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**THE INVOLVEMENT AND IMPACT OF ROAD CRASHES ON THE POOR: BANGLADESH AND INDIA CASE STUDIES**

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## Executive summary

Numerous studies carried out in recent years have indicated the high percentage of global road deaths taking place each year in the low and middle income countries of the world. These studies have also shown that the majority of fatalities involve vulnerable road users such as pedestrians and users of two and three-wheeled vehicles.

The recent international efforts surrounding WHO's 2004 World Health Day on Safe Roads including the launch of the *World report on road traffic injury prevention*<sup>1</sup>, highlighted the predicted continuing increase of road deaths in low income countries, with road crashes already a leading cause of death. Little, however, is known about the effects that fatal and serious road crashes have on low income households that, by definition, will have less resources on which to rely.

In 2000, the United Kingdom's Department for International Development funded a research study to update the road crash costing guidelines for low income countries. This study involved conducting household surveys in different locations to estimate the actual incidence as well as the economic and social impacts. Further analysis of the data collected in the two case studies, Bangladesh and Bangalore (India) has provided the basis for this report which compares the poor with the non-poor when involved in fatal and serious road crashes in urban and rural areas.

Using a random, multi-stage stratified process, over 83,000 households were surveyed in Bangladesh. This identified 203 road deaths and 536 seriously injured. This is believed to be the largest household survey ever undertaken of road casualties. A slightly different approach was taken in Bangalore. While a randomised survey was conducted in a Bangalore rural district, the urban surveys focused on a slum and an upper-middle class area. A survey of almost 20,000 households identified 83 deaths and 156 serious injuries, which were then supplemented by 156 road deaths identified by police records and 367 seriously injured found through hospital records.

Both studies relied on official definitions of poverty and used household income as the key indicator, as the information collected on household assets was unable to differentiate the poor from the non-poor. With a five year recall period for deaths, information on the pre-crash household income was unavailable and the poor were defined by the post crash household per capita income.

The report includes an estimate of the actual incidence of road death and serious injury for the poor and non-poor. Although the poor reported a higher death rate in Bangalore (both urban and rural households) and Bangladesh rural households, this was only significant in rural Bangalore, where the death rate of the poor was particularly high. However, when trip rate differences between poor and non-poor households (derived from earlier research in India) are taken into account, the poor may well be at greater risk. Conversely for serious crashes, the non-poor reported a higher injury rate in both countries, with differences being statistically significant for the Bangladesh rural areas. When results from this study are compared with published police statistics, many more people, both poor and non-poor are being killed and seriously injured in road crashes; for example, in Bangladesh the number of those killed and seriously injured was found to be 34 times higher than the official figure.

Males in the prime of life were the most common road fatality and although they were not often the head of household, they did provide the majority of the household income. Vulnerable road users accounted for the vast majority of all road deaths and serious injuries to both the poor and non-poor, with pedestrians as the most common casualty. Only in rural Bangalore did motorcyclists outnumber pedestrians in serious injuries.

The report also examines the impact that fatal and serious road crashes had on the victims' households and covered direct and indirect costs as well as the coping strategy adopted and the consequences.

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<sup>1</sup>WHO (2004). *World Report on road traffic injury prevention*. ISBN 02 4 156260 9, World Health Organisation, Geneva

Funeral and/or medical costs are reported in both monetary terms and also as a percentage of household income. In most cases the poor were found to spend a much greater proportion of their income on funeral and/or medical costs than the non-poor. Indirect costs included not only recovery days but also time spent looking for new work as the poor had less job security than the non-poor and fewer poor were able to return to their previous employment. New jobs also often meant lower salaries for the poor.

Most poor households went into debt by borrowing money to cope with the additional costs and lack of income following a road crash. Some also reduced their financial security by selling an asset while few chose or were able to take on extra work.

Consequences included reduced household income and reduced food consumption for the victim's family. For those households where the victim's pre-crash income was known, the pre-crash household income was estimated and compared to the reported post crash household income. A surprisingly large number of poor households post-crash were estimated to have not been poor before the death or serious injury, including approximately half of the rural poor households in Bangladesh and Bangalore.

While national and international priority is focused on reducing poverty, road crashes appear to be making this task more difficult as many non-poor households become poor after a road crash. In addition to the traditional calls for improved data systems and prevention efforts, priority needs to be given to helping traffic victims recover physically and their families financially. Care should be taken to minimise the consequences of those crashes not prevented, as these are expected to increase for decades to come throughout the low income countries of the world.

## List of Acronyms

BBS	Bangladesh Bureau of Statistics
DFID	Department for International Development, UK
DfT	Department for Transport, UK
GRSP	Global Road Safety Partnership
IMCH	Institute of Child and Mother Health
ITRD	International Transport Research Documentation data base
NIMHANS	National Institute for Mental Health and Neural Science
Rp	Rupee (Indian) {US\$1 = Rp 47 - average 2001}
Tk	Taka (Bangladesh) {US\$1 = Tk 57 - average 2001}
UK	United Kingdom
WHO	World Health Organisation
WB	World Bank
VRU	Vulnerable road user





# **The involvement and impact of road crashes on the poor: Bangladesh and India case studies**

## **1 Introduction**

Road crashes are known to be both a serious and growing problem for low-income countries. All known studies have also shown that, whilst road deaths are slowly decreasing in high-income countries, low income countries face a worsening situation. As infectious diseases are brought increasingly under control, road deaths and injury rise in relative importance. WHO's recent *World Report on Road Traffic Injury* estimates over one million people are killed and 15 million seriously injured each year in road crashes (WHO, 2004). The majority of these, about 85 per cent, occur in those countries that the World Bank classifies as low or middle income and where vehicle ownership levels are low by western standards (but in many cases growing very rapidly) and where much investment is being made in improving road infrastructure (Jacobs et al, 2000).

As with other technological advances, neither the benefits nor the costs of motorisation are guaranteed to be equally or fairly distributed. Clearly those who suffer the most disproportionately are the families that have had a member killed or seriously injured in a road crash. There has been concern over the vulnerability of the poor to road crashes even in high-income countries. For example, in 1995, TRL researched the social, economic and environmental factors in child pedestrian casualties, and the United Kingdom (UK) Government's Road Safety Strategy (DETR, 2000) highlighted the increased risk to children from low income families and accordingly, adopted a higher casualty reduction target for children. Reducing road casualties of children from low income households has also become a public service agreement for the UK government.

The over-involvement of the poor in road crashes is thus assumed also to exist, if not be worse, in low income countries. Impacts are a separate issue and the poor will undoubtedly fare worse as they will have fewer financial resources on which to rely. However, little work has been undertaken on the socio-economic status of victims of road crashes in low-income countries and even less is known of the impact of road crashes on the lives (and lifestyle) of victims and their families. Clearly with the emphasis that governments, aid agencies and society in general now place on poverty reduction and sustainable livelihoods, more research is needed on the impacts that road crashes have on the poor throughout the low income countries.

### **1.1 Background to the study**

Ideally a comprehensive study undertaken in a large number of countries would identify the involvement of the low-income in road crashes and provide information on the impact that these crashes have on their households. This report, however, is a small study based on the data collected in an earlier project funded by the UK Department for International Development (DFID) that produced 'Guidelines for Estimating the Cost of Road Crashes in Developing Countries' (Babtie et al., 2003). As part of estimating the costs involved, the research undertook household surveys first to estimate the number of road casualties, and at the same time, gather information on the economic and social impacts of road crashes.

Thus a great deal of information had already been collected in two countries on households of varying income levels, in urban and rural areas. This involved much more data collection work than expected and resulted in less analysis of the survey findings than desired. Accordingly, the survey data from two of the case studies (Bangladesh where over 83,000 households; and Bangalore (India) where almost 20,000 households had been interviewed) were re-analysed here to try to obtain a better understanding of the impact on the poor. The lead local counterparts from both case studies were also involved in this analysis and are co-authors of the report.

This research was necessarily constrained by the available data and the various deficiencies and differences in information collected from the two countries. Thus the conclusions may be somewhat limited and the reader should be cautious in applying them generally.

## **1.2 Objectives**

This study had three main objectives:

1. Estimate the actual incidence of road death and serious injury involving the 'poor'.
2. Assess the impacts (costs and consequences) of road crashes on poor households
3. Identify whether the 'poor' are more at risk or worse affected by road crashes than the non-poor.

## **1.3 Report structure**

Following this introduction, the report is organised into five main sections:

Section 2, Literature review:– gives a brief summary of relevant published research work related to this subject.

Section 3, Methodology:– explains the survey and sampling methodology used in the two case studies. It also clarifies how 'the poor' were defined, the other background research conducted by the local counterparts, and the statistical analysis undertaken.

Section 4, Involvement of the poor in road crashes :– reviews the findings on the incidence rates and compares them to official estimates. The road user mode, age and sex distribution, and occupation of poor and non-poor casualties are also compared. This section focuses on the primary casualty, who has been the traditional focus of road safety research.

Section 5, Impacts on households:– summarises the effects on the whole household, including the associated costs, both direct and indirect, the consequences and the coping strategy adopted. Consequences include the number of households which suffer a decrease in income following a crash and the effect on their poverty status. Key strategies include borrowing, selling an asset, taking on extra work or giving up work or study to care for the injured.

Section 6, Conclusions:– presents a summary of the findings and main recommendations

Appendix A:– includes a list of the survey variables that were analysed, while Appendix B presents the road death statistics by year of recall.

## 2 Literature review

A literature review was undertaken making use of a range of sources including the TRL link to the International Transport Research Data Base (IRTD), the DFID Transport Links research and publications web site and results of a recent World Bank (WB) appraisal of the relationship between socio-economic status and road crashes. Perhaps not surprisingly, the amount of information on the incidence of road crashes and their impact on low income households was limited.

In recent years, much publicity has been given to the over-representation of road casualties in low-income countries. The Global Road Safety Partnership (GRSP) co-funded the report 'Estimating Global Road Fatalities' that highlighted the discrepancy in low and middle-income countries where 85 per cent of the road fatalities occurred with only 40 per cent of the world's motor vehicles (Jacobs et al, 2000). This report also summarised the road user modes and age distribution of fatalities and showed the problem to be one of male pedestrians and bus passengers in the prime of life, with women and children more likely to be the bereaved and carers of the injured.

There has also been growing concern about the risk of road crashes to the poor in high-income countries. While data availability is a problem in low-income countries, evidence has been found in both the UK (Roberts and Power, 1996, Christie 1995) and Sweden (Laflamme and Engstrom, 2002), the two countries commonly believed to have the best road safety records, indicating the poor to be more likely to be involved in road crashes. A literature review of the social differences in traffic injury risks among the young included findings from New Zealand, US, UK and Canada showing the poor to be more at risk (Laflamme and Diderichsen, 2000).

In 2000, the UK Government's Road Safety Strategic Plan highlighted how the poorest children were five times more likely to die as pedestrians than the wealthiest children. Within two years, the Department for Transport (DfT) had launched the Dealing with the Disadvantaged initiative to tackle this problem. Working with education, transport, social and health services, £17.6 million has been allocated to this four year programme.

What is less well understood is the extent to which the poor in low-income countries are involved in road crashes and the impact road crashes have on their families and livelihoods. A limited number of studies have been carried out in low income countries. For example, Ghee et al (1997) analysed data from hospitalised road traffic casualties in six low-income countries and found a significant over-representation of males in the economically active age range of 16 – 45 and a commensurate under-representation of females, children and the elderly. In all countries studied, the median income of hospitalised road crash victims was found to be above the national average. The implication of this is that mid and upper income casualties are taken to hospital whilst poor people were not, assuming similar exposure to risk.

An unpublished report by W S Atkins (1998), in which road casualties in four developing countries were interviewed, found clear evidence that poorer sectors of the community were much more likely to be involved in road crashes than those who were better educated and with higher personal or household incomes. Similarly a study by Santikarn in Thailand (see Weinstein, 2003b), found that over 50 per cent of road injuries were either labourers or students.

In 1999, DFID commissioned TRL to carry out a study on Transport Safety and the Poor and this documented the lack of information available on the impact of road crashes on the poor sectors of society (Jacobs et al, 1999). DFID subsequently funded a scoping study and the previously mentioned full research study on road crash costing in low income countries (Babtie et al, 2003). The impact of road crashes on the poor was a key issue to be explored and the final report recommended the human costs component be inflated to reflect the social priority of reducing poverty.

The WB has also sought to understand the impact of road crashes on the poor. In 2000, the WB held a Transport and Poverty Conference that also acknowledged that little work had been done to determine the impact of road crashes on the poorest sectors of communities (Booth et al, 2000). An unpublished analysis of demographic, health and crash data from Cambodia by the WB indicated that casualties increase with income. However the author makes the point that the population in the richest quintile is little better off than those in the poorer quintiles and the result almost certainly reflects greater access to vehicles and increased mobility. The size of the study also limited its findings as the survey of 12,000 households only identified six fatalities and 174 injuries (Weinstein 2003a). The WB has also undertaken a literature review on the impact of road crashes and the poor (Weinstein, 2003b).

While the initial focus was on road crash involvement and primary casualties only, there has been growing appreciation that the loss of a breadwinner affects the whole household. The International Federation of Red Cross and Red Crescent Societies highlighted the knock-on effects of road crashes with an average of 25 years of working life lost to a family by a road death (1998, IFRC). Mock et al (2003) documented the economic consequences and coping strategies adopted by bereaved and injured families in Ghana. Mock also highlighted earlier findings by Pryer (1989) that emphasised the connection between the health of breadwinners and the nutritional status of children, thus indicating the need for health programmes to cover all household members, with Mock's own research showing a decrease in household food consumption following a road crash.

Hijar et al (2004) analysed road traffic injuries in Mexico using interviews conducted in hospitals and found that over one third of those injured had limited education. Of those injured, pedestrians had the highest medical costs with over 80 per cent having to meet their own out of pocket costs. Road crash victims were usually poor, unlikely to have health insurance and were often the head of the household and thus the main providers. Similarly Le Linh et al (2002) analysed injury data in Vietnam and found that almost 50 per cent of those injured were the primary income source of their households and that 93 per cent of those households had less than a US \$ 130 monthly income. These findings were presented at a conference in Massachusetts on the Health Equity of Road Traffic Injuries in 2001.

With a greater understanding of the knock-on effects of road crashes has come concern over the household's ability to recover financially. The role of the motor insurance industry in both preventing and compensating road casualties was the subject of a recent DFID funded scoping study (Aeron-Thomas, 2002). Lack of compensation for road traffic casualties in low income countries was highlighted as a key problem. The study summarised efforts being made in some countries to combat this problem, including third party injury insurance being collected through fuel levies. 'Strict' or 'driver liability' policies, whereby drivers are held responsible for crashes involving pedestrians and cyclists (some countries restrict this to children and elderly VRU's), were also discussed. This policy exists in India and was recently introduced in China, where according to newspaper reports, 109,000 people were killed in road crashes in 2002 (Zhiming, 2003). After much discussion, China adopted the 'doctrine of liability for wrongs' that holds drivers responsible for all crashes involving pedestrians except for any crash that was caused intentionally by the pedestrian.

In Uganda, the Traffic and Road Safety Act of 1998 allows for up to half of any traffic fine imposed to be shared with the victim, although this rarely happens in practice. Several high income countries already impose a victim surcharge on motoring offences which is dedicated to support services for victims while others allocate part of the traffic fine revenue to rehabilitation programmes (e.g. Australia).

A different perspective has also been highlighted in recent years. This is that in addition to financial and medical assistance, families (and society) also need to see that justice is done by the proper investigation of collisions and the punishment of culpable drivers. DFID introduced their Safety, Security and Accessible Justice (SSAJ) programme after participatory poverty assessments showed that poor people themselves viewed justice as a priority need (DFID, 2000, Anderson, 2002). The DFID-funded scoping study on Community Traffic Policing highlighted examples of justice-related impoverishment for road casualties that included the following:

- With traffic police focused on maintaining vehicle flows, the poor suffer from a lack of priority given to protecting pedestrians from injury from motor vehicles.
- Investigation of road collisions is not a police priority with most being accepted as accidents and not criminal acts.
- The threat of corruption discourages the poor from reporting collisions to the police as the legal process can postpone compensation for years and the poor may have to share their compensation with the agents of the state.
- The poor will seek to settle compensation privately, with victims accepting low but timely settlement offers.
- Lack of confidence in the justice system leads to lawlessness, including the threat of mob justice with drivers being beaten and vehicles burned after a crash (Aeron-Thomas, 2003).

From the above it can be seen that relatively few detailed studies have been undertaken in low income countries of the incidence of road crashes amongst different income groups and the impact that these crashes have on low income households. Even less priority has been given to documenting how this burden can be alleviated. A full list of references from both the literature review and also from the main body of this report is included at the end of the document.

### 3 Methodology

This Section briefly describes the methodology used in the household surveys, including how ‘the poor’ were defined, and gives background information on the two case studies.

#### 3.1 Poverty definition

A key issue concerning data analysis was clarifying and confirming the poverty line definition in the two study areas. Defining ‘the poor’ is not clear cut and advice was sought from specialists in India, Bangladesh, USA and the UK. While details of each case study are presented below, three key points to remember with the poverty definitions used by this study are that they were based on:

1. Official government estimates of poverty
2. Household per capita income (not victim income alone)
3. Post crash household income (not pre-crash household income)

It was agreed that definitions of poverty assessed separately for urban and rural areas would be based on official government definitions in the two countries. Data limitations made analysing income levels by various quantiles impractical. While both case studies collected information on household assets in order to define poverty on the assets approach, this was not possible as explained below and poverty definitions were based on income.

As the focus of this study was the impact on households, poverty was defined by the average income per household member and not limited to the income of the primary victim. Furthermore, household income was only collected at the time of the survey, i.e. the post crash period, and the pre-crash household income was not reported. However, the actual victim’s pre-crash income was collected, and it has been possible to approximate the number of pre-crash poor households as shown in Section 5. While this classification and comparison is limited by those cases of the victim’s pre-crash income being unavailable, the number of households estimated to be non-poor before the crash but poor after the crash is substantial and is discussed later.

##### 3.1.1 Bangladesh

The household questionnaire included key asset questions such as vehicle ownership and home entertainment but these indicators proved to be insensitive and were not able to differentiate poor from non-poor.

The poverty line defined by the Bangladesh Bureau of Statistics (BBS) was determined by the extended poverty survey conducted in May 1999 (BBS, 2002). Using minimum caloric requirements, the survey found 43.3 per cent of urban households and 44.9 per cent of rural households were below the poverty line. The poverty line definition for this study was therefore based on the per capita monthly income which matched these percentages. Accordingly, the poor were defined as those with an average monthly per capita income of Tk 1000 or less in urban areas and Tk 600 or less in rural areas {US\$1 = Tk 57 - average 2001}.

##### 3.1.2 Bangalore

As in Bangladesh, effort was made to identify the poor on a household assets approach rather than an income basis. The Bangalore survey included questions on household assets, livestock, household drinking water source, toilet facility, lighting source, fuel source, house construction materials, agricultural employment, land ownership, and the number of household members per sleeping room. The assets scores identified/available at the time of the survey were from the 1992/3 India National Family Health Survey.

Although the Bangalore surveys used the complete recommended asset survey, it was not possible to extrapolate the findings. The poverty line definition adopted by this study was that used by the Planning Commission for interstate price comparisons (1999-2000). This gave the Karnataka poverty line as Rp 310 and Rp 511 for rural and urban monthly per capita incomes respectively {US\$1 = Rp 47 - average 2001}.

## 3.2 The survey samples

### 3.2.1 Bangladesh

A descriptive cross sectional study was conducted in 12 districts and two metropolitan cities of Bangladesh during 2001. A multi-stage, stratified, cluster sampling method was used to choose a total sample size of 83, 199 households with 59,008 rural and 24,191 urban households. The urban sample included two metropolitan cities, Dhaka and Rajshahi, and two upazilas (sub-districts) from six urban districts while the rural sample included 20 upazilas from 12 districts.

**Table 3-1: Bangladesh household survey sample summary**

	Urban		Rural		Urban & Rural	
	poor	non-poor	poor	non-poor	poor	non-poor
Households surveyed	10,771	13,420	26,460	32,548	37,231	45,968
Residents surveyed	57,467	59,897	148,912	148,543	206,379	208,440
Household size	5.3	4.5	5.6	4.6	5.5	4.5
Road deaths (5 year recall)	27	31	82	63	109	94
Serious injuries (1 year recall)	103	113	136	184	239	297

From each upazila, five unions (the lowest administrative units comprising of approximately 20,000 population) were selected randomly. Then from each union, two villages were selected with each village considered as a cluster. The number of households and casualties surveyed are shown in Table 3-1.

Basic socio-economic details were collected (8 data fields) from all households surveyed. Victim questionnaires (over 60 data fields) were undertaken with those households where a road death had occurred in the past five years or a road injury in the past year. This provided data on 203 road deaths and 536 seriously injured (i.e. broken bones or overnight hospitalisation). Another 1189 casualties required medical treatment (but not hospitalisation) for minor traffic injuries were surveyed but they are not discussed in this report.

The household and victim questionnaires were pilot tested in the metropolitan, urban and rural areas. Workshops were conducted before and after the pilot testing of the questionnaires and were attended by representatives of medical personnel (including epidemiologists and surgeons), and also the transport and road safety professions. Quality control included reviewing the completed questionnaires on the same day to identify gaps or clarify responses. A selected subset (5%) of households was also re-interviewed. As seen in Table 3-1, the poor account for over half of those killed in road crashes (54%).

### 3.2.2 Bangalore

The Bangalore case study involved a survey of 96,414 people in 19,797 households stratified into approximate equal shares of rural, urban and slum areas. The rural survey was undertaken in Devanahalli, a sub district of Bangalore rural district, located 45 kilometres away from Bangalore city. Based on their population proportion, the rural survey included both Devanahalli town households (26%) and rural households (74%).

The urban surveys, including slum households, were conducted in Bangalore City (5.7 million population). As of January 2002, Bangalore City had nearly 1.5 million motor vehicles registered and

another 200,000 believed to regularly travel on the city's roads. The slum survey was undertaken in Koramangala slum area, which accounted for some 75 per cent of the 40,000 people in Koramangala ward. The urban survey focused on middle and upper income in Viveknagar and Austin Town areas within Bangalore South ward. Results of the household surveys are shown in Table 3-2. An independent surveyor re-surveyed 10 per cent of the households for quality control.

It should be noted, therefore, that owing to the particular sampling of houses in slums in urban areas, in the sample, a larger proportion of poor may be present than would be representative for the area. Nevertheless, the data analysis carried out is still valid as it focuses on comparing the poor (as defined in 3.1.2 above) and non-poor groups of households.

**Table 3-2 : Bangalore household survey sample summary**

	Urban		Rural		Urban & Rural	
	poor	non-poor	poor	non-poor	poor	non-poor
Households surveyed	2,830	10,902	1,865	4,200	4,695	15,102
Residents surveyed	15,222	48,912	10,802	21,478	26,024	70,390
Household size	5.4	4.5	5.8	5.1	5.5	4.7
Road deaths (5 year recall)	10	19	26	28	36	47
Serious injuries (1 year recall)	23	103	24	65	47	168

Although a large number of household surveys was undertaken, relatively few casualties were identified. Accordingly, additional casualties were identified from police and hospital records. A total of 175 households were selected on a random basis from the list of 649 road deaths recorded by the police in 2000. This led to 156 bereaved households being surveyed. From the medical records of four main Bangalore hospitals (Victoria, Bowring and Lady Curzon, National Institute of Mental Health and Neuro Sciences and Sanjay Gandhi Accident and Research Centre), the addresses of 40 road traffic casualty in-patients were randomly selected for each month of 2000. From this list, a further 367 seriously injured victims were identified and surveyed.

### 3.3 Additional research

This study benefited from the involvement of the lead local partners in the original costing study. As part of this research, they were asked to collect background information in order to improve and update the understanding of such key areas as the definition of poverty, other injury surveillance studies, and travel patterns. The latter included information that would reveal any difference between the poor and non-poor in such factors as the number of trips, road user modes, trip lengths and times, etc. This information was required in order to put the incidence rates into context when deciding if the poor were more at risk to being involved in road crashes.

Information on how human costs, i.e. the value for pain and suffering, were calculated with other illnesses was also sought. Human costs account for the majority of fatal and serious injury values of prevention estimates in high-income countries, unlike that in low-income countries. For instance, India has traditionally applied the early UK assumption of human costs of a road crash to be 20 per cent of the resource costs. Bangladesh has also used this ratio. Some countries, including South Africa, assign no value to the human costs of a road death as they only consider the costs from the primary victim's perspective.

### 3.4 Statistical analysis

Despite the large survey populations, the sample of resulting casualties was relatively small. Accordingly, the tables describing the analysis provide both the percentage and the absolute number in order to avoid any misinterpretations that the percentages refer to larger base numbers. This was also the reason why the economic classifications were restricted to two basic groups, poor and non-poor.



The survey data was analysed in SPSS (Weiss, 2002) with chi square tests conducted on the categorical data fields. Urban and rural road deaths and seriously injured were analysed separately. For continuous variables, one way ANOVA tests were undertaken. As explained in Section 5, mean values need to be treated with caution, due to the skewness identified. Both a parametric test ('t' test) and a non-parametric test (Mann-Whitney) were used to compare the poor with the non-poor. Statistical analysis tests were conducted by both TRL and the local counterparts in order to confirm the findings.

## 4 Involvement of the poor in road crashes

### 4.1 Introduction

The analysis of involvement covers both incidence estimates, i.e. how many are being killed and seriously injured in road crashes, as well as describing who is involved, i.e. road user type, age, sex, and occupation of those killed or seriously injured. As mentioned previously, casualties have been identified as poor or non-poor on the basis of their post crash household income per capita. Where possible, the survey findings have been compared with police road casualty statistics in order to identify the true burden of road crashes on the overall community.

### 4.2 Bangladesh

#### 4.2.1 Incidence

The incidence estimates for Bangladesh are based on the 739 road deaths and serious injuries identified by the survey of 83,199 households summarised in the previous Section 3. Among urban households that had been involved in a fatal or serious injury crash, the reported crash incidence was similar for the poor and non-poor (see Table 4-1). Whilst more rural poor households appear to have had a member killed in a road crash than non-poor households, this difference was not significant. The only major difference found was among rural households where someone had been seriously injured with the non-poor reporting a higher incidence rate, significant at the 95 per cent level. This resulted in the rural non-poor households having a significantly higher incidence rate for the combined killed/serious injuries. As discussed below, these findings are based on the poor and non-poor having similar exposure to risk, which may well not be the case.

**Table 4-1: Annual incidence per 100,000 population**

	Urban			Rural			Urban & Rural		
	poor	non-poor	sig.	poor	non-poor	sig.	poor	non-poor	sig.
Road death	9.4	10.4	ns	11.0	8.5	ns	10.6	9.0	ns
95% confidence interval	6.2-13.7	7.0-14.7	ns	8.8-13.7	6.5-10.9	ns	8.7-12.7	7.3-11.0	ns
Serious injury	179.2	188.7	ns	91.3	123.9	*	115.8	142.5	*
95% confidence interval	146.3	155.5-226.8	ns	76.7-108.0	106.6-143.1	*	101.6-131.5	126.7-159.7	*
Killed/seriously injured	188.7	199.0	ns	102.3	132.4	*	126.4	151.5	*
95% confidence interval	154.8-227.7	164.9-238.1	ns	86.7-119.9	114.5-152.2	*	111.5-142.7	135.3-169.2	*

Note: sig. = significance level: \*\* = 99% significance, \* = 95% significance, † = 90% significance, ns= non-significant

#### 4.2.1.1 Exposure to risk

It should be noted that the above comparison of incidence does not take into account the number of trips made, the road user mode involved, trip timing or length. An attempt was made to obtain up to date information on trip rates by households of varying income levels in the two countries but without any success. While the poor may have to travel further to access employment and services, they are assumed to include a larger share of those who travel very rarely. Likewise, while the non-poor can afford safer private motorised transport, they can also afford to make more non-essential trips with their greater disposable income.

Calculations were made of the increased travel rates by non-poor households (over poor households) that would be needed to make the incidence of death and serious injury in poor households significantly greater. For a road death, this was 7 per cent in rural households and 93 per cent in urban households while for serious injuries it was 38 per cent in urban households and 70 per cent for rural households. This means that as long as the Bangladeshi non-poor are travelling more than 7 per cent greater than the poor, then the rural poor are more at risk to having had a family member killed in a road crash. Earlier research carried out in India (Delhi, Jaipur, Patna and Vadodora) by Fouracre and Maunder (1987) showed that non-poor households had trip rates anything from 40 to 70 per cent

greater than poor households. Thus by taking trip rates into account, the incidence of deaths and serious injuries in Bangladeshi poor households (with the possible exception of deaths in urban areas) could indeed be greater than in non-poor households.

#### 4.2.1.2 Comparison with police estimates

In 2000, the police recorded 3,058 road deaths and 2,270 serious injuries (Bangladesh Police, 2001). Using the above incidence rates identified from the household survey, the 2000 national road casualty toll would have been 12,500 road deaths and 170,000 serious injuries. This is four times greater than the number of road deaths and almost 75 times greater than the serious injuries officially reported by the police. The number of Bangladeshis being killed and seriously injured on the road is estimated to be 34 times that officially recorded. Therefore, although the poor may not be more at risk of being killed or seriously injured in a road crash than the non-poor, many more Bangladeshis, both poor and non-poor, are being killed and seriously injured in road crashes than police statistics indicate. It should also be noted that in 2001 the police reported a decrease in road deaths and serious injuries with 2388 road deaths and 1661 serious injuries (Bangladesh Road Transport Authority, 2002), so the under-reporting problem may be worsening.

WHO's recent World report on road traffic injury prevention included the general guideline of 15 serious injuries (and 70 slight injuries) estimated for every road death (WHO, 2004). While the Bangladeshi police currently report fewer serious injuries than road deaths, the household surveys found 13 serious injuries for every road death. In urban areas, the poor and non-poor both reported 18-19 serious injuries for every road death. In rural households, the non-poor reported 15 serious injuries for every road death, almost twice the number reported by the poor (8).

#### 4.2.2 Road user type

More poor deaths occurred while walking than by any other road user mode (see Table 4-2). It should be noted that the information for this and subsequent tables on transport type, victim details and circumstances of the household were obtained from a separate questionnaire form to that for the household information in the earlier Table 3-1. The slight differences in the overall totals of these tables are due to the fact that it was not possible to match perfectly the information from both forms and, of course, some questions were not completed by all households.

**Table 4-2: Bangladesh road user type**

		Death				Serious injury			
		urban		rural		urban		rural	
		poor	non-poor	Poor	non-poor	poor	non-poor	poor	non-poor
VRU	Pedestrian	10 (42%)	7 (22%)	41 (49%)	26 (41%)	21 (20%)	26 (23%)	37 (31%)	45 (26%)
	Cyclist	1 (4%)	0 (0%)	5 (6%)	3 (5%)	9 (9%)	3 (3%)	7 (6%)	17 (10%)
	Rickshaw	2 (8%)	4 (13%)	4 (5%)	5 (8%)	31 (29%)	32 (28%)	22 (18%)	25 (15%)
	Motorcycle	2 (8%)	3 (9%)	0 (0%)	2 (3%)	8 (8%)	20 (17%)	5 (4%)	21 (12%)
	Auto rickshaw	2 (8%)	1 (3%)	8 (10%)	6 (9%)	11 (10%)	20 (17%)	16 (13%)	20 (12%)
4W	Car/taxi	0 (0%)	5 (16%)	2 (2%)	2 (3%)	1 (1%)	5 (4%)	7 (6%)	2 (1%)
	Minibus/bus	4 (17%)	10 (31%)	17 (20%)	16 (25%)	19 (18%)	6 (5%)	18 (15%)	30 (18%)
	Truck/lorry	3 (13%)	2 (6%)	5 (6%)	2 (3%)	3 (3%)	3 (3%)	2 (0%)	5 (3%)
	Others	0 (0%)	0 (0%)	2 (2%)	2 (3%)	3 (3%)	0 (0%)	6 (2%)	6 (4%)
Significance <sup>1</sup>		ns		ns		**		†	
VRU 4-wheel motor vehicle (4W)		17 (71%)	15 (47%)	58 (69%)	42 (65%)	80 (75%)	101 (88%)	87 (72%)	128 (75%)
		7 (29%)	17 (53%)	26 (31%)	22 (34%)	26 (24%)	14 (12%)	33 (23%)	43 (25%)
Significance <sup>1</sup>		†		ns		*		ns	
Total number		24	32	84	64	106	115	120	171

<sup>1</sup> The significance levels in this case relate to differences between the above distributions.

\*\* = 99% significance, \* = 95% significance, † = 90% significance, ns = non-significant {eg. ns – means that there is less than a 90% chance of a true difference existing between the distributions for poor and non-poor casualties in the above modes of travel.}

Pedestrians accounted for almost half of all rural poor deaths and four out of every ten urban poor deaths. Vulnerable road users (VRU's), which include auto rickshaw occupants, accounted for over two-thirds of the poor who were killed or seriously injured as well as the non-poor seriously injured. VRU's also dominated, although to a lesser extent, in deaths of the non-poor. VRU's accounted for an even larger share of the seriously injured and in urban areas, the number of serious injuries to rickshaw occupants outnumbered those to pedestrians.

The main statistically significant difference found in the overall distributions of casualties by mode of transport between poor and non-poor in Table 4-2 was with the urban seriously injured (99% significance), with the rural seriously injured approaching significance (at least 92%). Comparing all VRU's with all four wheeled vehicles also revealed a difference between the poor and non-poor for urban seriously injured (at least 98% significant) and approaching significance for urban deaths (at least 92%). Comparing all VRUs combined with all four wheeled vehicles combined also found a difference between the poor and non-poor for urban seriously injured (at least 98% significance) and approaching significance for urban deaths (at least 92%); that is, in urban areas, generally a greater proportion of the poor than corresponding proportion of non-poor are being killed as VRU's, but the converse is true for serious injuries.

Less than one-third of the deaths involving the poor and one quarter of those who were seriously injured occurred while they were in a 4 wheel motor vehicle. Bus occupants accounted for the majority of 4-wheel motor vehicle occupants. Very few of those killed or seriously injured were reported to be driving a vehicle at the time of the crash but were pedestrians or paying passengers.

### 4.2.3 Socio-economic characteristics

#### 4.2.3.1 Sex and Age

**Table 4-3: Age and sex of Bangladesh road casualties**

	Death				Serious injuries			
	Urban		Rural		Urban		Rural	
	poor	non-poor	poor	non-poor	poor	non-poor	poor	non-poor
<u>Age range</u>								
under 16 years	6 (25%)	3 (9%)	22 (26%)	18 (28%)	17 (16%)	11 (10%)	18 (15%)	17 (10%)
16-45 years	15(63%)	24 (75%)	43 (51%)	35 (55%)	73 (69%)	91 (79%)	85 (1%)	123 (72%)
over 45 years	3 (13%)	5 (16%)	19 23%)	11 (17%)	16(15%)	13(11%)	17 (14%)	31 (18%)
<u>Sex</u>								
Male	22(92%)	28 (88%)	70 (83%)	46 (74%)	85 (80%)	96 (85%)	100 (84%)	147 (86%)
Female	2 (8%)	4 (12%)	14 (17%)	16 (26%)	21 (20%)	17 (15%)	19 (6%)	24 (14%)

Note: No significant difference found in age or sex between poor and non-poor.

The vast majority of those killed and seriously injured were male (Table 4-3), which was consistent with that reported by the police and hospitals. Although the percentage of deaths occurring to males was greater for the poor (the opposite of that for serious injuries), there was no significant difference between poor and non-poor males.

While those in the prime of life were the main victims, children accounted for more than one in every four road deaths in rural households and among the urban poor households. Although the poor reported higher involvement of children as road deaths and seriously injured, there was no significant difference between the poor and non-poor children. While no estimates of their relative share in traffic were available, children under the age of 14 are estimated to account for 39% of the total population (UN, 2001).

Girls accounted for a larger share of total female deaths and serious injuries (32%) than boys did for total males (12%). This was consistent with the draft findings of the Bangladesh Health and Injury Survey that found the mortality rate for transport injuries was much higher for girls under the age of 10 than for boys (Rahman, 2003).

Pedestrians severely injured in crashes were analysed separately for age differences between poor and non-poor. The poor were over-represented in the age group 0 – 15 years but differences were not significant.

#### 4.2.3.2 Occupation and salary

Most casualties occurred to those working in business or service or who were students. There were no significant differences between the poor and non-poor for road deaths or serious injuries in either urban or rural collisions when looking at just business, service and student occupations. However, differences were found in other categories for rural road deaths and injuries and for urban serious injuries with, as might be expected, the poor significantly over-represented as labourers, agricultural workers and rickshaw drivers.

The average monthly salary of a poor urban road death was Tk 3,196 compared to Tk 11,695 for non-poor victims. Despite the much larger average non-poor salary, the difference was not significant. In rural areas, the average salaries were much closer with Tk 1,864 for poor deaths and Tk 2,583 for non-poor. The seriously injured reported lower incomes in the urban areas with Tk 1902 for poor and Tk 5,544 for non-poor, with the non-poor earning significantly more than the poor. These average victim incomes are all higher than the maximum per capita incomes defining poor households in urban and rural areas, which indicates that it is mainly the wage-earning members of poor households that are being injured in road crashes (see also section 5.2.2.1).

### 4.3 Bangalore

#### 4.3.1 Incidence

The casualty rates shown in Table 4-4 are based on the community survey findings only, and do not include the deaths and serious injuries identified by the police and hospital records. The poor were reported to have a higher road death incidence in both urban and rural areas, with the difference being significant for rural deaths where the poor reported an incidence almost twice that of the non-poor (95% significance).

**Table 4-4: Annual incidence per 100,000 population Bangalore**

	Urban			Rural		
	poor	non-poor	sig.	poor	non-poor	sig.
Road death	13.1	7.8	ns	48.1	26.1	*
95% confidence level	6.3-24.2	1.9-5.0	ns	31.4-70.5	7.3-16.0	*
Serious injury	151.1	210.6	ns	222.2	302.6	ns
95% confidence level	95.8-226.7	71.0-105.5	ns	142.3-330.6	99.0-163.5	ns
Killed/serious injury	164.2	178.3	ns	19.6	47.5	ns
95% confidence level	106.3-242.5	73.9-109.1	ns	181.3-387.8	108.7-175.8	ns

Note: sig. = significance level: \* 95% statistically significant difference between poor and non-poor, ns=no significant difference

The rural death rates for both poor and non-poor were much greater than those for urban deaths, and were taken from a sub-district that was described as rapidly motorising. The death rate for the rural poor is particularly high. When the urban and rural samples were combined, the poor were found to be statistically more likely to be killed in a road crash (95% significance) while the non-poor were more likely to be seriously injured (90% significance).

As with Bangladesh, the Bangalore incidence estimates need to be put into context. They have not been adjusted for exposure, i.e. number of trips, type of transport, timing or length of trip. Calculations were again made of the increased trip rates by non-poor households (over poor households) that would be needed to make differences in the incidence of death and serious injury in the poor households significant. For a road death, this was 64 per cent in rural households (which is possible), and for serious injuries it was 142 per cent in urban households and 136 per cent for rural households (which is unlikely).

#### 4.3.1.1 Comparison with police data

The Bangalore police report nearly 700 deaths and 7,000 serious and slight injuries every year in road crashes. Not all of these casualties will be Bangalore city residents. The police reported only 10 injuries for every road death. By comparison, in the urban households surveyed in this study, the non-poor reported 27 serious injuries for every road death compared to 11 for the poor. In rural areas, the figures were much lower but the non-poor still reported 12 serious injuries for every road death while the poor reported only 5. Thus the non-poor reported over twice as many serious injuries than did the poor. A working group of the Planning Commission of the Government of India recently estimated the ratio between deaths and hospitalised injuries and minor injuries to be 1:15:70 (Planning Commission, 2001). Thus, the number of serious injuries is estimated to be over 10,000, which is greater than the number of total injuries being currently reported by the police.

#### 4.3.2 Road user type

A breakdown of road user types by crash victims from the sample is shown in Table 4-5. VRU's (including auto rickshaws) accounted for the vast majority of those killed and seriously injured, especially in urban areas. Two modes, walking and motorcycling, dominated. The poor were more likely to be killed (both rural and urban areas) or seriously injured in urban areas as a pedestrian while the non-poor were most often motorcycle casualties.

**Table 4-5 Bangalore road user type casualties**

		Death				Serious injury			
		urban		rural		urban		rural	
		poor	non-poor	Poor	non-poor	poor	non-poor	poor	non-poor
<b>VRU</b>	Pedestrian	29 (60%)	54 (38%)	12 (46%)	6 (21%)	21 (45%)	97 (25%)	3 (13%)	13 (20%)
	Cyclist	3 (6%)	8 (6%)	5 (19%)	1 (4%)	5 (11%)	27 (7%)	4 (17%)	5 (8%)
	Motorcycle	15 (31%)	66 (47%)	2 (8%)	11 (39%)	10 (21%)	203 (53%)	8 (33%)	27 (42%)
	Auto rickshaw	0 (0%)	4 (3%)	0 (0%)	0 (0%)	5 (10%)	17 (4%)	2 (8%)	2 (3%)
<b>4W</b>	Car/taxi	0 (0%)	3 (2%)	0 (0%)	0 (0%)	1 (2%)	21 (6%)	0 (0%)	0 (0%)
	Minibus/bus	1 (2%)	5 (3%)	3 (12%)	7 (25%)	4 (9%)	15 (4%)	3 (13%)	12 (18%)
	Truck/lorry	0 (0%)	1 (1%)	3 (12%)	2 (7%)	0 (0%)	0 (0%)	3 (13%)	5 (8%)
	Others	0 (0%)	0 (0%)	1 (4%)	1 (4%)	1 (2%)	1 (.2%)	1 (4%)	1 (1%)
Significance <sup>1</sup>		ns		ns		ns		ns	
<b>VRU</b>		47 (98%)	132 (94%)	19 (73%)	18 (64%)	41 (87%)	344 (90%)	17 (71%)	47 (72%)
<b>4-wheel motor vehicle (4W)</b>		1 (2%)	9 (3%)	7 (27%)	10 (36%)	6 (13%)	37 (10%)	7 (29%)	18 (28%)
Significance <sup>1</sup>		ns		ns		ns		ns	
Total number		48	141	26	28	47	381	24	65

<sup>1</sup> The significance levels in this case relate to differences between the above distributions.

ns= non-significant; that is, that there is less than a 90% chance of a true difference existing between the distributions for poor and non-poor casualties in the above modes of travel.

In rural households, although this is a small sample, there was a wider distribution with fewer pedestrians involved and more cyclists and 4 wheel motor vehicle occupants. In rural households, 4 wheel motor vehicle occupants accounted for more than one in four deaths to the poor and one in three deaths to the non-poor. These included the occupants and drivers of 'matadors' (relatively large mini-buses), included under 'other'.

No significant difference was found between the modes involved in poor and non-poor crashes. Even comparing all VRUs combined with all four wheeled vehicles combined did not find any difference between the poor and non-poor for both urban and rural fatal or seriously injured.

### 4.3.3 Socio-economic characteristics

#### 4.3.3.1 Sex and Age

Those in the prime of life accounted for the majority of those killed and seriously injured in Bangalore (Table 4-6). This applied to urban and rural households as well as poor and non-poor. Relatively few deaths or serious injuries occurred to children while those over the age of 45 accounted for more than one out of three urban deaths and over 40 per cent of rural poor serious injuries. As with Bangladesh, girls accounted for a larger share of total female road deaths and seriously injured (17%), almost twice than the boys did for total male casualties (9%).

**Table 4-6: Bangalore road casualty age and sex distribution**

	Death				Serious injuries			
	Urban		Rural		Urban		Rural	
	poor	non-poor	poor	non-poor	poor	non-poor	poor	non-poor
<b>Age range</b>								
under 16 years	4 (8%)	7 (5%)	4 (15%)	5 (19%)	10 (21%)	37 (10%)	0 (0%)	7 (11%)
16-45 years	26 (54%)	83 (59%)	15 (58%)	16 (59%)	27 (57%)	255 (67%)	14 (58%)	40 (62%)
over 45 years	18 (38%)	50 (36%)	7 (27%)	6 (22%)	10 (21%)	89 (23%)	10 (42%)	18 (28%)
<b>Sex</b>								
Male	40(83%)	108 (77%)	20 (77%)	25 (89%)	37 (79%)	296 (78%)	21 (88%)	52 (80%)
Female	8 (17%)	32 (23%)	6 (23%)	3 (11%)	10 (21%)	83 (22%)	3 (12%)	13 (20%)

#### 4.3.3.2 Occupation and salary

Although the non-poor tended to report more semi-professional, skilled and semi-skilled casualties, and the poor reported more unskilled casualties, differences were not significant. The vast majority of all those killed and seriously injured claimed to be working full time at the time of the crash.

As might be expected, the poor road deaths had earned significantly less than the non-poor road deaths. Among urban victims, poor road deaths earned Rp 2662 per month while the non-poor had earned Rp 5446 (99.9% significance). Incomes were lower with rural victims with Rp 1400 per month for the poor road deaths and Rp 2000 for non-poor road deaths (90% significance). The impacts on the incomes of the seriously injured are discussed in the following section.

## 5 Impacts on households

### 5.1 Introduction

Whereas only one person may be involved in a road crash, the whole household can be affected, financially, socially and emotionally. Impacts include the direct out-of-pocket expenses incurred and the indirect costs of loss of work time, as well as the knock-on effects and the household response to this sudden shock. As the survey recall period for injuries was only one year, the impacts on the injured household are based on the short term and immediate aftermath and thus will not reflect the longer-term effects on the permanently disabled. The recall period for deaths was longer (5 years) and so the impacts from deaths and serious injuries are discussed separately.

### 5.2 Bangladesh

#### 5.2.1 Financial costs

##### 5.2.1.1 Bangladesh bereaved households

No significant difference between average funeral costs was found (Table 5-1), although when funeral costs were compared to household income, the urban poor spent almost three times their average monthly household income on the funeral, almost 80 per cent greater than the corresponding proportion of income paid by the non-poor (90% significance).

While bereaved poor households (both urban and rural) reported paying more in average medical costs, this was again not statistically significant. However, the burden was greater on poor households with a statistically larger amount spent when compared to household income.

**Table 5-1: Bangladesh road death associated costs (Tk) (US\$1 = Tk57)**

	Urban			Rural		
	poor	non-poor	sig.	poor	non-poor	sig.
Funeral	10,279	12,716	ns	8,784	12,148	ns
Standard deviation	(15,378)	(16,685)		(12,777)	(16,081)	
Medical treatment	4,925	3,064	ns	5,319	3,195	ns
Standard deviation	(8,826)	(11,880)		(18,978)	(6,903)	

Note: ns=no significant difference

As noted previously, the distribution of the measures used to compare the poor and non-poor were skewed and so the mean values must be treated with caution. These costs were self-reported and not independently verified. The comparison of these measures used a parametric test ('t' test) and a non-parametric test (Mann-Whitney) to compare the poor with the non-poor.

##### 5.2.1.2 Bangladesh households with serious injuries

Table 5-2 shows that non-poor urban households reported the medical costs of a serious injury to be over twice that of their poor counterparts (95% significance). However, when compared to average household income, rural poor households paid over three times the share that non-poor households paid (95% significance). Non-poor households also claimed higher property damage losses, but this was not significant.

Indirect costs were higher for poor households for although the time spent recovering and number of trips for medical treatment was similar for poor and non-poor casualties, the non-poor had better job security and were more likely to be able to return to their job. Approximately four out of every ten poor seriously injured were unable to return to their previous job. Searching for a new job took weeks,



especially for the rural poor. When they did find employment, it often paid less than their previous job.

**Table 5-2: Bangladesh serious injuries associated costs**

	Urban			Rural		
	poor	non-poor	sig.	poor	non-poor	sig.
<b>Direct costs</b>						
Medical treatment (Tk)	13,936	30,746	*	11,673	10,251	ns
Standard deviation	(24,944)	(72,037)		(13,741)	(19,187)	
Property damage (Tk)	1,717	9,599	ns	4,346	7,560	ns
Standard deviation	(6,377)	(58,076)		(11,497)	(26,501)	
<b>Indirect costs</b>						
Recovery (no. days)	72	68	ns	67	57	ns
Treatment (no. trips)	6.5	6.9	ns	5.2	5.9	ns
Able to return to job	61%	78%	*	56%	75%	*
Job search (no. days)	27	21	ns	57	27	*

Note 1: \*\*99% significance, \* 95% significance, † 90% significance, ns= non-significant

## 5.2.2 Consequences and coping strategy

Although the Bangladeshi poor may not be at greater risk of being seriously injured or killed in a road crash, when this does happen, the consequences on their household are much more severe, as seen in Table 5-3 and Table 5-5.

### 5.2.2.1 Bangladesh bereaved households

Whilst most fatalities in poor households did not involve the head of household, victims tended to be grown children who contributed a large share of the household income, especially in urban areas. Those killed had accounted for 62 per cent of the income in urban poor households, compared to 48 per cent for urban non-poor households. In rural areas, road death victims contributed 42 per cent of the monthly income to poor households, which was greater than the 24 per cent by non-poor victims (95% significance). Over seven out of ten bereaved poor families saw their total household income decrease after a road death. Although this was higher than non-poor households in both urban and rural areas, it was only significant (90% significance) among rural households.

This same proportion (7 of 10) of poor bereaved households also reported their food consumption and general living standard to have decreased. Households reported the same decrease in food production as they did for food consumption. While fewer non-poor households reported these negative impacts, only food consumption (and food production) for poor urban households was significantly worse (90% significance).

Poor households were more likely to go into debt after a road death with the majority of poor households needing a loan (95% significance). Impacts varied between urban and rural areas. While rural bereaved households reported more cases of work or study being foregone (90% significance), urban poor households were more likely to respond by taking on extra work (95% significance) or selling assets (90% significance). Compensation was rarely offered and almost always came from the other party with 13 per cent of urban poor bereaved households and 27 per cent of rural poor bereaved households receiving a private settlement. Only two of the total 203 bereaved households reported receiving any compensation from an insurance company.

**Table 5-3: Household impacts from Bangladesh road deaths**

		Urban			Rural		
		poor	non-poor	sig.	poor	non-poor	sig.
<b>Consequences</b>							
Income decreased	yes	18 (75%)	19 (59%)	ns	60 (72%)	34 (55%)	†
	no	6 (25%)	13 (41%)		23 (28%)	28 (45%)	
Food consumption decreased	yes	17 (71%)	15 (47%)	†	58 (70%)	35 (57%)	ns
	no	7 (29%)	17 (53%)		25 (30%)	27 (43%)	
Living standard decreased	yes	17 (71%)	16 (50%)	ns	62 (75%)	39 (63%)	ns
	no	7 (29%)	16 (50%)		21 (25%)	23 (36%)	
<b>Coping strategy</b>							
Arranged loan	yes	15 (65%)	8 (25%)	*	50 (61%)	21 (34%)	*
	no	8 (35%)	24 (75%)		32 (39%)	41 (66%)	
Sold asset	yes	8 (35%)	6 (19%)	†	27 (33%)	13 (21%)	ns
	no	15 (65%)	26 (81%)		54 (67%)	49 (79%)	
Took on extra work	yes	8 (33%)	2 (6%)	*	3 (4%)	1 (2%)	ns
	no	16 (67%)	30 (94%)		81 (97%)	61 (98%)	

Notes: \*\* 99% significance, \* 95% significance, † 90% significance, ns = non-significant  
 'No' includes 'did not know' as well as 'no'

Table 5-4 is an attempt to demonstrate the effect that fatal crashes have on the poverty status of affected households. The first column of data in the table shows that of the 24 urban bereaved families identified as poor after the crash, 8 (33%) were estimated to be not poor before the event, and it is not unreasonable to assume that this was due to the loss of the victim's contribution to the household income.

In rural Bangladesh, among the 82 rural poor households whose pre crash poverty status was known, 40 (49%) were not poor before the death, the crash thus apparently responsible for moving a relatively high proportion of affected rural households into poverty.

**Table 5-4: Bangladesh bereaved household poverty status (income per capita)**

			post-crash			
			poor		not-poor	
Urban	pre-crash	<i>not known</i>	0	-	2	-
		poor	16	(67%)	2	(7%)
		not-poor	8	(33%)	28	(93%)
	Total post-crash		24	(n=24)	32	(n=30)
Rural	pre-crash	<i>not known</i>	2	-	0	-
		Poor	42	(51%)	13	(20%)
		not-poor	40	(49%)	51	(80%)
	Total post-crash		84	(n=82)	64	(n=64)

In the above table it should be noted that in both urban and rural areas, a few households defined as poor before the crash became not poor, post crash. For example, two urban bereaved poor households were estimated to be non-poor after the death, and there may be a number of reasons for this change in poverty status, one possibility being that their income per capita has increased simply due to the victim being a child or non-earning member of the household. However, it should be remembered that this means that the family may have lost a future key income earner.

It must be emphasised out that the above findings from Table 5-4 and subsequently from Table 5-6, Table 5-10 and Table 5-12 should be regarded as indicative as consideration should be given to the following observations:-

1. There were a number of households whose poverty status was not known. This is particularly so in the case of serious casualties, most noticeably in Bangalore.
2. The data on income is likely to be less reliable in cases where the interviewee was required to remember the income level of the crash victim by up to 5 years previously (when the crash may have occurred - see Appendix B)
3. Over this period of time there may well be other factors that have affected family income.
4. The income per capita will be very dependent on which member of the family was the victim of the crash, i.e. a greater impact if this was the main wage earner.

### 5.2.2.2 Bangladesh households with serious injuries

As might be expected, the impact of a serious injury appeared to be less than that of a death with fewer households reporting negative consequence. However the majority of poor households still reported suffering a decrease in household income, food production and consumption, and living standard (95% significance – see Table 5-5).

**Table 5-5: Household impacts from Bangladesh serious injuries**

		Urban			Rural		
		poor	non-poor	sig.	poor	non-poor	sig.
Consequences							
Income decreased	yes	60 (57%)	38 (33%)	*	73 (62%)	72 (42%)	*
	No	46 (43%)	77 (67%)		45 (38%)	98 (58%)	
Food consumption decreased	yes	62 (59%)	29 (25%)	*	78 (66%)	68 (40%)	*
	No	44 (41%)	86 (75%)		40 (34%)	102 (43%)	
Living standard decreased	yes	62 (59%)	29 (25%)	*	81 (69%)	71 (42%)	*
	No	44 (42%)	85 (75%)		37 (31%)	97 (58%)	
Coping strategy							
Arranged loan	yes	66 (63%)	40 (35%)	*	74 (64%)	65 (39%)	*
	No	39 (37%)	75 (65%)		42 (36%)	100 (61%)	
Sold asset	yes	31 (29%)	17 (15%)	*	42 (37%)	36 (22%)	*
	No	75 (71%)	98 (85%)		73 (63%)	129 (78%)	
Took on extra work	yes	2 ( 3%)	0 ( 0%)	†	3 ( 6%)	2 ( 3%)	ns
	No	56 (97%)	86 (100%)		48 (94%)	72 (97%)	

Notes: \*\*99% significance, \* 95% significance, † 90% significance, ns= non-significant  
 'No' includes 'did not know' as well as 'no'

Rural households reported more negative impacts than did urban households. The poor were harder hit as the victims had provided 62 per cent of total rural household income, compared to 50 per cent among non-poor households (95% significance). In urban non-poor households, only a quarter reported their living standard and food consumption had decreased after a serious injury, with only one-third stating their household income had decreased.

Poor households had to borrow to cope with the costs of a serious injury. Over 60 per cent of poor households went into debt (or further debt), compared to a minority of non-poor households (95% significance). Borrowing money was the most common response with few families selling an asset, although again, the poor resorted to this more often than the non-poor (95% significance). Few households gave up work or study to care for the injured (one in six rural poor households) and very few took on extra work. The latter may well indicate the lack of availability of employment.

As with the bereaved, more households were found to be poor after the crash than before (see Table 5-6). This included 20 out of 96 (21% - for which data were available) of urban poor households and 37 out of 100 (37%) rural poor households which were not poor before the crash but were poor after the event. This compares with less than 10% of post crash non-poor households were considered poor before the serious injury.

**Table 5-6: Bangladesh seriously injured household poverty status (income per capita)**

			post-crash			
			poor		not-poor	
Urban	pre-crash	<i>not known</i>	10	-	2	-
		poor	76	(79%)	7	(6%)
		not-poor	20	(21%)	106	(94%)
	Total post-crash		106	(n=96)	115	(n=113)
Rural	pre-crash	<i>not known</i>	20	-	16	-
		Poor	63	(63%)	14	(9%)
		not-poor	37	(37%)	141	(91%)
	Total post-crash		120	(n=100)	171	(n=155)

Again, it should be remembered that these are short-term impacts and based on the first months (0-12) after a serious injury. At the time of the survey in 2001, approximately 10 per cent of poor households had received compensation from the other party while only four families out of 536 had received any compensation from insurance companies for the serious injury sustained.

### 5.3 Bangalore

#### 5.3.1 Financial costs

##### 5.3.1.1 Bangalore bereaved households

Table 5-7 shows that the non-poor bereaved households reported medical costs much higher than the poor, which was as high as twice as much in rural areas. The non-poor also reported greater damage costs incurred than the poor, although neither these were found to be significant.

**Table 5-7: Bangalore road death direct costs (Rp) (US\$1 = Rp47)**

	Urban			Rural		
	poor	non-poor	sig.	poor	non-poor	sig.
Medical costs	18,454	27,834	ns	17,882	36,621	ns
Standard deviation	(28,519)	(51,494)		(23,315)	(91,343)	
Damage costs	3,650	7,788	ns	5,875	7,654	ns
Standard deviation	(3,132)	(20,252)		(9,428)	(13,251)	

Note: \*\*99% significance, \* 95% significance, † 90% significance, ns= non-significant

However, when medical costs are compared as a percentage of total household income, the poor are paying over 150 per cent more in urban areas and 72 per cent more in rural areas.

##### 5.3.1.2 Bangalore households with serious injuries

As with road deaths, non-poor households with a serious injury spent more on medical costs (see Table 5-8), although this was only significant in urban areas (90% significance). Again, when compared to household income, the poor were found to be paying proportionately almost twice as much as the non-poor in urban areas and 45 per cent more in rural areas. The poor claimed higher damage losses in urban areas but these too were not significant.

**Table 5-8 Associated costs of Bangalore serious injuries (Rp) (US\$1 = Rp 47)**

	Urban			Rural		
	poor	non-poor	sig.	poor	non-poor	sig.
Direct costs						
Medical costs	13,760	29,012	†	7,325	15,447	ns
Standard deviation	(25,380)	(60,291)		(6,620)	(24,268)	
Damage costs	11,450	6,328	ns	4,775	6,933	ns
Standard deviation	(26,041)	(15,814)		(10,552)	(17,482)	
Indirect costs						
Recovery (no. days)	87	68	ns	58	60	ns
School missed for under 16 (no. days)	103	47	ns	N/a	19	ns
Work days missed (no. days)	99	93	ns	93	73	ns
Able to return to job	71%	84%	ns	54%	67%	ns

Note: \*\*99% significance, \* 95% significance, † 90% significance, ns= non-significant

The majority of the seriously injured were able to return to their job. Rural poor households had less job security with fewer victims returning to their previous employment.

### 5.3.2 Consequences and coping strategy

#### 5.3.2.1 Bangalore bereaved households

Table 5-9 shows that the majority of households suffering a road death reported their household income had declined after the crash. The urban poor reported the highest percentage (88%) but there was no significant difference between the poor and non-poor. Rural households also reported a decline in food production.

The most common coping strategy adopted by the affected households was to borrow money. Three of every four urban poor bereaved households and over half non-poor urban households and rural poor households arranged a loan. In urban households, a majority of households also had to give up work or study after a death. Few families sold an asset or took on extra work, except for the urban poor where one in four households took on extra employment.

Overall less than one in five bereaved households received any compensation, including one in three rural poor households, the majority of which came from the other party. Of the total 243 bereaved families surveyed, only 30 (12%) received any compensation from insurance companies.

**Table 5-9 Household impacts from Bangalore road deaths**

		Urban			Rural		
		poor	non-poor	sig.	poor	non-poor	sig.
<b>Consequences</b>							
income decreased	yes	42 (88%)	112 (79%)	ns	19 (73%)	23 (82%)	ns
	no	6 (13%)	29 (21%)		7 (27%)	5 (18%)	
food production decreased	yes	n/a	n/a		19 (73%)	23 (82%)	ns
	no				7 (27%)	5 (18%)	
<b>Coping strategy/response</b>							
had to arrange loan	yes	35 (73%)	74 (53%)	*	14 (54%)	12 (43%)	ns
	no	13 (27%)	67 (48%)		12 (46%)	16 (57%)	
had to sell asset	yes	8 (17%)	9 (6%)	*	3 (12%)	3 (11%)	ns
	no	40 (83%)	132 (94%)		23 (89%)	25 (89%)	
gave up work or study	yes	32 (67%)	85 (60%)	ns	8 (31%)	14 (50%)	ns
	no	16 (33%)	56 (40%)		18 (69%)	14 (50%)	
took on extra work	yes	12 (25%)	14 (10%)	*	1 (4%)	4 (14%)	ns
	no	36 (75%)	127 (91%)		25 (96%)	24 (86%)	
Received compensation	yes	8 (16%)	26 (19%)	ns	9 (35%)	5 (18%)	ns
	no	40 (83%)	115 (82%)		17 (65%)	23 (82%)	

Note: \*\* 99% significance, \* 95% significance, † 90% significance, ns= non-significant

As in Bangladesh, more bereaved households were found to be poor after the loss of life than before (see Table 5-10). Of the 41 urban bereaved households who were identified as poor after the death and whose pre crash victim income was known, 29 (71%) were estimated to be not poor before the death but poor after the incident while among rural bereaved households, it was 9 of the 17 (53%) in this situation.

Although these involve small sample sizes with many missing values, the implication is that the majority of bereaved households were not poor before the fatal crash took place.

**Table 5-10 Bangalore bereaved household poverty status (income per capita)**

			post-crash			
			poor		not-poor	
Urban	pre-crash	<i>not known</i>	7	-	41	-
		poor	12	(29%)	0	(0%)
		not-poor	29	(71%)	100	(100%)
	Total post-crash		48	(n=41)	141	(n=100)
Rural	pre-crash	<i>not known</i>	9	-	6	-
		Poor	8	(47%)	0	(0%)
		not-poor	9	(53%)	22	(100%)
	Total post-crash		26	(n=17)	28	(n=22)

### 5.3.2.2 Bangalore households with a serious injury

Seven of ten poor households with a serious injury reported a decrease in their income, and in urban areas, this was significantly higher than non-poor households (95% significance). Rural households appeared better able to maintain their food production than income with a minority claiming food production had decreased (see Table 5-11).

**Table 5-11: Household impacts from Bangalore serious injuries**

		Urban			Rural		
		poor	non-poor	sig.	poor	non-poor	sig.
<b>Consequences</b>							
income decreased	yes	33 (70%)	218 (57%)	*	17 (71%)	41 (63%)	ns
	no	14 (30%)	163 (43%)		7 (29%)	24 (37%)	
food production decreased	yes	n/a	n/a		10 (42%)	23 (35%)	ns
	no				14 (58%)	41 (63%)	
<b>Coping strategy</b>							
Had to arrange loan	yes	31 (66%)	191 (50%)	ns	16 (67%)	36 (55%)	ns
	no	16 (34%)	190 (50%)		8 (33%)	29 (45%)	
Had to sell asset	yes	10 (21%)	52 (14%)	ns	10 (21%)	52 (14%)	ns
	no	37 (79%)	330 (86%)		19 (79%)	56 (86%)	
gave up work or study	yes	42 (89%)	334 (87%)	ns	17 (71%)	57 (88%)	†
	no	5 (11%)	48 (13%)		7 (29%)	8 (12%)	
took on extra work	yes	1 ( 2%)	8 ( 2%)	ns	3 (13%)	4 ( 6%)	ns
	no	46 (98%)	374 (98%)		21 (88%)	61 (94%)	
Received private compensation	yes	4 ( 8%)	27 ( 7%)	ns	3 (13%)	5 ( 8%)	ns
	no	43 (92%)	355 (93%)		21 (88%)	60 (92%)	

Notes: \*\* 99% significance; \* 95% significance, † 90% significance, ns= non-significant  
 'No' includes "do not know" as well as "no"

The vast majority of households with a serious injury had to have at least one member give up work or study to care for the injured, including nine out of ten urban poor households. Two-thirds of poor households also had to borrow money to cope with the increased medical costs and reduced earnings, compared to half of non-poor households. One in five poor households and one in seven non-poor households sold an asset to raise money following a serious injury. As with bereaved households, few households with a serious injury received any compensation (8%). Only 12 (2%) had received any compensation from insurance companies at the time of the survey.

As with bereaved households, many households suffering a serious injury were found to be poor after the incident but not before (see Table 5-12). This included four of 23 urban poor households (17%) and three of 12 (25%) rural households that became poor. However, again as with bereaved households, there are many missing values for the victim's pre-crash income.

**Table 5-12: Bangalore seriously injured household poverty status (income per capita)**

			post-crash			
			poor		not-poor	
Urban	pre-crash	<i>not known</i>	24	-	136	-
		poor	19	(83%)	0	(0%)
		not-poor	4	(17%)	246	(100%)
	Total post-crash		47	(n=23)	382	(n=246)
Rural	pre-crash	<i>not known</i>	12	-	34	-
		Poor	9	(75%)	0	(0%)
		not-poor	3	(25%)	31	(100%)
	Total post-crash		24	(n=12)	65	(n=31)

## 6 Summary and conclusions

### 6.1 Summary

This study considered the impact of road crashes on the poor in Bangladesh and Bangalore, India. In Bangladesh, the survey was nationwide and all casualties were identified by the household surveys. In the Bangalore study, a slum and upper middle class neighbourhood were surveyed in Bangalore city, while the rural sample came from a Bangalore rural district. These locations are also at different levels of motorisation and economic prosperity. With 1.5 million motor vehicles registered, Bangalore city alone has more than three times the number of motor vehicles of Bangladesh. In light of the different survey approaches and the different stages of development, the case study summaries are presented separately below. The summary findings apply equally to the poor and non-poor, except where stated.

#### 6.1.1 *Involvement of the poor*

It is worth repeating that the findings summarised below are based on the post crash household per capita income and the official local poverty definition.

##### 6.1.1.1 *Bangladesh*

- The poor are estimated to be involved in over half of all road deaths (54%).
- Based on the information available, the poor did not appear to be statistically significantly over-represented in fatal and serious injury road crashes. However, when trip rate differences between poor and non-poor households (derived from earlier research) are taken into account, the poor may well be at greater risk.
- The number of road deaths and serious injuries is estimated to be 34 times that officially reported so many more people, including the poor, are affected.
- For every road death, there were between 8 (rural) to 19 (urban) serious injuries reported.
- Most deaths and serious injuries to the poor involve VRU's, and while pedestrians were the most common road death, many serious injuries involved rickshaws.
- Males in the prime of life are confirmed to be the main victim of fatal and serious road crashes.
- Among the poor, children accounted for one in four deaths and one in six serious injuries (39% of total population are under age 14).
- Most victims, both poor and non-poor, were working full-time in business or service or were studying.

##### 6.1.1.2 *Bangalore*

- The poor reported a higher incidence of road deaths in both urban and rural areas with significant differences in rural households. The non-poor were found to have higher involvement rates with serious injuries.
- Only a fraction of serious injuries are recorded by the police.
- The poor reported only 5 (rural) to 11 (urban) serious injuries for every road death, half the ratios of those reported by the non-poor.
- Two modes dominated road deaths and serious injuries. Pedestrians were the most common road user mode involved for the poor while the non-poor tended to be motorcyclists.
- Over half of all killed and seriously injured occurred to the young--middle age adults. More casualties occurred to those over the age of 45 than to children.
- The vast majority of casualties was reported to have been working full-time. Although the non-poor were more likely to have skilled or professional employment, and the poor were more likely to have unskilled jobs, the difference was significant only with urban deaths.



## **6.1.2 Impact on households**

### **6.1.2.1 Bangladesh**

- When compared to household income, poor bereaved households paid more on funerals and medical treatment.
- Fewer seriously injured poor were able to return to their job and spent between 27-57 days searching for new work. Over seven out of ten poor bereaved families suffered a decrease in household income, food consumption and living standard.
- The majority of poor bereaved households went into debt (or further debt) after a road death, compared to only one-fourth of urban non-poor bereaved families and one-third of rural non-poor bereaved families (95% significance).
- One third of poor households also sold an asset after a road death (90% significance in urban areas), while one-third of urban poor bereaved households also took on extra work (95% significance).
- While fewer households reported negative impacts following a serious injury, the majority of poor households still reported a decrease in income, food consumption and living standard (95% significance), with the rural poor suffering the most.
- As with bereaved households, the majority of poor households with a serious injury relied on borrowing money (63%), while selling an asset was the second most common response (29% urban poor, 37% rural poor).
- Road crashes appear to be a trigger for poverty; among bereaved households 33% of urban poor and 49% of rural poor bereaved households were not believed to be poor before the crash. Among seriously injured households, 21% urban poor and 37% rural poor were estimated to be not poor before the serious injury occurred.

### **6.1.2.2 Bangalore**

- While the non-poor reported paying more than the poor in medical costs, this was only significant in the case of urban serious injuries.
- On average, between 4-6 months of schooling was missed by a seriously injured victim of school age.
- Although the majority of seriously injured were able to return to work, almost half of the rural non-poor had to find new jobs.
- Majority of poor households had to borrow money after a road death or serious injury.
- Majority of urban bereaved households and almost all households with a serious injury reported having to give up work or study.
- Very few bereaved or injured had received compensation at the time of the survey.
- Fatal and serious injury crashes had a devastating effect on many households with 71% of urban poor and 53% of rural poor bereaved households estimated to be not poor before the crash. Among the seriously injured poor households, 17% of urban and 25% of rural households were not poor before the serious injury.

## **6.2 Recommendations**

Although this was a relatively small study, many of its findings have confirmed previous research, including the high involvement of VRU casualties and the serious problem of under-reporting. The common assumption that VRU's, especially pedestrians, are a proxy for the poor has also been upheld.

Four key areas are addressed below:

- Epidemiology
- Prevention
- Post crash care

- Access to justice

These are intended to improve the understanding of the problem (including its size), and promote actions that will reduce the risk and medical and social consequences of a road crash, especially to the poor.

### **6.2.1 Epidemiology**

Whilst there may now be greater understanding of the global road death toll, official police recorded data are still used to estimate the individual national burden. No low-income country is believed to incorporate hospital or community surveys in their estimate of road deaths and injuries, although Uganda has begun requiring hospitals to monitor the number of road traffic casualties. Until this is done, the true toll of road crashes on the community, and especially the poor, will be severely underestimated.

More community surveys in low income studies are also needed to estimate the actual number of those being killed and injured in road crashes. While these are more costly, they may be more likely to include the poor than hospital surveys. In the interim, while an adjustment factor for road deaths may not be possible, estimates of the number injured in road crashes should be based on accepted injury to death ratios.

### **6.2.2 Road traffic injury prevention**

A very high proportion of the poor are being killed and seriously injured as VRU's, especially while walking. Accordingly road safety prevention efforts should be targeted at reducing the risk to VRUs. This should include such key actions as road safety audits being integrated into road rehabilitation programmes. Road safety audits check the collision potential of any road improvements, including that to VRUs.

It should be noted that while VRU safety should be the priority, this is not the same as making VRU's the target audience for all road safety interventions. Children and pedestrians may account for a large per cent of the number of casualties but they are also the vast majority of the population. By comparison, there are many fewer motor vehicle drivers and owners who are involved in fatal and serious injury crashes. For example, in Uganda a juvenile (under the age of 18) has a 1 in 8000 annual chance of being killed or seriously injured in a road crash, whereas a driver has less than a 1 in 100 annual chance of being involved in a fatal or serious injury crash (TRL, 2004). Instead of trying to change the behaviour of millions of children in order to save hundreds of their lives, a more logical approach would be to target drivers and owners who will be adults and on average, much better educated and more affluent than the potential casualties.

Owners and drivers should also be the target group to increase seatbelt usage as many motor vehicle occupant casualties, including those to the poor, could be avoided with the use of seatbelts. With most passengers in buses (including mini and minibuses), seatbelt enforcement was not thought to be possible. Kenya, with its recent introduction of seat belt requirements for matatus (mini-buses), has shown otherwise. Lessons should be learnt from Kenya (lead time, publicity campaign, tax exemption, etc.) to help other countries increase seat belt usage.

### **6.2.3 Post-crash medical care**

Post-crash care cannot be ignored with road deaths expected to increase by over 80 per cent in low and middle income countries in the next few decades (WHO, 2004). The injured and the burden on carers and their households will also increase and the vast majority of these are unlikely to be prevented. As with all other health and social problems (i.e. WHO's "3 by 5 campaign" for 3 million HIV sufferers to receive anti-retroviral medication by 2005), investment must be made in containing the damage and improving the injured and bereaved families' chances of recovery.

Road safety plans and strategies need to include actions that improve pre hospital emergency medical services as well as acute care in hospitals and rehabilitation services.

#### **6.2.4 Access to justice**

In the vast majority of countries, more lives are lost on the road than by murder and the police will be responsible for investigating more road deaths than other suspicious deaths (Aeron-Thomas, 2003). As road crashes have traditionally been considered as ‘accidents’, they have not ranked high in police priorities. To the bereaved family however, there is no difference in the outcome, i.e. a sudden unnatural and unnecessary death to a loved one. Lack of confidence in the judicial system results in victims not reporting road crashes to the police and accepting private out of court settlements which may be timely rather than adequate. Fatal and serious road traffic crashes need to be investigated properly, with culpable drivers prosecuted for the community to believe life is not cheaper on the road.

Support services that are beginning to be established for both victims of crime, such as domestic and sexual violence victims, and victims of disease (HIV) should also be extended to the bereaved and grievously injured road traffic victims. Likewise restorative justice programmes should consider including road traffic crashes as many drivers may be more culpable than criminal and the victims, especially the poor, may be more in need of financial compensation than seeing a driver imprisoned. Civil compensation policies that assume drivers to be liable for crashes involving cyclists and pedestrians should facilitate faster compensation to VRU victims. Compensation procedures need to be publicised in order for the public to be aware of their rights and funds established for hit and run victims.

#### **6.2.5 Concluding remarks**

This study has provided evidence that while the poor may not be at increased risk to road death and serious injury, many of the households identified were not poor before the road death and serious injury. With the most common victim being the main source of household income, this is not surprising. Nevertheless, the fact that many non-poor households become poor following a family member’s involvement in a road crash is obviously hindering national and international efforts to reduce poverty significantly.

Many of the above recommendations are, of course, not new. The call to improve alternative data sources to that of the police dates back many years and has been a common theme in the last decade. Similarly, road safety audits have been promoted for several years as they balance the traditional road construction and maintenance focus on motorised traffic and ensure that the safety needs of all, including those on the roadside who are not travelling, are considered. More comprehensive studies are, however, still required in low income countries to investigate the involvement of the poor in road crashes and the impact that these crashes have on the families affected. It is hoped that with the long awaited involvement of the health sector, data can be improved and additional resources can be invested in prevention and control of road traffic injury with a greater focus on the casualties and their families.

## References

- Aeron-Thomas A. (2000), Under-reporting of road traffic casualties in low income countries, Unpublished Project Report PR/INT/199/00, TRL, Crowthorne.
- Aeron-Thomas A (2002), The role of the motor insurance industry in preventing and compensating road casualties. TRL - Department for International Development, London, UK.  
[http://www.transport-links.org/transport\\_links/filearea/documentstore/301\\_Insurancefinalreport.PDF](http://www.transport-links.org/transport_links/filearea/documentstore/301_Insurancefinalreport.PDF)
- Aeron-Thomas A (2003), Community traffic policing. PR/INT/265/2003 TRL Crowthorne - Department for International Development, London.  
[www.transport-links.org/transport\\_links/filearea/documentstore/325\\_scoping%20study%20final%20report%20V3.pdf](http://www.transport-links.org/transport_links/filearea/documentstore/325_scoping%20study%20final%20report%20V3.pdf)
- Alfaro, J-L., Chapuis, M., Fabre, F. (Eds) (1994). COST 313: Socioeconomic cost of road accidents, Report EUR 15464 EN, Brussels, Commission of the European Communities.
- Atkins, W. S. (1998). Pedestrian accidents vulnerability in developing countries. DFID Research Project Number R6236 (Unpublished Report), Epsom, Surrey.
- Ayati E, and W Young (2002), 'Estimation of the cost of rural road crashes in a developing country', Traffic Engineering and Control, February 2002, pg 56-60.
- Babtie Ross Silcock and TRL (2003). Guidelines for Estimating the Cost of Road Crashes in Developing Countries. Project R7780. Department for International Development, London, UK  
[http://www.transport-links.org/transport\\_links/filearea/documentstore/105\\_R%207780.PDF](http://www.transport-links.org/transport_links/filearea/documentstore/105_R%207780.PDF)
- Bangladesh Police (2001). Traffic Accident National Report 2000. Dhaka
- Bangladesh Road Transport Authority (2002), Road casualty statistics for 2001, unpublished data, Dhaka.
- Bester, C (2000). Comparing road fatalities on three continents. Proceedings of the conference Road Safety on Three Continents, Pretoria, South Africa.
- Booth D, L Hanmer, E Lovell (2000), Poverty and Transport (draft), The World Bank Transport and Poverty Alleviation Workshop, June 13, 2000, Washington, DC.
- Christie N (1995). Social, economic and environmental factors in child pedestrian accidents: A research review. TRL Project Report 116, TRL, Crowthorne.
- Christie N (1995). The high risk child pedestrian: socio-economic and environmental factors in their accidents. TRL Project Report 117, TRL, Crowthorne.
- de Haan, M.L. (1992) An estimate of the unit cost of road traffic collisions in South Africa for 1991, South Africa Road Board, Project Report, PR-91/113/1, Pretoria, Department of Transport.
- DETR (2000). Tomorrow's roads - safer for everyone: the Government's road safety strategy and casualty reduction targets for 2010. Department of Environment, Transport and the Regions, London
- Department for Transport (2004), Tomorrow's roads: safer for everyone: The first three year review, Department for Transport, London.
- Evans, T and Brown, H. (2003). Road traffic crashes: operationalizing equity in the context of health sector reform. Injury Control and Safety Promotion 2003, vol 10, No 1-2, pp. 11-12.
- Fouracre P and D Maunder. (1987) Travel demand characteristics in three medium sized Indian cities TRRL SR 121. Transport and Road Research Laboratory, Crowthorne.

Ghee, G. Silcock, D. Astrop, A. and Jacobs, G. (1997). Socio-economic aspects of road accidents in developing countries. TRL Report 247. Transport Research Laboratory, Crowthorne.

Hasselberg M, Laflamme L, Weitoft GR. (2001). Socioeconomic differences in road traffic injuries during childhood and youth: a closer look at different kinds of road user. *J Epidemiol Community Health*. 2001 Dec; 55(12):858-62.

Hijar, M, Arredondo, A, Carrillo, C and Solorzano, L (2004). Road traffic injuries in an urban area in Mexico. An epidemiological and cost analysis. *Accident Analysis and Prevention*, V36, N1, p37 – 42.

Híjar, M, Vazquez-Vela, E and Arreola-Rissa, C. (2003) Pedestrian traffic injuries in Mexico: A country update. *Injury Control and Safety Promotion* 10.1–2 (2003): 37–43.

Hills, P. J. and Jones-Lee, M. (1980) The costs of traffic accidents and the valuation of accident prevention in less developed countries, A Report to the World Bank, University of Newcastle upon Tyne.

International Federation of Red Cross and Red Crescent Societies (1998), World Disasters Report, Oxford University Press, Oxford, UK.

Jacobs G, I Sayer, D Maunder, A Astrop and A Downing, (1999), Transport Safety for the Poor. TRL Unpublished Project Report PR/OSC/154/99, Transport Research Laboratory, Crowthorne.

Jacobs, G D, D A C Maunder and P R Fouracre, (1980). Transport problems of the urban poor in developing countries. World Conference on Transport Research, London.

Jacobs, G D, A Aeron-Thomas and A Astrop (2000). Estimating global road fatalities. TRL Report 445. Transport Research Laboratory, Crowthorne.

Johnston, I R, Campbell, B J, Mohan, D, Tiwari, G, Petrucelli, E, Mackay, G M, Knight, P R, Trinca, G W, Mclean, A J and Haight, F A (1998). Reflections on the transfer of traffic safety knowledge to motorising nations. Global Traffic Safety Trust, Vermont South, Victoria, Australia.

Kopits, E and Cropper, M L (2003). Traffic fatalities and economic growth. World Bank Working Paper No: 3035. World Bank, Washington.

Laflamme, L and Diderichsen, F. (2000). Social differences in traffic injury risks in childhood and youth – a literature review and a research agenda. *Injury Prevention*. 2000 Dec;6(4):293-8.

Laflamme, L and Engstrom, K. (2002). Socioeconomic differences in Swedish children and adolescents injured in road traffic incidents: cross sectional study. *BMJ*, February 16, 2002; 324(7334): 396 - 397.

Linh C. Le, Cuong V. Pham, Linnan, M J, Dung V. Do, Phuong N. Le, Hanh H. La and Anh V. Le. (2002). Vietnam profile on traffic-related injury: facts and figures from recent studies and their implications for road traffic injury policy. Road Traffic Injuries and Health Equity Conference, Cambridge, Massachusetts, USA.

Mackay, M and Wodzin, E. (2002). Global priorities for vehicle safety. International Conference on Vehicle Safety 2002: IMechE conference transactions. London, England, Institution of Mechanical Engineers, 2002, p. 3-9. Report No.: C607/016/2002.

Maunder D. and P. Fouracre. (1981) Household and travel characteristics in residential areas of Delhi. TRRL SR 673. Transport and Road Research Laboratory, Crowthorne.

Maunder D. (1984) Trip rates and travel patterns in Delhi, India. TRRL Research Report No.1. Transport and Road Research Laboratory, Crowthorne.

Maunder D. A.C (1986). Public transport needs of the urban poor in Delhi, CODATU 3, Cairo, Egypt. CODATU. Vaux-en-Velin, Cedex, France

Miller (2001) Assessing the burden of injury: Progress and pitfalls. *Injury Prevention and Control*, edited by D Mohan and G Tiwari, Oxford University Press, New Delhi.

- Mock C N, Forjuoh S N, Rivara F P (1999). Epidemiology of transport related injuries in Ghana. *Accident Analysis and Prevention*, 31: 359-370.
- Mock C N, S Gloyd, S Adjei, F Acheampong, O Gish, Economic consequences and resulting family coping strategies in Ghana, *Accident Analysis and Prevention*, 35 (2003) 91-90.
- Mohan, D (1989). Road safety in low income countries. *Journal of Traffic Medicine, International Association for Accident and Traffic Medicine, Uppsala, Sweden*, V17 N3-4. p1-2.
- Mohan, D (2001), Social cost of road traffic crashes in India. 1st Safe Community-Conference on Cost Calculation and Cost-effectiveness in Injury Prevention and Safety Promotion, 30 September-3 October 2001, Viborg County, Denmark.
- Morren L (2003), 'Can road safety contribute to poverty alleviation, Asia Injury Prevention Foundation, [www.asiainjury.org/html/p3\\_poverty\\_initiatives.html](http://www.asiainjury.org/html/p3_poverty_initiatives.html)
- Murray C and Lopez A (1996), *The global burden of disease. Vol. 1. World Health Organisation/Harvard School of Public Health, Boston.*
- Nantulya, VM and Muli-Musiime, F. (2001) Kenya. Uncovering the social determinants of road traffic accidents. In: *Challenging Health Inequities: From Ethics to Action*. Editors: Evans, T., Whitehead, M., Diderichsen, F., Bhuiya, A., Wirth, M. New York: Oxford University Press. pp 211-225
- Nantulya, V M and Reich, M R. (2002). The neglected epidemic: road traffic injuries in developing countries. *British Medical Journal*, Volume 324, p1139 – 1141..
- Nantulya, V M and Reich, M R. (2003). Equity dimensions of road traffic injuries in low-and middle-income countries. *Injury Control and Safety Promotion 2003*, Vol 10, No. 1 – 2, pp.13-20.
- Odero, W, Khayesi M and Heda P M. (2003). Road traffic injuries in Kenya: Magnitude, causes and status of intervention. *Injury Control and Safety Promotion 2003*, Vol 10, No. 1 – 2, pp.53-61.
- Palmer, C. J. Astrop, A. J. and Maunder, D. A. C. (1997). Constraints, attitudes and travel behaviour of low income households in two developing cities. *TRL Report 263. Transport Research Laboratory, Crowthorne.*
- Pearce, T. Maunder, D. A. C Mbara, T. C. and Babu, D. M. (1998). Road safety for buses. Paper presented at CODATU VIII Conference, Cape Town, South Africa.
- Peden, M., Hyder, A. (2002) Road traffic injuries are a global public health problem, *BMJ Volume 324, War on the Roads*, 11 May 2002, pg1153.
- Rahman A, AKM Fazlur Rahman, Shumona Shafinaz, Michael Linnan (2003), (draft) Report on the Bangladesh Health and Injury Survey, ICMH, UNICEF and TASC/CDC
- Report of the Road Traffic Injuries and Health Equity Conference (2002) Cambridge, Massachusetts, USA.
- Rodriguez, D Y, Fernandez, F J and Velasquez, H A. (2003). *Injury Control and Safety Promotion 2003*, Vol 10, No. 1 – 2, pp.29 - 35.
- Roberts, I, Norton, R., and Taua, B. (1996). Child Pedestrian Injury Rates; the Importance of "Exposure to risk relating to socio-economic and ethnic differences in Auckland, New Zealand. *Journal of Epidemiology and Community Health*, 50, pp. 162-165.
- Roberts, I and C. Power, (1996). Does child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991. *British Medical Journal*, 313:714-786.
- Sayer, I. A. and Downing, A. J. (1996). Pedestrian accidents and road safety education in selected developing countries. *TRL Report 227. Transport Research Laboratory, Crowthorne.*

St. Bernard, G and Matthews, W. (2003) A contemporary analysis of road traffic crashes, fatalities and injuries in Trinidad and Tobago. *Injury Control and Safety Promotion* 10.1–2 (2003): 21–27.

Suriyawongpaisal, P, and Kanchanasut, S (2003) Road traffic injuries in Thailand: Trends, selected underlying determinants and status of intervention. *Injury Control and Safety Promotion* 2003, Vol 10, No. 1 – 2, pp.95 - 104.

Swati, S. M. and Downing, A. J. (1981). Bus driver training pilot study. NTRC Report 62. National Transport Research Centre, Islamabad, Pakistan.

Trawen A, Maraste P, Persson U. (2002) International comparison of costs of a fatal casualty of road accidents in 1990 and 1999. *Accident Analysis and Prevention*; 34(3): 323-332.

Transport Research Laboratory (1995), Overseas Road Note 10. Costing road accidents in developing countries (1995). Transport Research Laboratory, Crowthorne.

TRL (2003), Bangladesh Road Crash Costing Discussion Document, TRL, Crowthorne.

TRL (2004), Fact Sheet on Road Crashes in Uganda, TRL Production of Engineering Specifications, Standards and Institutional Strengthening Project, Kampala.

UN (2001), World Population prospects, The 2000 Revision Highlights, pp 47-50.

Weinstein, J (2003a). Cambodia Road Traffic Crash Study, (Unpublished Report) World Bank. Washington.

Weinstein J (2003b), draft literature review on impact of road crashes and the poor, World Bank, Washington.

Weiss N A (2002) SPSS Manual, 6/E. ISBN: 0-201-73713-2. Addison-Wesley. Reading, Massachusetts.

WHO (1999). The World Health report 1996. Making a difference. World Health Organisation, Geneva./ Harvard School of Public Health / World Bank. Boston.

WHO (2004). World Report on road traffic injury prevention. ISBN 02 4 156260 9, World Health Organisation ,Geneva

WS Atkins (1998), Pedestrian accidents vulnerability in developing countries, DFID Research Project Number R6236 (Draft), Epsom, Surrey.

Zhiming X (2003), 'Progress on China's Roads, China Daily, November 3, 2003.

Zhou, Y, T D Baker, Rao, K and Li, G. (2003). Productivity loss from injury in China. *Injury Prevention* 2003; 9: 124 -127.

## Appendix A: Road victim survey variables

<u>Bangladesh</u>	<u>Bangalore</u>
Road user mode	Casualty age
Household role	Casualty sex
Casualty sex	Date of crash
Casualty age	Crash location
Treatment type	Road type
Total cost	Road user mode
Job time/pattern before crash	Other mode
Monthly salary before crash	Crash helmet worn
Funeral cost	Was crash reported to police
Household income impact	How badly injured
Food consumption impact	Place of death
Food production impact	No. hours after crash before dying
Living standard impact	No. days after crash before dying
Loan required	Pre-crash occupation
Sell asset	Returned to previous occupation
Work/education foregone	Pre-crash work pattern
Additional work required	Post crash work pattern
Value damaged assets	Pre-crash salary
Private compensation	Current salary
Insurance compensation	% household income contributed
Compensation paid out	Household income decline
Place of death	Household food production decline
Job type before crash	Medical costs
Reported to police	Missed work days
Survival duration	Missed school days
Job absentee due to injured	Borrow money
Job absentee due to looking for new job	From whom and how much
Job type after crash	Sell asset
Job time/pattern after crash	Amount sold
Could return to old job	Asset type
Monthly salary after crash	Carer's work/education foregone
Passenger type	Additional employment required
	Damaged property
	What kind of damaged property
	Damage cost
	Compensation
	Compensation amount



## Appendix B: Road death recall

**Table B-1 Bangladesh number of households by date of death**

Crash year	Urban			Rural			Urban & Rural		
	poor	non-poor	total	poor	non-poor	total	poor	non-poor	total
2001	7	1	8	11	14	25	18	15	33
2000	4	8	12	24	10	34	28	18	46
1999	5	11	16	13	16	29	18	27	45
1998	3	6	9	18	14	32	21	20	41
1997	4	4	8	9	7	16	13	11	24
1996	1	2	3	9	3	12	10	5	15
Total	24	32	56	84	64	148	108	96	204

Note: 1996 and 2001 are part years, hence lower numbers.

**Table B-2 Bangalore number of households by date of death**

Crash year	Urban			Rural			Urban & Rural		
	poor	non-poor	total	poor	non-poor	total	poor	non-poor	total
2002	1	3	4	0	0	0	1	3	4
2001	2	3	5	9	7	16	11	10	21
2000	1	0	1	1	5	6	2	5	7
1999	2	4	6	5	4	9	7	8	15
1998	3	7	10	4	4	8	7	11	18
1997	1	2	3	5	5	10	6	7	13
1996	0	0	0	1	3	4	1	3	4
1995	0	0	0	1	0	1	1	0	1
Total	10	19	29	26	28	54	36	47	83

Note: 1995, 1996, 2001 and 2002 are part-years.

This is limited to those deaths identified by the household surveys and does not include those identified by police records.

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