es Salaam, the largest city and commercial capital of Tanzania. The two wards are adjacent and have a single common highway bisecting them and were therefore treated as a single geographic area. This area was chosen because of testimonially high RTI rates.

2.2. Sampling strategy

A single-stage cluster sampling was used to select individuals and households for an interview. Because density statistics were not available, the study was carried out without regard for population density. This sampling strategy is used widely in low-income countries where accurate data on specific address locations is not available (Henderson et al., 1973; Henderson and Sundaresan, 1982; Kobusingye et al., 2001; Moshiro et al., 2001, 2005). In the two wards, a total of 30 global positioning satellite (GPS) points were randomly selected. By applying a grid to a satellite map of the study area and using a random number generator, coordinates on the grid were selected and converted to formal coordinates using Google Maps software (Google™, Mountain View, California). Each GPS point was termed a cluster.

Data was collected on 200 individuals closest to the actual GPS coordinates at each cluster. The sample size of 6000 individuals for the two wards combined was desired because of the following assumptions: if the incidence was taken to be 30 per 1000 person years, and we sought a 50% reduction, then in order to achieve significance with a design effect of 2.0, we would require a sample size of $n = 2670$ for 80% power and 95% confidence in a 2-tail analysis. Furthermore, a design effect coefficient of 2.0 was used, since there was no manner to quantify or estimate the intracluster variability. This value has been cited by other authors as a reasonable estimate in the absence of a pre-existing derivation (Bennett et al., 2002; Hayes and Bennett, 1999; Henderson et al., 1973; Henderson and Sundaresan, 1982).

2.3. Interview process

Research assistants were hired from the local allied health school to perform the interviews. The students were selected after undergoing an examination on the study protocol. The research assistants were taken to a specific cluster each day to collect the data. If any of the interviewed individuals reported being involved in an RTI in the previous 12 months, a 2-page questionnaire was administered in the relevant language. An individual was considered involved in an RTI if the interviewee stated that the individual had been involved in an RTI. There was no discrimination for number of disability days.

The questionnaire sought to gather the following information; demographics, circumstances of the incident, health consequences, long-term functional status, economic impact and length of disability. Information was also collected on any household members that may have died. A household member was considered any individual spending the majority of nights at a location with a primary entrance shared by the other household members over the previous 12 months. The principal investigator reviewed each completed questionnaire with the research assistants, and randomly audited 10% of the clusters to ensure accuracy.

The study was pilot tested to ensure the interview methods and questionnaire was reasonable and problem free. Minor adjustments were made to ensure the accuracy and consistency of the interview process. The project was approved by the Tanzanian Ministry of Health and Social Welfare and the National Institute of Medical Research.

2.4. Data management

The data was entered into a Statistics Program for the Social Sciences version 18.0 database (SPSS inc, Chicago, IL) by the research team. Demographics were calculated for the denominator, and an injury incidence was tabulated. Frequencies and means were calculated for categorical and continuous variables, respectively. Minor injuries were defined as those with disability days less than or equal to 30 days, and major injuries, as those with greater than 30 disability days. If an individual was still recovering from an RTI at the time of interview, the time from the RTI was used as disability days. For the purposes of analysis, children under the age of 1 were considered 1-year old.

In order to appreciate the economic impact of RTIs in this community, disability days were averaged and summed in total and for each age group without regard for severity. While recall has been found to be variable, and most accurate for minor injuries within 3 months, all injuries from the previous 12 months were included to get the broadest description of injury characteristics and circumstances (Mock et al., 1999a,b).