



The burden of road traffic injuries in developing countries: the 1st national injury survey of Pakistan

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KEYWORDS

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Summary Objectives: To assess the burden of road traffic injuries in Pakistan—a developing country in South Asia. **Methods:** A nationally representative household interview survey, to measure the burden of all injuries for all ages and in both genders using a three-month recall period. **Results:** The overall incidence of injury events was 41 (CI: 39.2-43.8) per 1000 per year and for road traffic injuries 15 (CI: 13.7-16.5) per 1000 per year. The relative risk for road traffic injuries was found to be higher in males, those 16-45 years old, and those in the professional category of laborers and vendors. **Conclusions:** This first national survey reflects the growing impact of injuries, especially road traffic injuries in Pakistan and portends a challenge for the national health system.

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Introduction

At the dawn of the new century, injuries are increasingly recognized as a major public health problem. They are also predicted to be the one of the most daunting challenges, as health systems, in general, are least prepared to respond to this issue.¹ Injuries kill and maim people, destroy families, and devastate communities in the process. Many of the injured suffer life long disability, physical disfigurement, and in addition financial ruin. There are an estimated 10 million motor vehicle crashes annually worldwide.² Where

estimates are available, injuries due to motor vehicle crashes are the leading cause of healthy years of life lost and are the leading cause of death in adolescents and young adults in the world. Nearly three quarters of deaths resulting from these crashes occur in developing countries.^{1,2}

Prevention of road traffic injuries in the developing world has been hampered by limitations of knowledge, absence of reliable estimates of the current level of injuries, and traditionally restrictive views on health and disease.³ This situation exists because research for the reduction of traffic injuries is funded at a disproportionately lower level than other health issues.⁴ In addition, governments have not viewed the problem of road traffic injuries as a public health problem, but primarily as a transport or police sector issue. In the absence of

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any reliable estimates, available information is based mostly on hospital experience and police records and is obviously incomplete and un-representative. Sound assessment of public interest in health matters and informed discussion of related policy, presupposes that reasonably accurate data are available on population and health profile. In the absence of reliable vital registration data and inadequate health facility based information, population based surveys have been extensively used to provide information for calculating key health indicators.⁵

The National Injury Survey of Pakistan (NISP) was undertaken to define the incidence of injuries in the Pakistani population, and to estimate the burden of injuries on the country. The survey objectives were to establish the epidemiology of injuries in Pakistan by describing the frequency and distribution of injuries by age, sex, location, residence, educational status, and profession; and identifying those groups, which have a relatively higher risk for injury. Given these objectives, this survey attempts to provide new knowledge in the field of injuries in developing countries, and is policy relevant. This paper describes the results of NISP pertinent to road traffic injuries.

Methods

NISP is a retrospective injury survey of a representative sample of Pakistani households to identify injuries and injury related deaths. The outcome of an injury was measured in terms of morbidity, mortality, and disability. The definition of injury was any type of injury on any part of the body, in the last three months resulting in the seeking of treatment (care) in a health care setting (including the informal sector), or the inability to perform at least half a day of usual work. This definition includes persons who died on the spot due to an injury, or died because of an injury during the study period. The risk factors examined in NISP are age, sex, residence, education, and occupation. The respondent of the questionnaire was the head of the household and the oldest woman in the house. In the event that respondents were not available at the first visit of the enumerator, the household was revisited according to the convenience of the respondent. All cases of injuries that occurred in the last three months were counted. The study was launched exactly three months after a Muslim festival (Eid-ul-Azha) to assist recall and the survey was conducted in Pakistan in the summer of 1997 (June-July).

The study universe consisted of all households belonging to the rural and urban areas of all the four provinces of Pakistan and the capital area, as defined in the 1981 population census. This excluded certain tribal and military areas, constituting about 4% of the total population—a sample that has been used for all national surveys in the country.^{6,7} The sample design was a stratified, cluster, and systematic sample of all households in the study area. The stratification was done based on three categories of major cities (greater than 100 000 population), semi-urban areas, and rural areas, and was aimed at producing overall injury estimates for each strata. Although the unit of sampling was a household, the unit of analysis was an 'injured person,' within three months before the survey.

The primary sampling unit was the enumeration blocks (of the Federal Bureau of Statistics master sampling frame) in all urban areas, and villages in rural areas. The sample in all urban areas was selected with a probability proportional to the number of households, while the sample in rural areas was selected with a probability proportional to the population enumerated in the 1981 census. The secondary sampling units were households based on a master sampling frame developed by the Federal Bureau of Statistics and used for national sampling.⁸ The purpose of this study was to estimate the magnitude of all types of injuries (motor vehicle, assaults, falls, burns, poisoning, suicide, and drowning) at the national level. Therefore, using an estimated prevalence of 40 per 1000, a 1% precision at 95% confidence levels, a three-month recall period and adjusting for design effects, the effective sample size was calculated to be 30 000 persons. This sample size uses a multiplier of 1.5 in order to accommodate for the design effect, because we sampled clusters of households at the primary sampling units while analyzed for individuals. In addition, this included a strata-specific sample to yield meaningful estimates for major urban, other urban and rural areas, and translated into an effective sample of 4500 households.

The information about injuries was obtained with the help of a structured questionnaire. The questionnaire was developed in English language and translated into Urdu, Punjabi, Sindhi, Baluchi, and Pushto. During the field testing it was realized that 'forward and backward' translation, in fact, introduced biases due to dialectical and linguistic incongruence. Therefore, it was decided to carry out the survey using the English version of the questionnaire to minimize this translation bias. To maximize the output it was decided that every

Table 1 Distribution of road traffic, and all injuries by age in Pakistan (NISP 1997).

Category	Incidence per 1000 person per year		Relative risk	
	Road traffic	All	Road traffic	All
Age				
Less than 15 years (N = 12 902)	8.7	35.3	Reference category (RR = 1.0)	
16-45 years (N = 12 800)	21.6	45.6	2.48** (1.57, 4.0)	1.29* (1.00, 1.66)
46-59 years (N = 1792)	15.6	49.1	1.79 (0.66, 4.21)	1.38 (0.83, 2.20)
60 years and above (N = 1432)	14.0	50.3	1.60 (0.48, 4.22)	1.42 (0.81, 2.35)

Source: NISP 1997-99. *0.01 < p < 0.05; **p ≤ 0.01.

enumerator should be good in English and must know the local language. This made the Federal Bureau of Statistics enumerators' ideal candidates, because all of them had bachelor degrees and were residents of local areas. A written training manual was prepared in English as well as in Urdu for the ready use of enumerators.

Data entry, cleaning, and exploration were done at a central location in Islamabad and quality control procedures were implemented at all stages. Injury rates (incidence) were calculated by age, sex, profession, educational status, and place of residence (strata). Annual rates for the country were generated using 128.4 million as the total population of Pakistan in 1997.⁷ Strata and risk factor analysis was done and tests of significance were conducted using a statistical package (SPSS for windows).⁹ This survey was approved by the institutional ethics committees at Johns Hopkins School of Public Health, USA and the Health Services Academy in Pakistan.

Results

Three hundred persons were found injured in the surveyed population of 28 926 over a three-month

recall period reflecting an all-injury incidence of 41.2 per 1000 persons per year (CI: 39.2-43.8) in the civilian (non-institutional) population of Pakistan for 1997. The incidence for all injuries was 41.3 for rural, 46.3 for urban, and 35.2 per 1000 per year for the semi-urban strata. The mean age of the injured was 23.9 years (standard deviation of 18) and 76% were males. On the average, 17 workdays were lost per person because of an injury. This included an average length of stay in a health care facility per injury per person of 2.3 days, and recovery time at home (post-discharge) of 14.8 days.

Tables 1-4 describe the incidence and relative risk for all type of injuries with disaggregated information for transport (road traffic) injuries. From here onwards, the focus of result presentation and discussion would be restricted to road traffic injuries only. NISP data revealed that rate of road traffic injuries was 15.1 per 1000 (CI: 13.7-16.5) for 1997. The incidence of road traffic injuries was highest in those 16-45-years-old and the risk of road traffic injuries was 2.5 times higher in this age group as compared to children (Table 1). The overall injury rate increases as age increases, but the trend is not statistically significant. Road traffic injuries in males contributed almost three times more than

Table 2 Distribution of road traffic, and all injuries by gender and place of residence in Pakistan (NISP 1997).

Category	Incidence per 1000 person per year		Relative risk	
	Road traffic	All	Road traffic	All
Gender				
Female (N = 13 838)	6.9	20.8	Reference category (RR = 1.0)	
Male (N = 15 088)	22.5	60.4	3.24** (2.04, 5.34)	2.90** (2.21, 3.84)
Place of residence				
Semi-urban (N = 8068)	14.4	35.2	Reference category (RR = 1.0)	
Rural (N = 11 098)	14.1	41.3	0.978 (0.59, 1.64)	1.18 (0.87, 1.62)
Urban (N = 9760)	16.8	46.3	1.17 (0.70, 1.95)	1.31 (0.97, 1.79)

Source: NISP 1997-99. **p ≤ 0.01.

Table 3 Distribution of road traffic, and all injuries by educational status in Pakistan (NISP 1997).

Category	Incidence per 1000 person per year		Relative risk	
	Road traffic	All	Road traffic	All
Educational status				
Six years or more schooling (<i>N</i> = 1944)	12.3	30.9	Reference category (RR = 1.0)	
No education (<i>N</i> = 6806)	17.6	42.3	1.42 (0.58, 4.19)	1.37 (0.77, 2.57)
1-5 years schooling (<i>N</i> = 7454)	26.3	53.1	2.12 (0.91, 6.08)	1.72 (0.99, 3.19)

Source: NISP 1997-99.

females, both as a proportion of total injuries, as well as sex specific injury rates (Table 2). The probability of a road traffic injury in urban populations is 19% more compared to rural populations, and 16% higher than in semi-urban settings, but none of these differences were significant (Table 2).

Analysis for exploring the relationship between injuries and educational status was conducted for the age group 16 years and above only. Those who had 1-5 years schooling had relatively higher risk of road traffic injuries compared to those who had six years or higher education, and also those who were illiterate (Table 3). However, none of these findings were statistically significant. Analysis of data using nine different occupational categories revealed that the frequency of injuries was highest amongst laborers and vendors, and lowest in homemakers (Table 4). Children (< 15 years) were excluded, and estimates of relative risk were generated using homemaker as a reference category. The risk of road traffic injury was significantly different from homemakers for all professions with only two exceptions; road traffic injuries in farmers and other injuries in service/paid employees that were not significantly different (Table 4). The risk of road traffic injury is 7-10 times higher for labourers and

vendors, showing that these productive (and often young) groups are extremely vulnerable to road traffic injuries.

NISP data revealed that the largest proportion of those with a road traffic injury were vehicle occupants (34%)—largely occupants of buses and larger vehicles. They were followed by pedal cyclists and motorcyclists (Fig. 1). Pedestrians comprised a lower proportion of those injured in road traffic.

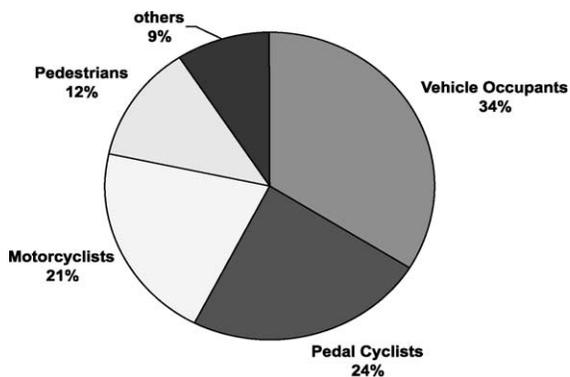
Discussion

Pakistan is facing the challenges of a complex epidemiological transition marked by persisting infectious diseases and a rising burden of non-communicable diseases.^{10,11} In the face of these challenges Pakistan needs to make policies based on evidence. Diarrhea, pneumonia, maternal mortality, and tuberculosis remain an unfinished agenda, but non-communicable diseases and injuries have also become an undeniable challenge for health policy makers in Pakistan.¹¹⁻¹⁴ Injury prevention and control in Pakistan is in its infancy and will remain ineffective without strong local leadership. An important step is an appreciation of

Table 4 Distribution of road traffic, and all injuries by profession/occupation in Pakistan (NISP 1997).

Category	Incidence per 1000 person per year		Relative risk	
	Road traffic	All	Road traffic	All
Profession/occupation				
Home-making (<i>N</i> = 8389)	5.7	20.0	Reference category (RR = 1.0)	
Student (<i>N</i> = 4628)	17.3	47.5	3.02** (1.40, 6.77)	2.37** (1.55, 3.63)
Service/paid employee (<i>N</i> = 4154)	15.4	27.9	2.69** (1.19, 6.23)	1.39 (0.83, 2.29)
Farmer (<i>N</i> = 3171)	11.3	55.5	1.98 (0.73, 5.13)	2.77** (1.77, 4.33)
Labourer (<i>N</i> = 1707)	49.2	119.5	8.60** (4.04, 19.17)	5.96** (3.88, 9.20)
Vendors (<i>N</i> = 1071)	56.0	104.6	9.79** (4.27, 22.90)	5.22** (3.11, 8.62)
Businessman (<i>N</i> = 1388)	23.0	51.9	4.02** (1.42, 10.71)	2.59** (1.40, 4.59)
Other (<i>N</i> = 300)	40.0	93.3	6.99** (1.26, 25.90)	4.66** (1.76, 10.46)

Source: NISP 1997-99. $\chi^2 = 134.67$ with eight degrees of freedom (analysis includes children under 5 years as a category). ** $p \leq 0.01$.



Source: National Injury Survey of Pakistan (NISP) 1997

Figure 1 Road injuries by mode of transport ($n = 109$).

the problem by policy makers and the public. The results of this study have been used to inform policy makers, public health professionals, and health care providers that injuries are a substantial public health problem in Pakistan, which can be controlled by a mix of appropriate legislation, preventive interventions, and proper case management. The NISP, as the first survey of its kind and magnitude in Pakistan and parts of the developing world, has revealed that the magnitude of injury problem is much more than judged by earlier estimates.^{12,13,15} The results show that most injuries occur to persons between 16 and 45 years of age, which is consistent with other reports from the developing world, and is an important finding for injury prevention interventions since 85% of the total population of Pakistan is below 45 years of age.^{7,16,17}

Children 0-15 years were the second major category of those injured, and represent a great potential loss of healthy life. Children whose mothers were either illiterate or had less than 5 years of schooling had a trend of higher risk than those children whose mothers had more than 5 years of schooling. These findings need further exploration to document the linkages between maternal characteristics and childhood injuries. Similarly, of the injured, those with none or 1-5 years schooling had a trend of higher risk of road traffic injury. A multiplicity of factors such as higher exposure from extensive local travel for work, risk taking behaviors, and travel on high-risk vehicles such as public buses may play a role. It has been shown that higher income and higher education decreases the risk of non-fatal injuries.¹⁸

A significant risk factor for road traffic injury turned out to be the profession of a person. Homemakers, paid employees, and farmers had relatively lower risk of road traffic injury, while laborers and vendors had a higher risk of

being injured. A possible explanation includes differential exposure to road travel between the groups. For example, the majority of farmers live in rural areas, work on their farms, and travel less compared to other population groups. Similarly, a likely reason for the high risk for vendors and laborers may be their everyday travel exposure in relatively unsafe vehicles, and travel in commercial or public service vehicles.

The NISP data revealed that vehicle occupants (passengers) comprised the largest group of those injured during motor vehicle crashes, and the majority of these were occupants of buses (public service vehicles). Studies from other developing countries also report that motorcyclists, bicyclists, pedestrians, and commercial vehicle passengers are the main victims of road traffic injuries.^{17,19,20} This is in contrast to the developed world, where the majority of crash victims are car drivers, and is an important finding for future interventions. Measures proven effective in reducing injuries to car drivers may not be optimal in a country like Pakistan where the majority of victims get injured or die while sitting in a public commercial vehicle or walking on a road.

Motorcyclists were the third major group comprising the injured from road traffic crashes. A study from Karachi, Pakistan showed only 13% helmet use by motorcycle drivers despite a mandatory helmet law in the country.²¹ One hypothesis has been that since most tropical developing countries have longer and stronger spells of hot weather, they need an altered helmet design to enhance compliance. This argument is valid but there are reports of a socio-cultural perception in Pakistan where people consider the helmet a silly gadget and are not convinced of its utility.²¹ Military personnel, e.g. in Pakistan observe the helmet law strictly, in all types of weather conditions. The relatively high cost of helmets also add to reluctance in purchasing, in addition to the fact that most riders are unable to perceive any real benefits from paying for the helmet. It is recommended that qualitative research methods be used in Pakistan to understand such perceptions of users prior to any educational or informational campaigns.

Enforcement of existing traffic laws by police and other agencies in Pakistan is weak and in general, confined to post-crash situations when damage has already been done.^{22,23} Instead more pre-emptive, pre-collision monitoring and screening is needed reflecting a proactive and dynamic approach to road traffic injuries. It is clear that traffic police would need to be equipped with proper monitoring apparatus and training. More importantly,

the culture of enforcement and use of indirect and invisible payment systems would need to be addressed for success. There is evidence that appropriate first-aid and referral of the injured saves many lives, reduces complications, and minimizes disabilities.^{19,24-26} Pakistan has an existing network of community health workers who could potentially be trained in the initial treatment of injuries to initiate an appropriate response system.

Population based data on injuries from other developing countries is scarce, although data from Ghana and Uganda in Africa are available for community based samples.^{27,28} Rates for road traffic injuries from both countries are higher than the ones reported here from Pakistan. This differential is explained by the several factors including the methods used since the African studies were not national samples, time frames during which the study was done and the recall periods, and the mix of vehicles on the roads with higher motorcycle proportions in Pakistan. Unfortunately, international comparisons of data is not possible as standardized information is not available from all developing countries—a goal being promoted by WHO and partners.³

This study did not evaluate the specific conditions and environment in which the reported injuries occurred, and limited questions to specific variables. It could not accurately measure the 'permanent disability' being caused by injuries with the use of a three-month time period. The NISP captured only those injuries serious enough to seek care or advice from a health care provider. Obviously, such estimates will underestimate the total burden of all injuries by undercounting minor injuries in a population. In addition, health care is not accessible to a significant proportion of society for geographical, social, and economic reasons.^{12,29} Thus with the NISP definition of injury there would be some injured people who may either not seek care, or may not receive care, and may have been missed. NISP was not designed to capture 'injury deaths' since estimation of deaths would require a much bigger sample size in a household interview survey. As a result, it would be more appropriate to view the NISP as an attempt to define estimates of non-fatal, serious injuries in Pakistan. The survey design and sample calculations were based on the last census prior to NISP in 1981; however, the Federal Bureau of Statistics continuously updates its Master Sampling Frame based on population projections and the latest frame for 1997 was used in this survey.

The NISP results have demonstrated that there is a significant burden of injuries, especially road traffic injuries, on both the society and the health system in Pakistan. Nationally representative information provided by the NISP about the incidence and exposure of injuries has helped to measure the public health burden due to road traffic injuries. This evidence should help advance the programmatic and advocacy needs of both local and global partners in the injury discipline. This also provides one model for other developing nations, to estimate their own national burden of injuries.

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