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Road Traffic Accidents in Uganda: Epidemiological and Transport Policy Implications

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Abstract
A recent accident in June 2004, claimed the life of the attorney general of Uganda. There is a growing concern about the rising trend in mortality and morbidity from road traffic accidents in developing countries due to their effect on health care resources and budgets. Traffic accident injuries account for high medical care costs and loss of productivity (Murray, et al., 1996). This paper first, examines traffic accident mortality and trends in injuries in Uganda. Second, it seeks to understand the spatial variations in traffic accidents from 1997 to 2002. The role of urbanization and transport changes in causing a shift in the relative importance of various sources of mortality are central to the discussion in this paper. Improvement in road conditions is often promoted, in part, as tool to improve traffic safety. The study analysis, based on Uganda data, suggests that tarmac improvements are associated with fatal accidents and that urbanization and transport policy changes are associated with increases in serious accident rates. This paper contributes to the scant literature on the epidemiology of road traffic accidents in Africa, and to the growing debate on lack of an effective transport policy in developing countries.

Keywords: Traffic accidents, Epidemiology, Uganda

Introduction
Road traffic accidents are one of the leading causes of injuries and death in both developed and developing countries, and for both women and men (Murray and Lopez, 1996; Red Cross, 1998, Nantulya and Reich, 2002). Traffic accidents are predicted to become the second leading cause of death in developing countries by the year 2020 (New Scientist, 1996); a remarkable rise from the eleventh leading cause of death in 1990. Developing countries are experiencing rapid
urbanization (Population Reference Bureau, 1997), and some of the developing areas have attracted industrial investments by multinational companies. The role of industrialization, urbanization, and transport changes (modernization) in causing a dramatic shift in the relative importance of various causes of mortality requires a careful geographical analysis.

Modernization has been accompanied by an increase in the number vehicles on the road and vehicle ownership. The relationship between vehicle ownership and accident fatalities has been of interest to researchers. In developing countries, accident fatality rates are associated with increase in vehicle ownership, and in developed countries the higher the level of vehicle ownership the lower the fatality rate (Jacobs and Fouracre, 1985; Red Cross, 1998). Traffic accident fatalities and injuries are also closely tied to demographic characteristics. Injuries are highest among the 1 to 44 years age group, and contribute a substantial percentage to long term disability -- adjusted life years (DALY) (Murray and Lopez, 1996). DALY is a measure that has been used to analyze the global burden of diseases. It uses mortality data to estimate loss of health life for populations of different world regions.

There is a growing concern about the rising trend in mortality and morbidity from road traffic accidents due to their effect on health care resources and budgets. Traffic accident injuries account for long medical care costs and loss of productivity (Murray, et al., 1996). Unfortunately, little progress has been made in road traffic prevention (WHO, 1980; TRRL, 1995). Furthermore, traffic accidents, as a major cause of mortality rates in developing countries have not been studied adequately.

This paper, first, examines traffic accident mortality and injury trends in Uganda. Second, it seeks to understand the spatial variations in traffic accidents during the 1997 - 2002 period. The period of study represents a rapid increase in traffic accident mortality in Uganda and an increase in vehicle ownership. This study is an attempt to bring to light the emerging problems of road traffic epidemiology, whose costs to governments and people in developing countries are enormous.

**Geography and Epidemiology of Traffic Accidents**

Several aspects of the road traffic accidents can be studied epidemiologically, and have a spatial component. One aspect is the relationship between demographic characteristics of the accident victims and the nature of accidents (WHO, 1975; 1980). For example, in the United Kingdom, a classic study found that 50 percent of all male deaths in the age range, 15-19, are due to motorcycle accidents (Sabey and Straught, 1975). Jacobs and Faouracre’s (1985) study found that fatality and injury rates were related to increase in ownership of two wheeled motor vehicles.
The distribution of traffic accidents can be examined geographically using the principal causes as shown in Figure 1.

There are three principal causes of accidents: (1) Human factors -- the road user or host; (2) road environment vector -- nature of the road, junctions, and surface type; and (3) vehicle agent -- design of the vehicle, and volume of traffic (TRRL, 1995; Haddon, 1972). The human factors include demographic characteristics such as age and sex, psychological factors, alcohol, and drug use. Some host characteristics can increase the risk level of accidents (Odendaal, 1976; Noordzij and Mulder, 1994). The state of health of the road user can influence the risk of injury--producing road accidents (TRRL, 1995; WHO, 1980; Haddon, 1972).

Figure 1:

PRINCIPAL CAUSES OF TRAFFIC ACCIDENTS

Adapted from Haddon, W. (1972)

Epidemiological studies done in developed and developing countries have identified four high-risk groups of road users. The first group of high-risk road users is children. Children have one of the highest fatal accident rates in both developed and developing countries. The second consists of youths between the ages of 15-25. Most male deaths in the 15-25 age group are caused by traffic accidents (Catchpole, Cairney and Macdonald, 1994). The third group of high-risk road users is pedestrians. Pedestrians have a fatal accident rate higher than the general population in both developing and developed countries. The fourth high-risk road users are cyclists. Cyclists as a group have one of the highest fatal accidents rates (Gilbert and McCarthy, 1994), especially in developing countries.
The road environment is the second principal cause of accidents. The road environment is defined as the road conditions at the time of the accidents - wet or dry, the location - junction, flat stretch, and surface conditions - tarmac, dirt, or murrum. The speed at which vehicles travel partly depends on the road environment conditions. Speed is one of the most important contributing factors to traffic accidents.

The third principal group of causes of accidents includes vehicles and traffic environment. The vehicle factor includes the following: vehicle design; seat belts and crash helmets. Traffic environment is the volume of traffic - number of vehicles, motorcycles, and pedestrians.

Vehicles and Fatalities
The relationship between vehicles and fatalities has been of interest to researchers in different disciplines. Several studies have found that in developed countries, the number of fatalities and injuries per vehicle decreases with increasing ownership (Garwood and Munden, 1968; Jacobs and Fouracre, 1985). The two-wheeled vehicles have high fatality rate per miles traveled, but the number of passengers in this category is decreasing in developed countries. Since the number of passengers in this category has decreased in developed countries, an increase in vehicle ownership has also been accompanied by a decrease in casualty rates. In developing countries, the number of passengers on two-wheeled vehicles is increasing; therefore, the increase in number of vehicles has been accompanied by an increase in fatalities and injuries (Jacobs and Fouracre, 1985).

Road Environment
Environmental conditions are important in the analysis of traffic accidents. The literature indicates that traffic accidents are common during rush hours when the volume of traffic is high, and at locations frequently traveled - hot accident spots, and accidents are associated with condition of the roads. To measure this variable, we can use the number of kilometers or roads and differences in road conditions - tarmac and murrum surface conditions.

Excessive speed has been noted as an important factor in accidents (Moore et al, 1995; Cowley, 1987). The speed at which the vehicles travel partly depends on the road conditions and the human factors. Drivers tend to drive faster on better roads. The speed data are often not available and when they are, they are based on the estimation of the police investigating the accident. We use a surrogate measure of number of tarmac miles to examine this factor.

Traffic accidents occur more often in urban areas than rural areas (Solomon, 1964). This is partly because urban areas have a higher volume of traffic, better
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Roads, and interaction is greater in urban areas than in rural areas. The level of urbanization is an important factor in the analysis of traffic accidents.

Human Factor
There is very limited data on the human factors. The statistics published usually does not include any information of the accident victims and mental and physical conditions of the drivers. In the absence of specific data on victims of accidents, district census demographic data are used. This weakness limits the number of hypotheses that can be generated for testing.

Data Source
The data used in the analysis are from the Uganda Statistical Abstract 1997-2002. The following data are used: Number of Vehicles on the Road 1997-2002; Road Accidents 1997-2002; and Annual Traffic Accident statistics by district for 1997 to 2002. The data were compiled from police reported accidents. All major accidents are reported to police but some minor ones may not be reported. Despite this weakness, the data are very close to a true representation of the traffic trends in Uganda by district.

Kalangala district is composed of a group of islands on Lake Victoria. There are no reported road accidents. There are some motorcycles on the islands but no motor vehicles. Boat accidents do occur but they are not reported in the traffic accidents data. Kalangala was not included in the analysis.

There are several weaknesses inherent in the data: (1) Accidents are not classified by location. For example, urban and rural accidents are not separated. Instead, a single figure is given for each district; (2) Characteristics of the accident victims are not provided; (3) The nature or type of accident leading to the injury or fatality is not provided; (4) Time of accident is unknown; (5) Speed data are not available; (6) Vehicle information is not available and registration of vehicles is done only at one place – Kampala.

Virtually no information is available on the relationship between speed and accidents in Uganda. This weakness is true of most countries partly due to the difficulty of obtaining data on speeds of vehicles immediately prior to collision. There is also no data on conditions of the vehicle prior to the accidents. More than 90 percent of the vehicles in Uganda are reconditioned vehicles mostly from Japan (Ministry of Economic Planning, Uganda Government, 1999). The average vehicle is more than five years old.

In the absence of some data, it is impossible to do a detailed analysis of accidents and human factors (host), and road conditions (vector). Some
surrogate measures are used in the analysis. The urban and rural classification is accommodated in the analysis by examining the relationship between accidents and the percent urban population. The speed factor is measured using the road surface variable.

The data on reported traffic accidents in countries with primate cities tend to be skewed. Two types of analysis were done to deal with this problem. One included Kampala City district and a second one excluded Kampala. The rationale for this was to find out what sets of variables are important when Kampala district (a metropolitan area) is included in the analysis and when it is excluded.

Analysis
Figures 2 and 3 show the trends of fatal accidents from 1997 to 2002. Fatalities rate per 100,000 population and per 10,000 vehicles for Uganda is relatively high when compared to developed countries. Fatality rate per vehicle declined in 1998 but slowly has been upward. The fatality rate per 100,000 population declined in 1998 but has climbed since then. The data on road traffic accidents from 1997 to 2002 show an upward trend. There has been a general increase in the number of accidents, injuries, and persons killed. The accident rate per 10,000 vehicles has risen since 1998 as shown in Figure 3. That is the exact opposite of what has happen in developed countries where increase in number of vehicle has been accompanied by decrease in accident rate per 10,000 vehicles.
Figure 2

ACCIDENT FATALITY TRENDS IN UGANDA

YEAR

Figure 3

FATALITY RATE PER POPULATION, 1997-2002

YEAR
Accidents trends are shown in Figure 4. There has been substantial increases in the accidents. Figure 5 shows the estimated number of vehicles (buses, mini buses, cars and motor Cycles) on the roads from 1997 to 2002. The number of buses (a good indicator of mass transportation) on the roads has not increased as fast as other vehicles. On the other hand, the number of mini buses has increased rapidly. This is in part due to the government policy to privatize the transport industry. Public owned corporations including transport companies have been privatized. Private mini buses called matatu (Swahili word for taxis) have replaced the buses on the roads. In the Kampala metropolitan area, mini buses provide the basic of transportation.
The change from buses to mini-buses has dramatically increased the number of mini-buses (matatus) and vehicles on the roads. The increase in number of mini buses has led to fierce competition for customers (passengers/riders). The relationship between accidents and mini buses and two-wheeled vehicles is shown in Figure 6. The $r$ squares are 0.89 and 0.82 respectively. Both relationships are significant at 0.5 level. It is generally agreed that most road traffic accidents involve mini-bus vehicles and two-wheeled vehicles. Several factors may account for this relationship: over-crowding of the matatus, speeding, and the fact that vehicles are not well maintained. Data on number of passengers and conditions of vehicles are not readily available.
Figure 6  Fatal accident rate and increase in vehicle ownership (minibuses and two wheeled vehicles) 1996 – 2002

Source: Uganda Statistical Abstract, Ministry of Planning and Economic Development

There are some regional differences in the distribution of accidents. The districts in the southern part of the country have the highest number of road traffic accidents (see Map 1). The regional variation observed in the map follows economic patterns and infrastructure development. The region most developed economically and with most roads network has the highest rate of accidents.
Fatality and serious accidents are directly associated with number of tarmac kilometers in the district (See Table 1 and 2). This finding supports the fact that accidents are higher in the most developed region of the country as shown in Map 2. Tarmac roads are most traveled by vehicles and speeding is common. Improved roadways conditions are associated with increase in fatal accidents. Why do we have more fatal accidents in those districts with more kilometers of tarmac roads?

Table 1
1999 Fatal Accidents

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<th>B</th>
<th>SE</th>
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Adjusted R Square = .6804, Standard Error = .2586, N = 46
Adjusted R Square = .8263, Standard Error = .2699, N = 47
P = .05.
Table 2

2002 Fatal Accidents

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Adjusted R Square = .6556, Standard Error = .2750, N = 52
Adjusted R Square = .8231, Standard Error = .2729, N = 53
P = .05.
* Indicates that N = 38 (Kampala District is included.)

Serious accident rates are associated with the level of urbanization of the district. Districts with highest percent urban population have the highest rate of serious accidents. This finding supports the view that traffic volume in urban areas may be an important factor in understanding the nature and distribution of road accidents. In urbanized areas there is a high volume of traffic, but the traffic speeds here do not compare with those of tarmac highways. Thus, there is a tendency to have a high number of serious accidents but relatively few fatal accidents in the most urbanized districts.

The analysis looked at the impact of the primate city development on traffic accidents. When Kampala is excluded from regression the association is not clearly defined. A human factor measured as percent of male population aged 15-49 in the district (Malper). The r squares are 0.51 and 0.93 for 1997 and 2002 respectively.

Table 3

1999 Serious Accidents

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</table>

Adjusted R Square = .5103, Standard Error = .3567, N = 46
Adjusted R Square = .9344, Standard Error = .6595, N = 47
P = .05

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The two most important variables (tarmac roads and percent urban population) in explaining fatal and serious accidents are also measures of modernization. Also the rapid rise in number of vehicles especially mini-buses has increased traffic accidents fatalities. In other words, modernization has increased mortality rates by a non-communicable cause of mortality. Are we experiencing an epidemiological transition? This question is answered in the next section.

Discussion and Conclusion

This study shows that there is an association between serious injury accidents and urbanization in Uganda. This is in part due to heavy concentration of motor vehicles in urban areas and government policy on the transport sector. The increase in vehicle ownership (especially mini-buses) is in part due to the government efforts to privatize the transport industry. Urban transportation is in the hands of the private sector as per the International Monetary Fund and World Bank requirement to privatization all sectors of the economy. Therefore, the increase in number of vehicles on the road is partly a product of a government policy and economic growth.

Unfortunately, the present volume of traffic still uses the urban road networks designed during the colonial days in the 1950s. This has created serious congestion problems during rush hours, and an inevitable increase in road accidents. The traffic police department in Uganda is probably in the same position as the physical roads; the department cannot effectively handle the traffic.

Many of the fatal and serious accidents involve the mini-buses. They are often overcrowded, go over the speed limit, and some are generally in unsafe driving conditions. The government's inability to enforce the driving law has, in part, contributed to the unsafe driving conditions in the country. The failure to
enforce the rule of law on the roads and effectively regulate the transport industry may be seen as an indirect cause on the part of the government.

There are some other actions, which have indirectly contributed to the rise in traffic accidents. Since 1989, Uganda has been rebuilding its infrastructure. In the 1980s, there was a Ugandan joke about driving and the terrible road potholes conditions. Ugandans joked that you could tell a drunk driver if you saw someone drive in a straight line. The potholes in roads prevented fast and straight lane driving. A positive aspect of these terrible road conditions is that fatal accidents were very low. Fatal accidents occur mainly on the tarmac highways. The improvement in road conditions is associated with an increase in fatal and serious accidents.

However, better (tarmac) roads alone do not lead to traffic safety. It is also probable that policies geared toward improving the economy, such as privatization of the transport industry and rapid urbanization have other unwanted consequences such as increases in road traffic accidents. The consequences of such policies should be anticipated, and improvements should be made to counter the outcomes of the policies.

Traffic accident mortality is on the rise in most developing countries. It is becoming one of the leading causes of mortality. The epidemiology of traffic accidents represents a non-communicable cause of mortality. Developing countries are experiencing a rise in mortality caused by infectious (communicable) diseases and non-communicable diseases or causes. In the urban areas, the two causes exist side by side. In Uganda, deaths are attributed to AIDS and accidents. This is a situation where the communicable and non-communicable causes act together. This may be the delayed epidemiologic transition model (Omran, 1977).

The non-communicable causes of mortality, such as accidents, are a product of driving habits. Speeding is one of the major causes (Transport and Road Research Laboratory (TRRL), 1994). The study of speed as an agent presents an interesting topic for the epidemiological study of mortality in a developing country, and a tool to examine transport policies in these countries (Odendaal, 1976; Carlson, 1990; Halafi, 1990; TRRL, 1994).

"Speed Kendezako" (Please reduce speed) is a popular song on Ugandan radio waves. The song warns the people that speed kills. Unfortunately, long distance taxi and bus drivers tend to drive faster whenever the song is played on their car radios -- ignoring the warning and message of the song. The song talks about the two of leading cause of mortality in Uganda – accidents and AIDS/HIV related causes.

The AIDS/HIV connection is found within the second interpretation of the lyrics of the song. This interpretation refers to sexual behavior and rapid
infection of HIV virus. In the second interpretation ‘speeding’ is equated with multiple sexual partners or reckless sexual behavior. The song warns that such behavior leads to AIDS and eventual death. The song advises people to practice safe sex, stay with one partner – slow down, not to speed. In this respect, speed is a metaphor for reckless sexual behavior. The second interpretation reveals the close proximity of two of the ten leading mortality causes – road traffic accidents, and HIV/AIDS related diseases.

The use of the speed metaphor to describe other reckless human behaviors can also be found among drug users’ language in North America. One of the street names for a dangerous drug in the United States is ‘speed.’ It is interesting that intravenous drug use and the sexual behavior of those with multiple partners invoke the speed metaphor. Several studies exist on the two applications of the metaphor. Epidemiological studies on intravenous drug use, sexually transmitted diseases, and HIV/AIDS are common in medical geographical literature. However, speed and traffic accidents are scanty covered in medical geography and in African research.

There is another connection between HIV/AIDS mortality and accident mortality. Both affect the most productive population (15-45) and children. These two groups bear the greatest burden. The government of Uganda has an important role to play in the road traffic epidemiologic equation. To return to the lyrics of the Ugandan popular song “Speed Kendezako” (Please reduce Speed), while the individual has a very important role in reducing the HIV/AIDS infection through reducing his/her sexual activities; the government has the most to offer in the case of traffic accident mortality and injuries. It has a responsibility to police the drivers, and to implement policies to ensure a safe transport system. The government of Uganda should increase effort in building better and wider roads. It should also review and reverse its policy on public transportation by ensuring that safe drivers and vehicles are on the roads. The drivers must drive with care – on and off the road.

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