Road Traffic Accidents: A review of Literature

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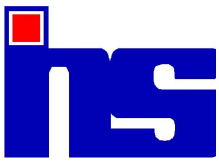

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Introduction:

Road traffic injuries are a global problem affecting all sectors of society. The process of rapid and unplanned urbanisation has resulted in an unprecedented revolution in the growth of motor vehicles across the globe. Because of the rapid economic growth, motor vehicles are expected to continue to grow rapidly in the coming years, creating tremendous pressure on insufficient road infrastructure. There has been a total neglect in the corresponding areas, such as road design, traffic regulation, maintenance of street lights, improvement in safety technology and road safety mechanisms, increased accessibility to medical services and a change in the attitude of road users (WHO,1984).

Despite the growing burden of road traffic injuries, road safety has received insufficient attention at the international and national levels. This has resulted in part from: a lack of information on the magnitude of the problem and its preventability; a fatalistic approach to road crashes; and a lack of the political responsibility and multidisciplinary collaboration needed to tackle it effectively. However, much can be done to reduce the problem of road crashes (UN Report, 2003).

Road Traffic Accident Scenario: Global & Indian:

In 2002, an estimated 1.2 million people worldwide died and as many 50 million were injured as a result of road traffic accidents. Road traffic injuries accounted for 2.1 per cent of global mortality and were responsible for 25 per cent of all deaths due to injury (Jacobs et al., 2000). Around the world, injuries are among the leading cause of death for people in the age range of 15 to 44 years (Peden et al., 2002).

Road traffic injuries also exact a heavy toll in terms of the ill health they cause. In 2000, road traffic crashes ranked as the ninth leading cause of

mortality and morbidity, accounting for 2.8 per cent of all global deaths and disability (UN Report, 2003). World Health Organization (WHO) projections suggest that by 2020 road traffic injuries could rank third among causes of death and disability, ahead of such other health problems as malaria, tuberculosis and HIV/AIDS (Murray & Lopez, 1996).

Accidents are a major cause of demands on the health system, whether at primary or the tertiary health care level. Transport vehicles occupy more than ¼ th of all urban space. The earth's surface is crisscrossed by a road network of 2 crore kilometers, on which more than 80 crore vehicles are at any given moment speeding away or struggling in traffic jams. 450 lakh new vehicles are manufactured every year (Pasricha, 1995). The leading cause of injuries resulting in loss of healthy years of life, are those caused by motor vehicle accidents (WHO, 1999). An estimated ten million accidents involving motor vehicles occur annually worldwide (WHO, 1989). India accounts for about 10 percent of road accident fatalities occurring worldwide and an estimated 1,275,000 persons are grievously injured on the road every year. The incidents of Road traffic accidents in India have been increasing and deaths due to this has increased more than tenfold, from 4500 in 1960 to over 50,000 in 1990 (Sudha Xirsagar, 1990). The global and Indian mortality percentage in the age group of 15-44 yrs. were about 54 and 45 respectively in the year 2000.

Current and projected trends in motorization signal that the problem of road traffic injuries will get worse, becoming a global public health crisis. Data from many countries show a clear relationship between increasing levels of motorization and the number of road deaths. The rapid rate at which motorization is taking place in many low- and middle-income countries means that these countries will have less time to address the problem of increasing road traffic injuries and to mitigate their adverse consequences. WHO estimated in 1996 that by 2020, road traffic crashes would be the second leading cause of mortality and morbidity in developing countries (Dinesh Mohan & Tiwari, 1998.) This is in contrast to higher-income countries, where

long-term development means that vehicle use evolves at a slower pace, allowing road safety efforts to evolve in parallel. For example, in Finland, 30 years of government campaigning on road safety have led to a 50 per cent decrease in the number of fatalities, despite a tripling of road traffic volume (UN Report, 2003).

Vulnerable Population:

The numbers and rates of road traffic injuries vary by region, age, gender and road user type. The burden of road traffic injuries falls disproportionately on people in low-and middle-income countries. Although the number of motor vehicles per capita is considerably higher in high-income countries, low- and middle-income countries have the highest burden of injuries and fatalities due to road crashes. For example, in 2002 the vast majority - 90% of road traffic deaths were in low- and middle-income countries and only 10 per cent occurred in high-income countries. The magnitude of the road traffic injury problem varies considerably according to geographical region. Of the 1.26 million annual road crash deaths in 2000, more than a third (435,000) occurred in Southeast Asia. Although Southeast Asia has the highest proportion of global road fatalities, Africa has the highest road traffic death rate, 28 deaths per 100,000 population. The ill health, or morbidity, that results from road traffic injuries also differs widely by region, with Southeast Asia accounting for more than one third of the morbidity resulting from road traffic injuries each year (WHO, 2002). When comparing fatalities by level of motorization, the regional variation is different. For example, Sweden has a relatively low rate of 1.3 deaths per 10,000 vehicles, whereas in some African countries the rate is more than 100 deaths per 10,000 vehicles (UN Report, 2003). Road traffic injuries involve issues of equity. They disproportionately affect the poor in developing countries, where the majority of road crash victims are vulnerable road users (pedestrians, cyclists, children, passengers). In more developed countries too, there are steep social class gradients in figures on pedestrian injury, with children of lower

socioeconomic status being more likely to die in collisions involving pedestrians than their more affluent counterparts. A further inequity issue is that poorer socioeconomic groups have less access to medical services, leading to disparities in chances of recovery or survival. An important inequity is the trend of investing increasing resources in the building and maintenance of an infrastructure for private motorized transport, while overlooking the public transport needs of the larger part of the population (Nantulya et al., 2003).

The car population as a proportion of total motor vehicles is much lower in a less motorized country (LMC) like India than in the highly motorized countries (HMCs). Hence, the vulnerable road user (VRU) population comprising of pedestrians, bicyclists and motorcyclists constitute 60-80% of all traffic fatalities in India. Car occupants comprise less than 10% of all deaths (Dinesh Mohan, 2001).

Road traffic injuries disproportionately affect young people. Deaths among adolescents and young adults, caused due to motor vehicle accidents are alarmingly increasing in most of the developing countries across the globe (Odero, 1997; Jacobs & Sayer, 1983; Mohan & Bawa, 1985). The burden of disease from injuries is to be addressed as an important public health issue in the developing world and is attributable to injuries, ranging between 5% and 20% in developing countries, and on an average, one in ten hospital beds is occupied by an accident victim (Baker et al., 1992). More than 50 percent of global mortality due to road traffic injury occurs among young adults, aged 15 to 44. Similarly, morbidity is highest among this age group, whose members account for about 60 per cent of worldwide morbidity each year as a result of road traffic injuries (Peden et. al., 2002).

Globally, the road traffic injury mortality rate for males is almost three times as high as it is for females. Males in Southeast Asia and Africa have the highest road traffic injury mortality rates worldwide (Peden et. al., 2002).. Similarly, the rate of morbidity that results from road traffic injuries is higher for men than for women, with males in China and India suffering

disproportionately from this cause of ill health (UN Report, 2003, Nantulya et. al., 2003).

Socioeconomic impacts:

Road traffic injuries have enormous health, social and economic impacts on individuals, families, communities and nations (Jacobs et al., 2000). Besides the direct physical and psychological impact on those directly affected by road traffic injuries, road crashes also place a heavy burden on those involved with the victims. Family, friends and the communities of those directly affected by road traffic injuries can also experience short- and long-term adverse social, physical and psychological outcomes (Mayou & Bryant, 2003). For example, every year in the European Union more than 40,000 people are killed and more than 150,000 disabled for life by road traffic crashes. This leaves more than 200,000 families bereaved or with family members disabled for life (www.fevr.org.,2003). It is frequently the breadwinner of the family who is disabled or killed as a result of a road crash. Therefore, in addition to the emotional impacts, those affected must cope with reduced family incomes, and frequently have to deal with criminal and/or civil justice systems (UN Report, 2003).

There are also considerable indirect effects of road traffic injuries: members of the public may be affected by road traffic injuries even when they or their family members are not directly involved in road crashes. For example, fear of road traffic injuries can prevent old people from venturing outdoors. In many high-income countries, increasing use of cars has led to a general decline in walking and an increase in sedentary lifestyles, which in turn has had adverse consequences in terms of increasing obesity and cardiovascular health problems (Mayou & Bryant, 2003; UN Report, 2003).

The injuries and disability resulting from road traffic crashes put a significant drain on economies, typically consuming between 1 and 2 per cent of a country's gross national product per annum. Globally, estimates suggest

that the economic costs of road traffic injuries amount to $518 billion per annum. In developing countries, the costs are estimated to be about $65 billion, twice the annual amount of development assistance to developing countries. These costs include direct medical costs, as well as indirect and longer-term costs. The economic impact of road traffic injuries is especially damaging, particularly for countries struggling with poverty alleviation and the overall challenges of development, because economically active age groups are the most vulnerable to such injuries (Jacobs et al., 2000).

The issue of traffic safety is relevant to countries that are trying to promote sustainable development. This has been highlighted at numerous conferences, most recently at the 2002 World Summit on Sustainable Development. It has been recommended that in developing countries where there is rapid motorization, urban development and transportation planning be integrated, and that reliance on mass transit and alternative modes of transport be increased. Such efforts should help to mitigate the adverse impacts of increased motorization (UN Report, 2003).

Need for reliable information:

In many countries, the quality of data being used to assess the road safety situation is poor and indicators are not standardized, making comparisons difficult. There are frequent discrepancies between data for example, from police and from health-related sources. Underreporting of road traffic injuries also limits the validity of some existing data sources. Countries that have effective collection, management and analysis of road traffic crash data generally use a cross-sectoral range of sources (e.g. from police, transport and health sectors).

Road safety is inadequately researched in many countries. Information is lacking on many aspects of the problem. Funding for research relating to road traffic injuries is disproportionately low given the impact it has on both mortality and morbidity. From the perspective of national Governments and

development agencies, the economic impacts of road traffic crashes, injuries and fatalities are of major importance. However, many countries lack the data needed to accurately calculate the costs of road traffic crashes and their impacts, to evaluate the cost-effectiveness of prevention strategies and to decide what priority to give to various intervention strategies. A lack of research means that the magnitude of the problem, its impacts and the cost and effectiveness of intervention are not fully understood, particularly in low- and middle-income countries (UN Report, 2003).

Accurate data are essential for prioritizing public health Issues , monitoring trends and assessing intervention programmes. Many countries (including India) have inadequate information systems on road traffic injury, making it difficult to realize the full nature of the problem and thus gain the attention that is required from policy-makers and decision makers. There are a number of areas where the road traffic injury data are often problematic, and these include:

- Sources of data ; for example, whether data are from police or health sources;
- the types of data collected;
- inappropriate use of indicators;
- non-standardization of data'
- definitional issues related to traffic deaths and injuries;
- Under reporting;
- Poor harmonization and linkages between different sources of data.

The lack of reliable data is most critical at the national and local levels, where the data are needed as a sound basis for road safety planning and decision-making. The useful resources for such study are Injury surveillance guidelines (Holder et al., 2001) and Guidelines for conducting community surveys on injuries and violence (Sethi et al., 2004).

Risk factors:

A number of factors that affect the probability of a road traffic injury and can be modified by intervention have been identified. These can be considered within a "systems approach", which is aimed at identifying all the

sources that contribute to crashes and then trying to reduce their consequences (Haddon, 1968).

The phenomenal increase in the number of motor vehicles in urban cities coupled with limited road space, inadequate facilities for pedestrians and cyclists, irresponsible driving and violation of traffic rules has resulted in a significant number of road accidents. In developing countries, the predominance of non-motorised traffic and pedestrians, the lack of experience of drivers and the unsuitability of much of the infrastructure for mixed traffic present rather different challenges. Poor traffic enforcement in many current systems pits pedestrians against two- and three-wheelers, cars, buses, minibuses, trucks, and domestic animals- all on the same road in the same time and space - creating immense conflict among the different road users and a high potential for traffic injury. According to experts, 70 per cent of the accidents in India occur because of poor roads and bad driving. “Poor roads, bad driving and lack of traffic sense are the main reasons for the high rate of accidents.” The problem in India is compounded by the mixed traffic-cars, auto-rikshaws, two-wheelers, bullock carts, everything plying on the same roads unlike Western countries (Economic Survey of Delhi, 2002).

The following are the risk factors associated with road traffic accidents:

1. Speeding: The speed of motor vehicles is at the core of the road injury problem. Speed influences both crash risk and crash consequence. The higher the speed, the shorter the time a driver has to stop and avoid a crash, and the more severe the impact when a crash occurs (Andersson & Nilsson, 1997). Simple measures such as rumble strips and enforcement of speed limits can reduce speed and injuries.
2. Alcohol: Drivers and pedestrians with any level of alcohol in their bodies have been shown to be more likely to be involved in a road crash than those who have not been drinking, and their injuries are also likely to be more severe. Appropriate legislation and effective enforcement of drunk-driving laws have been shown to be effective in reducing the likelihood of road traffic fatalities and disability (European Transport Safety Council, 1995; Mishra et al, 1984; Maycock, 1997).
3. Helmets: Head injuries are the main cause of death among two-wheeler riders. Helmets protect very effectively against such injuries. In rapidly motorizing low- and middle-income countries, the number of motorbikes is increasing dramatically, with a parallel increase in head injuries. A helmet that is designed

specifically to suit the environment and situation of low- and middle-income countries, coupled with laws that require helmet use and effective law enforcement, could substantially reduce fatalities and injuries among motorbike users (Peek-Asa et al, 1999; Mishra et al, 1984; Radin, 2002).

4. Safety devices (seat belts, child restraints): The use of seat belts has been shown to significantly reduce the severity of injury in road crashes. Similarly, under utilization or inappropriate use of child restraints substantially increases the risk of injury (European Transport Safety Council, 1996).

5. Use of handheld mobile phones: In the recent years, handheld mobile phones have emerged as a major road safety problem. Redelmeir and Tibshirani (1997) reported that drivers who use handheld phones face a risk of road crash four times higher than that faced by other drivers, imperiling themselves and other road users. Hands-free phones can also distract drivers, but the current evidence suggests that handheld phones pose a greater problem (Royal Society for the Prevention of Accidents, 2002).

6. Trauma care: In many countries there is a striking absence of adequate trauma management once road collisions have occurred. A lack of timely and effective pre-hospital care and long intervals between crash and hospital admission (particularly in rural areas) are contributing factors to the outcome of road traffic injuries. Within the hospital setting, inadequate availability of trained personnel, medicines and supplies in emergency rooms also contribute to mortality and morbidity resulting from road crashes (UN Report, 2003).

7. Poor road design and roadway environment: There is a huge potential to reduce road traffic injuries through better road design and maintenance. Better signs and markings, for example, are highly effective and low-cost ways of improving road safety. Safety assessments should be included in road infrastructure planning to eliminate avoidable risk, particularly to vulnerable road users (Ross et al, 1991).

8. Non-implementation of road safety standards: Introducing minimum standards for road safety (such as speed limits, rules against drunk driving, driver and vehicle licensing, etc.) are key elements of successful strategies to reduce road traffic injuries (Andersson & Nilsson, 1997; European Transport Safety Council, 1995).

9. Vehicle design & safety devices: In recent years there has been substantial progress in occupant protection through the introduction of legislative requirements for front-and side-impact crash worthiness. However, similar progress has not yet been made with regard to pedestrian injuries. The protection of both vehicle occupants and pedestrians can be further improved by ensuring that vehicles are equipped with appropriate safety features and devices (Kanianthra, 2003).

10. Lack of vehicle inspection programmes: The lack of proper maintenance for vehicles and heavy vehicles is a contributing factor to the problem of road traffic injuries. In many countries there are no inspection requirements for the annual registration of vehicles. This may result from lack of training for inspection personnel, inadequate resources and/or the low priority that is given to this problem (Jones & Stein, 1989).

Intervention Strategies:

Road crashes can be prevented. To date, however, efforts to address the problem of road traffic injuries have frequently been ineffective. One reason for this may be the tendency for road traffic injuries to be seen as the focus of a single sector. An examination of strategies that have been successful in reducing road traffic injuries suggests that there is an urgent need for a shift to a multisectoral approach, with public health playing an instrumental role (UN Report, 2003).

The important role that public health can play in the prevention of road traffic injuries includes: the collection and analysis of data in order to demonstrate the health and economic impact of road traffic crashes; research on risk factors, the implementation, monitoring and evaluation of interventions; the delivery of appropriate primary prevention, care and rehabilitation of injured people; and advocacy for greater attention to the problem.

The road traffic accident related deaths and injuries are assuming alarming proportions across the globe. However, much can be done to reduce the problem of road crashes. Road traffic injuries, like any other health problem, can often be prevented by appropriate regulatory, planning and design level interventions.

Bibliography:

Andersson G and Nilsson G (1997). Speed management in Sweden. Linkoping, Swedish National Road and Transport Research Institute.

Baker SP, B. O'Neill, MJ, Ginsbury and Li G (1992). The Injury Fact Book. 2nd ed. New York: Oxford University Press.

Delhiplanning.nic.in/Economic%20Survey/Ecosur2001-02/PDF/chapter12.pdf

Mohan D (2001). Road traffic crashes, injuries and public health. Economic & Political Weekly, Vol. XXXVI (50), 4656-62.

Haddon Jr. W (1968). The changing approach to the epidemiology, prevention and amelioration of trauma: the transition to approaches etiologically rather than descriptively based. American Journal of Public Health, 58: 1431-1438.

Holder Y, Peden M, Krug E, Lund J, Gururaj G and Kobusigye O, eds., (2001). Injury Surveillance Guidelines. Geneva, World Health Organization (WHO/NMH/VIP/01.02)

Jacobs GB and Sayer I (1983). Road Accidents in Developing Countries. Accident Analysis and Prevention 15: 295-298.

Jacobs G, Aeron-Thomas A and Astrop A (2000). Estimating global road fatalities. Crowthorne, Transport Research Laboratory. (TRL Report, No. 445).

Jones IS and Stein HS (1989). Defective equipment and tractor-trailer crash involvement. Accident Analysis and Prevention, 21: 469-481.

Kanianthara JN (2003). Advanced technologies: The pathway to total safety. In: 18th Enhanced Safety for Vehicles Technical Conference, Nagoya, Japan, 19th May 2003. Washington , DC, Nation Highway Traffic Safety Administration, 2003 (www.nrd.nhtsa.dot.gov/departments/nrd-01/esv/18th/discussions/JK_ESVAdv.html)

The risk of using mobile phone while driving (2002). Birmingham, Royal Society for the Prevention of Accidents.

Maycock G (1997). Drinking and driving in Great Britain: a review. Crowthorne, Transport Research Laboratory (TRL Report 232).

Mayou R and Bryant B (2003). Consequences of road traffic accidents for different types of Road user. Injury, 34: 197-202.

Mishra BK, Banerji AK and Mohan D (1984). Two-wheeler injuries in Delhi, India: a study of crash victims hospitalized in a neuro-surgery ward. Accident Analysis and Prevention, 16:407-416.

Mohan D and Tiwari G (1998). Traffic safety in low income countries: issues and concerns regarding technology transfer from high-income countries. In: Reflections of the transfer of traffic safety knowledge to motorizing nations. Melbourne, Global Traffic Safety Trust, 27-56.

Mohan D and Bawa PS (1985). An Analysis of Road Traffic Fatalities in Delhi, India. Accident Analysis and Prevention 17: 33-45.

Murray CJL and Lopez AD (1996). The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and projected to 2020. Cambridge: Harvard University Press.

Nantulya VM, Sleet DA, Reich MR, Rosenberg M, Peden M and Waxweiler R (2003). Introduction: the global challenge of road traffic injuries: can we achieve equity in safety? Injury Control and Safety Promotion, 10:3-7.

Odero W, Garner P and Zwi A (1997). Road Traffic Injuries in Developing Countries: A Comparative Review of Epidemiological Studies. Trop Med Int Health 2: 445-460.

Pasricha PS (1995). You only live once: A teenagers guide to road safety. Nasha Publications, Mumbai .

Peden M, McGee K and Krug E, eds. (2002). Injury: a leading cause of the global burden of disease. 2000. Geneva, World Health Organization. (http://whqlibdoc.who.int/publications/2002/9241562323.pdf, accessed 30 October 2003)

Peek-Asa C, McArthur DL and Kraus JF (1999). The prevalence of nonstandard helmet use and head injuries among motorcycle riders. Accident analysis and Prevention, 31:229-233.

Redelmeier DA and Tibshirani RJ (1997). Association between cellular-telephone calls and motor vehicle collisions. New England Journal of Medicine, 336: 453-458.

Ross A, Baguley C, Hills V, Mc Donald M, Silcock D eds., (1991). Towards safer roads in developing countries. A guide for planners and engineers. Crowthorne, Transport Research laboratory.

Sethi D, Habibula S, McGee K, Peden M, Bennet S, Hyder AA, Klevens J, Odero W and Suriawongpaisal P, eds., (2004). Guidelines for conducting community surveys on injuries and violence, Geneva, World Health Organization.

Seat-belts and child restraints: increasing use and optimising performance, European Transport Safety Council, 1996.

Radin Umar RS. (2002). Helmet Initiatives in Malaysia. In: Proceedings of the 2nd world Engineering Congress. Sarawak, Institute of Engineers: 93-101.

Reducing injuries from alcohol impairment, Brussels, European Transport Safety Council, 1995.

Sudha Xirasagar (1990). Prevention and control of road traffic accidents. Health Administrator 1 (2): 84-87.

United Nations General Assembly (2003): Global road safety crisis. Report of the Secretary-General. Fifty-eighth session.

World Health Organization (1984) Road Traffic Accidents in Developing Countries: Geneva, WHO Technical Report Series 703.

World Health Organization (1989). New Approaches to Improve Road Safety, Geneva: WHO Technical Report Series, 781.

World Health Organization (1999). World Health Statistics Annual, Geneva: WHO.

World Health Organization (2002). WHO Global Burden of Disease project, Version1.

www.fevr.org/english.html#Road, accessed 17 November 2003.