

Socioeconomic impact of road traffic injuries in West Africa: exploratory data from Nigeria

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ABSTRACT

Background Road traffic injuries (RTIs) are increasingly contributing to the burden of disease in sub-Saharan Africa, yet little is known about the economic consequences and disability associated with them.

Objective To explore cost and disability consequences of RTIs in Nigeria.

Design A population-based survey using two-stage stratified cluster sampling.

Subject/setting Information on care-seeking choice, cost of treatment, ability to work, reduction in earnings, and disability were collected on 127 subjects who had suffered an RTI, of 3082 study subjects in seven Nigerian states.

Outcome measures Univariate analysis was used to estimate frequency of disability, types of care sought, and trends for work lost, functional ability and cost of treatment. Unadjusted bivariate analysis was performed to explore care-seeking, cost of care, and work lost among disabled and non-disabled people.

Results RTIs resulted in disability for 29.1% of subjects, while 13.5% were unable to return to work. Of the disabled people, 67.6% were unable to perform activities of daily living, 16.7% consequently lost their jobs, and 88.6% had a reduction in earnings. Private physician and hospital treatment were the most common forms of initial treatment sought, but traditional treatment was the most common second form of care sought. Average direct costs of informal and formal treatment were US \$6.65 and US\$35.64, respectively. Disabled people were more likely to seek formal care ($p=0.003$) and be unable to work ($p=0.002$).

Conclusions Economic and functional ramifications must be included in the spectrum of consequences of RTIs to fully appreciate the extent of the burden of disease, implying that health systems should not only address the clinical consequences of RTIs, but the financial ones as well.

INTRODUCTION

Road traffic injury (RTI) is a leading cause of global deaths, disproportionately affecting the developing world.¹ While sub-Saharan Africa has a fraction of the motor vehicles found in Europe and North America, mortality from RTI in Africa is among the highest in the world.^{1 2} The economic consequences of RTI have been documented in many high-income countries. In 2000, the Federal budget allocated US\$152 billion towards provision of direct healthcare services, training and disease prevention; in the USA, the total cost to society of RTI was estimated to be US\$230.6 billion in the year 2000, while injuries from road traffic crashes cost an estimated US\$146 billion.^{3 4} Although the burden of RTI in terms of incidence and mortality has been

reported in several countries in sub-Saharan Africa, data regarding both the disability and socioeconomic effects of RTI in this region remain scarce.^{5–8}

Data on disability are extremely limited in sub-Saharan Africa, except for a study from Ghana.⁹ There have been reports of varying depth on the economic effects of injury in developing countries such as Malaysia, Brazil and Ghana, but few examine the economic effect of RTI at the individual level.^{10–13} In a community-based survey carried out in Ghana, economic consequences of injury were explored in terms of direct cost of treatment, lost wages due to injury, and coping strategies used by families to compensate for the loss of work and money associated with injuries.¹² The direct economic impact (money spent on treatment) was estimated to be US\$31 per person in urban areas and US\$11 per person in rural areas, while 83% of injuries resulted in intra-family labour reallocation, about one-third resulted in loss of family income, and 5% in missed school days.

A report over 20 years ago on the economic consequences of RTI in Nigeria that focused on the cost to society used measures such as insurance company losses and damage to public structures.¹⁴ These data, collected in the 1960s, report estimates of US\$4.5 million in annual insurance losses due to RTI.¹⁴ A more recent report from 2007 focused on the cost of RTI at the household level in one geopolitical zone of Nigeria. The average hospitalised injured patient spent approximately US\$17 per day on medical treatment¹⁵; the average monthly per capita income that year was US\$77.¹⁶ Although undoubtedly valuable, information on cost treatment limited to the hospital setting probably overlooks the costs incurred by injured people who do not seek hospital care, which has been shown to be as high as 80% of some injured populations.¹⁷

Availability of information on disability and economic consequences of injury in Nigeria and sub-Saharan Africa are scarce at best. This study seeks to explore the care-seeking behaviours, cost of treatment, and consequent disability of victims of RTI in Nigeria using information gathered during a population-based survey.⁸ It is hoped that this information on the socioeconomic burden of RTI will help inform intervention decisions in Nigeria.

METHODS

A community-based survey was conducted in seven of Nigeria's 36 states and Federal Capital Territory in 2005 using an existing sampling frame, the National Integrated Survey of Households sample design, from the National Bureau of Statistics in Nigeria. The details of the survey methodology

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have been previously described elsewhere.⁸ Briefly, a two-stage stratified, cluster sampling design was used to sample households from 56 Enumeration Areas which were the primary sampling unit. Heads of households and adult household members of the 80 households sampled in each state served as survey respondents, who were interviewed by experienced research assistants from the National Bureau of Statistics. Heads of household served as proxy respondent for subjects less than 18 years of age, the legal age of adulthood in Nigeria. The survey instrument was derived from existing instruments used in similar surveys performed in Ghana and Uganda.^{5,7}

RTI was defined in the survey as physical body damage as a result of a motor vehicle crash, being hit by a motor vehicle, or other transport-related crash mechanism. A 12-month recall period was used; injuries that occurred more than 1 year before the interview date were not included in the analysis. In addition to demographic and epidemiologic data, the results of which have been reported elsewhere, questions regarding care-seeking, injury severity, disability, and cost of treatment were asked of the survey respondents.⁸ Disability was defined as having a functional status below preinjury baseline for that individual at the time of the survey, a definition used previously in West Africa.⁹ End points evaluating functional disability included disability, impairment of ability to perform activities of daily living (ADLs), and type of disability. Questions regarding economic consequences of injury were asked in terms of direct cost of treatment, ability to return to work, days of work lost, job loss, and reduction in earnings. 'Work' included both waged and unwaged labour that contributes to a household's productivity. Reduced or lost earnings included both earnings lost due to an inability to work and decreased productivity due to injury. In addition, information on the type of care sought and order of care sought for RTI was also recorded.

Once data collection was complete, data were entered into Epi-Info data-management software and then analysed using Stata version 10.0. Univariate and bivariate analysis were performed for all demographic characteristics and socioeconomic consequences explored in the survey. Cost-of-treatment data were heavily right-skewed, a common problem encountered in continuous cost data. Data were found to approximate a normal distribution when log-transformed, so means and 95% CI were calculated using log-transformed cost data. All costs were converted into US dollars using an exchange rate of 1 US\$ to 134 Nigerian Naira for 2005.

This study was conducted and approved by both the Nigerian Office of the World Health Organization and the Nigerian Ministry of Health. Anonymous, deidentified, secondary data were shared with the International Injury Research Unit, Department of International Health at Johns Hopkins University for further analysis.

RESULTS

A total of 3082 people were included in the survey, 127 of whom reported that they had sustained an RTI in the previous year. The results of the survey in terms of incidence and population-based epidemiology have been described elsewhere.⁸ Of the 127 people who had been injured in a road traffic crash, nearly one-third (37) responded that their injury resulted in a disability (table 1). The most common types of disability reported included difficulty using a hand or arm (24%) and difficulty or inability to ambulate (16%). Among those who had an RTI, 17 (13.4%) were unable to return to work. Of the 109 injured study subjects able to return to work, 21 (19.3%) had more than 1 month during which they could not work. RTI resulted in a disability that prevented

Table 1 Characteristics of injured people in terms of disability, work loss, functional ability and lost earnings

	Number	Frequency (%)
Disability (n=127)		
Yes	37	29.1
No	90	70.9
Able to return to work? (n=126)		
Yes	109	86.5
No	17	13.5
Missing	1	
Days of work lost (for those able to return to work) (n=107)*		
One day	13	12.1
2–4 days	22	20.6
5–7 days	12	11.2
1–2 weeks	23	21.5
3–4 weeks	16	15
Over 1 month	21	19.6
Missing	2	
Ability to perform ADLs (after disability, n=37)		
Able	12	32.4
Unable	25	67.6
Job loss (as a result of disability, n=36)		
Yes	6	16.7
No	30	83.3
Missing	1	
Reduction in earnings? (as a result of disability, n=35)		
Yes	31	88.6
No	4	11.4
Missing	2	

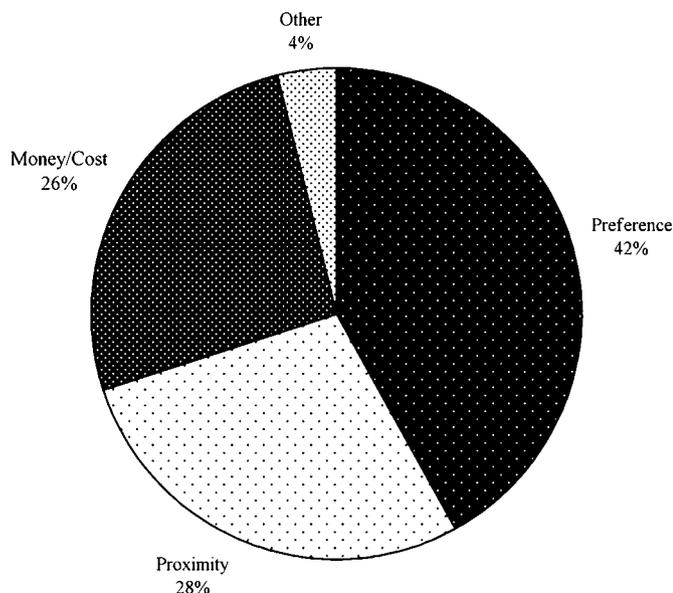
*Only those who were able to return to work were asked the question about number of days missed due to disability.
ADLs, activities of daily living.

performing ADLs for 25 (67.6%) of the study subjects who were disabled at the time of the survey. Job loss was a direct result of RTI-related disability for six (16.7%) of the disabled study subjects, while 31 (88.6%) sustained a reduction in earnings.

Formal medical care was sought by 77% of study subjects; hospital treatment and treatment by a private physician were the most common types of initial care sought (table 2). Home treatment (22%) was the next most common, followed by health post or clinic treatment (17%). Although only eight (6%) of RTI-injured people sought first-line care from bone setters, herbalists and other traditional healers, 15 study subjects sought traditional treatment after they had already first been treated in a different setting. Traditional treatment was the most common second treatment option chosen by RTI-injured people, comprising 39% of those study subjects who sought more than one treatment, and 12% of all who had an RTI. Individual preference was the most common reason for a choice of first

Table 2 Distribution of order of treatment sought by injured people

	First provider	Second provider	Third provider	Fourth provider	Total visits per type of provider
Home	28	11	3		42
Traditional treatment	8	15	1	1	25
Health post or clinic	21	4			25
Private doctor	35	2	1		38
Hospital treatment	35	6			41
Total	127	38	5	1	171

Reason for First Choice of Care (% , n=127)**Figure 1** Reason for choice of first treatment sought by injured people.

provider (42%), but proximity and cost of treatment were also often quoted (figure 1).

The average total direct cost of treatment reported was US \$25.4 (95% CI 18.78 to 34.34) (table 3). The mean direct cost of care was US\$39.40 (95% CI 21.69 to 71.56) for disabled people and US\$20.84 (95% CI 14.76 to 29.42) for non-disabled people (table 4). Although these results suggest a disparity in direct cost of treatment between disabled and non-disabled, this difference was not significant ($p=0.067$). People who were disabled as a result of their RTI were more likely to seek formal care ($p<0.003$) and more often unable to return to work ($p<0.002$) than their non-disabled counterparts (table 4). A higher proportion of disabled people paid more than the Nigerian monthly average per capita income (US\$62 per person for 2005) for treatment of their injury than non-disabled people ($p=0.019$).¹⁸

DISCUSSION

Given the scarcity of population-based data on the consequences of RTI, especially in sub-Saharan Africa, the findings of this explorative study from Nigeria are informative, both in terms of the magnitude of resultant disability and the extent of economic impact. Nearly one-third of those injured in a road traffic crash in this study suffered a disability. RTI caused frequent and repeated visits to both formal and informal healthcare providers; and the choice of providers was determined by costs, proximity and other preferences. The mean direct cost of treatment was ~US\$25 per person, which is ~40% of the mean monthly per capita income in Nigeria reported for 2005—a major burden on household expenditures. Moreover, once disabled, these victims

Table 3 Cost of treatment in 2005 dollars by treatment category

Treatment	Mean cost	95% CI*	p Value†
All informal	6.65	3.54 to 12.47	—
All formal	35.64	26.09 to 48.68	<0.0001
Total cost	25.4	18.78 to 34.34	—

*95% CIs were obtained as log-transformed data since data were not normally distributed.

†Student t test with unequal variances was used to compare mean of log-transformed cost of formal and informal care.

Table 4 Cost of care, care-seeking behaviour, and ability to work, for disabled and non-disabled respondents

	Disabled	Non-disabled	p Value*
Mean cost of care, US\$ (95% CI)†	39.40 (21.69 to 71.56)	20.84 (14.76 to 29.42)	0.067
Paid >US\$62 for care, %‡	50.0	24.4	0.019
Sought formal care, %	94.6	70.0	0.003
Unable to work, %	29.7	6.7	0.002

*p Values were calculated with the χ^2 test for dichotomous data and the t test for unequal variances with log-transformed continuous cost data.

†Data are for n=127 injured respondents except for cost data where cost data were not available for three injured respondents (n=124).

‡US\$62 is equivalent to the monthly per capita income in Nigeria in 2005 (Source: UNdata).

of RTI are unable to perform usual activities, in addition to continuing treatment costs and job losses.

Further understanding can be gained through comparison with findings in other studies from Africa, despite challenges of different methods and definitions. Two reports from Ghana deal with long-term disability⁹ and consequences of injury in terms of work lost¹²; although they differ methodologically from this study in terms of recall, categorisation of measured variables, and sample size, useful comparisons can be made. In Nigeria, the proportion of injured subjects whose RTI resulted in disability was nearly 30%; in addition, nearly 20% of all injured people lost more than 1 month of work due to RTI. In Ghana, mean disability times for injured people from urban and rural areas who had been working before their injury were 43.3 ± 61.6 days and 32.6 ± 53.5 days, respectively.¹² As was found in this study, the most common types of disability found in Ghana were in the upper and lower extremities (34% and 47%, respectively), and most sought 'modern' medical care (78%), consistent with the 77% found in this report.⁹ Ability to perform daily activities was also similar in the Ghana report and this study, with 67% of disabled people unable to perform such activities in both cases.

In this study, 88% of disabled people suffered a reduction in earnings, pointing to the potentially striking economic consequences of RTI-related disability in this context. Disabled and non-disabled people spent an average of US\$39.40 and US\$20.84 on treatment, respectively. Although categorised according to injury severity instead of disability in Ghana, the cost of treatment also falls along a spectrum of severity; minor injuries resulted in an average of US\$6 spent on treatment and 8.8 days of disability, whereas severe injuries cost an average of US\$55 to treat and led to 77.7 days of disability.¹² The only other study to report costs in Nigeria is from a large hospital in the south-western region, which reported that patients with RTI spent an average of US\$444 on their medical care for 25 days in the hospital.¹⁵ As the previous study only sampled inpatients, especially those with longer stays, the resultant estimated costs are much higher, as would be expected.

This study was powered to allow estimations of population-based incidence of RTI as part of the original objectives.⁸ The number of RTI cases captured in this survey (n=127) in the context of a population-based survey provides an opportunity to avoid the usual biases when RTIs are studied using institution-based records. The population-based context also provides information on the disability and economic ramifications of those injuries not commonly captured by other methods, namely less severe injuries that still affect the Nigerian population in terms of both money spent and work time lost. However, this survey did not allow in-depth assessment of economic costs using specific methods such as willingness to pay or consumption assessments. Moreover, all costs were reported

and not verified using any alternative sources, and are thus amenable to recall bias, as in other interview-based surveys.

Estimation of primary indirect costs and secondary indirect costs (such as earnings lost by other household members) of RTI were beyond the scope of the household survey administered in this study. Recording direct costs of illness under-represents the true cost of RTI, as indirect costs have been estimated to be 2.5–7 times that of the direct cost¹¹; using these ratios, we calculate that the true costs (both direct and indirect) of RTI in Nigeria are in the range US\$62.5–175 per person. In Ghana, the secondary indirect costs of injury included decreases in family food production and consumption, as well as intra-family work reallocation and resultant decline in family income.¹² Over 90% of rural families and 75% of urban families reported RTI-resultant labour reallocation, meaning that one or more family members ceased performing their usual activities in order to care for injured people.¹² These secondary economic effects of RTI were not captured in this study, implying that these results under-represent the true economic burden of RTI to Nigerian society.

The 1-year recall used in this study does not capture long-term disabilities, as injuries that occurred more than 1 year before the interview date were not included; this may result in some under-reporting of the longer-term consequences of RTI. In assessing long-term disability, Mock *et al*⁹ found that the mean length of time of the injury event before the interview in disabled people was 6.8±7.7 years. Alternatively, some injuries, which may not have ultimately resulted in disability, may have been included in the disability count because the RTI-injured people had not had the necessary time to recover.

A 12-month recall period was used in this study, which is subject to a 'memory decay' phenomenon, resulting in under-reporting of less serious injuries, although severe injuries are thought to be consistently reported up to 12 months.¹⁹ The effect of a potential recall bias would result in underestimation of less serious RTIs, but more serious RTIs, which were the focus of the study, would be likely to be consistently reported. One would expect the recall bias to be slightly exaggerated in instances where the household head served as a proxy for the study subject, again making less severe injuries less likely to be reported, thus resulting in an underestimation of the overall rates of RTIs and their subsequent socioeconomic consequences.

In 2006, the Nigerian Federal Road Safety Commission reported that 17390 people sustained an RTI, and 4944 people died from RTI in Nigeria. Using these figures and assuming each one of the injured spends US\$25 on their care, a minimum annual burden of US\$435 000 can be estimated for the direct costs of RTI to the Nigerian population; this does not include the costs of those injured in other years, costs to the state, and indirect costs.²⁰ This means that the health burden in terms of both people affected and lives lost, in addition to the economic burden, makes addressing RTI an imperative for Nigeria. Moreover, RTIs are not just an epidemiological or clinical issue; rather they represent a major challenge for health systems in terms of both preparing to confront their aetiology and to help pay for their consequences.

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What is already known on this subject

- ▶ Road traffic injuries are an increasing cause of death and disability in sub-Saharan Africa.
- ▶ Cost of hospital treatment and the cost to society in terms of public works due to road traffic injuries in Nigeria are significant.

What this study adds

- ▶ Road traffic injuries resulted in reported disability in one-third of respondents.
- ▶ Nearly 89% of injured respondents suffered a reduction in earnings due to their injury.
- ▶ The average total cost of treatment was US\$25 per person (95% CI 19 to 34).

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

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