



ReviewPaper

Linking Economic Development and Road Traffic Accidents: A Global Review

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ABSTRACT: Road related casualties as "disease of development" views are not to be encouraged anymore. Developing country road accidents are a complex issue having not only multi-sectoral dimensions, but also intricate are the wide differentials in the entitlements of the population using roads. The former can be changed with lesser effort by technological and behavioural interventions; however, the latter are intrinsic problems associated with the risks held by the population. Since the latter's behaviour and occupational risks are unambiguously related to the occupational features and living conditions and so on.

KEYWORDS: Economic development; road traffic accidents; road safety and technology

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Human beings' material progress has attained unprecedented heights especially during the last century largely promoted by increasing physical mobility. Change in pattern of mobility is necessitated by a general transformation in the economic structure of a country from predominantly agrarian and feudal to industrialized/tertiary sector oriented. Road Traffic Accidents (RTAs) are generally considered as a price of material progress of human beings. Historically motor vehicle accidents have been believed as 'accidents', random events that are inevitable outcomes of road transport (Gumber 1994; WHO 2002). This is an oft-heard issue in the context of discussions on the prevention and road safety, because many tend to think that when there happens an increase in income to the population and urbanization leads to increased motorization, as a consequence, there is an increased likelihood of vehicular accidents and the consequent casualties. This argument is strengthened by data from developing countries where richer areas show a high prevalence of RTAs compared to low-income areas. Another characteristic that further adds fuel to their argument is the notion that accidents happen to individuals in the higher income bracket. Do these mean road accidents are a price of modernisation? Which are the major determinants in the process of economic development that lead to road traffic accidents and the associated casualties?

However, the mobility has not been costless and over the decades, the world has lost · millions of human lives. It is estimated that more than 30 million individuals lost their lives and the hopes of the 30 million's dependants perished on roads since the first pedestrian casualty reported in 1898 (IFoRCaRC 1998). A lion's share of this wastage of lives could have been avoided, indeed. It is also important to note that the distribution of injury burden is not uniform across countries and populations and severely against the low income countries and individuals from low social and economic structure. Even an untailored look at the global scenario of road transport growth (mobility) and road place casualties would take one to conclude that there exists wide inequalities in the benefits and costs of mobility with inter and intra-country dimensions~ It is seen further that the beneficiaries do not always carry the costs of their actions and merely classifying the costs as "economic externalities" would amount to oversimplification of a complex issue.

Global burden Injuries were (not only road traffic injuries) responsible for 21.7 per cent of the global deaths and 31.1 per cent of DALYs lost in 2001 (WHO 2002). According to a World Health Organization estimate, one out of ten persons as disabled in the world; and injury was the main cause of disablement for 1 out of 7 disabled persons. According to WHO, one million deaths due to RTis in 1998 and second leading cause of death among 15-44 years and 10 million were seriously injured on the world's roads (Murray and Lopez 1996). RTIs constitute one quarter of all injury deaths worldwide (Hofinan et al 2005). Eighty five percent of it occurs in LMICs, where majority of the casualties were pedestrians, cyclists and riders of motorised two wheelers. More than a quarter of all road traffic deaths occur in South-East Asia, while Africa has the highest road traffic death rate (28.2) per 100,000 population (WHO 2002). In both high/low-income countries, unintentional injuries

constitute 68 percent of total mortality due to injuries. As it is known that victims of injuries belong to the most economically active population, deaths and disability caused by injuries might be a leading cause of financial catastrophe and impoverishment among the households. Apart from death and hospitalization, injuries impose major socio-economic and psychosocial burden on children, women, survivors and families, by direct and indirect methods (Mock 2003). Injuries, many a times, start a chain of further health problems and a Bangalore based survey finds that nearly one third of the surviving members were suffering from posttraumatic problems of depression, anxiety, fear, suicidal tendencies, alcohol problems following injury, which were directly attributable to injury itself, apart from the post-injury disabilities. A hospital-based study of traumatic brain injuries observed that around 30 percent of the injured were leading a poor quality of life (Gururaj G 2004a).

According to Global Burden of Disease project, among the injured due to RTAs, 25 per cent sustain brain injuries, 20 per cent have fractures and around 10 per cent suffer open wounds (WHO 2002). In both developed and developing countries, the share of communicable diseases in total DALYs lost declines with age and that of non-communicable diseases rises. However, in case of injury, it follows an inverted U-shaped curve with age, meaning injury affects the prime age group 5-44 the most (including the schooling children, youth and productive work force. A majority of injuries (2/3 of fatal injuries) belong to unintentional category, of which the main cause is motor vehicle accidents (Gumber 1994). In many low and middle-income countries, the burden of road traffic injuries constitute between 30 per cent and 86 per cent of all trauma admissions (Odero et al 1997; Barss et al 1998).

Besides natural disasters, road traffic accidents are one of the critical events that have got the potential to wipe out an entire household and family at a time. Globally, the distribution of accidents, associated mortality and morbidity is heavily skewed against the low and middle-income countries. For example, nearly 85 per cent of the fatalities occur in these countries having only 40 per cent of the world's motor vehicles. The poor are killed and seriously injured mainly as vulnerable road users (pedestrians, motorcyclists and cyclists). Researchers further find that poorer individuals are more vulnerable to RTIs and the outcomes are also found to be poor (Ghee et al 1997). For instance, a Vietnam study finds that 50 per cent of the injured were primary income earners and 93 per cent had a monthly income of less than USD 130 (Le Linh 2002). The poor victims contributed most to their household's earnings (average 62 per cent in urban areas and 42 per cent in rural areas), and the loss of income tipped many households into poverty. One in every 4 deaths and 1 in 6 serious injuries to the poor involved a child (under-16 years) (Aeron-Thomas et al, 2004).

Economic progress and road traffic accidents Statistics point out that there is direct relationship between per capita income growth and road related casualties up to a certain limit and high-income countries have surpassed the stage and low- and middle-income countries (LMICs) are passing through a dangerous phase of fast rising road casualties. Nearly 80 per cent of the global road accident related deaths occur in developing countries whose share in global vehicle population is less than 75 per cent implying that they bear a disproportionate burden of deaths and disabilities due to RTAs in 2000. The fatality rate is 70 per 10,000 vehicles - 25 times higher than for any developed country (Khan 1997) implying that lot more needs to be done in the reduction of passenger safety mechanisms in the vehicle as well as in the post-accident trauma care services in poor countries. The total number of road traffic fatalities and injuries is forecast to rise by 65 per cent between 2000 and 2020 (Murray & Lopez 1996; Koptis & Cropper 2003) and in low- and middle-income countries, deaths are expected to rise by about 80 per cent. On the contrary, they are expected to come down by 30 per cent in high-income countries (Peden et al 2004). According to the World Bank's Traffic Fatalities and Economic Growth (TFEG) project, between 2000 and 2020, South Asia is predicted to record a 144 per cent increase in road traffic fatalities. If the LMICs follow the general trend of rich industrialized countries, the former's fatality rates will begin to fall in the future, but would cost immensely. As per the model's predictions, India is anticipated to start its decline in road traffic related fatality rates after 2042. The broader message of these predictions is that should current trends move on and new effective interventions are not undertaken, then more casualties will be experienced.

The aforesaid facts and figures raise some important and critical questions. How does one explain relationship between road traffic accidents and fatalities vis-a-vis economic growth across developing and developed societies? Is the trend unavoidable and inevitable and should we allow the trend to carry forward as a matter of luck and destiny? Who are the beneficiaries of income growth and who are at the receiving end? What are the lessons we need to learn from the societies which reversed the so-called trend rather than allowing the countries to cost lives? How does one address the issue of road related casualties in the context where societies are fundamentally divided among economic lines and so on.

Biphasic relationship Studies have recorded a biphasic relationship between the incidence of road traffic casualties and economic progress with casualties rising for the low-income countries and declining for the industrialized countries (Van Beeck et al 2000). Why there exists an inverted U-shaped relationship between incidence of road accidents and economic development has been a question of perennial interest among injury researchers. The reasons are not far to seek: a number of complementary and competing explanations are at work. In a primitive society agriculture is the mainstay of livelihood for the majority and most of it is used for

own-consumption (subsistence) and not much marketable surplus is generated. However, in the later stages, commercialization of agriculture (production of agricultural goods for the market) necessitates mobility of factor inputs and outputs requiring expansion of roads and vehicles in a given society. Since modernization of agriculture requires industries to supply large number of inputs like fertilizers, equipments, etc and processing of agro-goods, industrial sector also gains momentum leading to an enhanced pace of growth of motor vehicles and their paths. The tertiary sector (banking and financial services, communication, insurance, computer software etc) acts as a lubricant in the process of agricultural and industrial expansion and tertiary sector requires the fast movement of goods & services. If no effective measures are taken, casualties resulting from the movement of traffic would be the highest when industrial and service sector attains a very high rate of growth. Now let's see what happens to the type of motor vehicles on the roads. In the first phase when agriculture was the mainstay of the economy, individuals used to possess slow moving vehicles including vehicles requiring manual effort like cycles, cycle-rickshaws, bullockcarts, etc as they are cheaper with less priority for safety measures. In the first stage, road accidents and associated casualties would be minimum which is primarily due to the low speed. With technological progress, the mobility gets enhanced by sophisticated vehicles and rate of road casualties increases uninhibited.

Prominent postulates The existing different strands of literature trying to understand the history of road accidents and economic development may be classified under four major explanations. Coase's theorem constitutes the origin of externalities argument in which any externalities problem could be effectively solved if we are able to accurately assign the property right to create problems (road accidents) and then cheaply traded and he sincerely believed that a matured market economy is a fine way to do that (Coase 1960).

It is thus argued that regulation of externalities and its fruitful assignment of liabilities are possible generally only at advanced stages of economic development when the institutional arrangements attain maturity. The contributors of externalities include the manufacturers of vehicles, insurance companies, enforcement agencies etc and the absence of an effective institutional framework means that the contributors of accidents are not accounted for. Here, Vickrey (1968) stresses emphatically the specific role of motor-insurance policies in risk-taking on roads. The second theoretical stream emphasizes the role of low investment in road safety in low-income countries. The low priority attached to prevention of road safety mechanisms is primarily based on the notion of cost-effectiveness of public health interventions and the belief that road accident victims are not generally poor. The cost-effectiveness argument bases its arguments reasoning that resources be allocated in such a way that the marginal returns from spending on prevention or cure of disease should be maximum for a given unit of resource spent. With increased income for countries, they can earmark a greater proportion of resources towards road safety and passenger security. The political economy behind the increased allocation may be attributed to the increased wield that the upper and middle income groups they possess.

The so-called vehicle mix hypothesis points out that the effect of economic growth? In the changing mix of vehicles on the road (Tay 2003) need not be always positive from the road accident's point of view. Individuals, with income growth, prefer convenience to mass transport means the former are more vulnerable to road accidents. The vulnerability is more if the personal vehicles are two wheelers whose probability of meeting with an accident as well as fatalities is many times higher than other major category of vehicles. The fourth hypothesis on the relationship between road accidents and economic development elicits the role played by an effective pre-hospital emergency services and trauma care systems. Improved investments in trauma care and pre-hospital care are positively correlated with higher survival in a large number of places (Adam et al 1994; Arreola-Risa et al 2000). Thus, it is observed that despite fast increasing volume of traffic, road traffic accidents decline at the pragmatically advanced phases of economic development probably due to a combination of factors including a higher preference towards quality on roads including better roads, the safety of travelers and vehicles, creation of a suitable legal framework and an effective enforcement of road rules, etc. Bishal et al hypothesize that investment in harm reduction, improvements in emergency transport and timely and adequate medical treatment of victims reduced fatalities despite increased crashes and injuries (Bishai et al 2006).

Epidemiology Gordon, viewing injuries from an epidemiological perspective, thinks that injuries are the product of not one cause, but of forces from at least three sources that are the host, the agent (or vector) and the environment (physical and socio-economic) in which host and agent find themselves (Gordon, 1949). Haddon (1980) emphasized that unlike diseases, the onset of injury is sudden and the consequences are devastating, besides the loss of energy. He has introduced time dimension into injury theories and divided the process of injury occurrence and outcome into distinct phases called "pre-event", "event" and "post-event" so that prevention becomes easier.

Uncertainty in incidence of Road Traffic Injuries (RTIs) leaves little opportunity for the households to plan the financing of medical care to the injured. The uncertainty forces households to incur higher amount of inefficient spending because when compared to what is necessary to spend in a normal consumption of goods and services is not available to the injured and his/her household. Inefficient spending means the financier of the cost of treatment makes an expenditure which is higher than what needs to be spend in a normal situation. Here

uncertainty introduces additional costs through two constraints. Firstly, choice constraints and secondly monetary constraints. The first one means, even if the victim has the required financial resources, choice of facilities is not often exercised due to inability to exercise choices due to lack of access and or due to lack of availability. Second, lack of resources forces the injured or household to undertake the needed medical interventions in the required time which then forces the household to make a higher expenditure later on. Financial uncertainty in treatment arises when there exists an individual based financing mechanism like OOP where utilization of health services for treatment is based on purchasing power and such a system may exclude the injured belonging to lower income groups. Here two issues become immensely important in determining the output and outcomes. One is the physical availability of health services and second is the financial accessibility to the patient to access the available service. For the policy makers, this means that there is a clear need for establishing trauma care centres having at least necessary equipments at places where there is a higher probability of accidents. Secondly, mechanisms for financing medical care for injured needs reemphasis because financing by households incurs inefficiency which can be reduced by protection mechanisms. This points to the specific characteristic of a health system called 'unprotected financing' in the form of OOP that makes the difference.

Gender dimension Globally 2.7 times as many males as compared to females die from RTIs, accounting for the largest sex differentials in mortality rates from unintentional injuries (WHO 2002). It is also said that greater risks for male boys compared to females girls due to their involvement in activities like crossing roads unaccompanied by adults, bicycling, fast driving etc. Further, for pedestrians, it is seen that risk of being involved in a collision, mortality and long-term specialized care increases with age. Gender roles in terms of greater exposure to driving with high-risk behaviour like over speeding, alcohol use, drug use, disregard for pain etc. In places where women's mobility is restricted, men move around in vehicles more than women and thus at an increased risk of suffering injuries. Females are more likely to wear helmets than men and in Karachi, Pakistan males were observed to be more likely than females to jump off a moving bus (43 per cent Vs 1.6 per cent), get on a moving bus (49 per cent Vs 12 per cent) etc all risky amidst heavy urban traffic. If other things remain constant, women are at a greater risk of lower body injury because of their smaller stature (WHO 2002). Studies of frequency and severity of lower body injuries found an excess of ankle/tarsal injuries among females, and follow-up research found that this was due to sex differences in height.

Transport limitations, long distance to health facilities, and weak communication system, and lack of timely resources prevent the injured from seeking adequate care. Gender disparities in RTIs may possibly be an extension of prevailing gender disparities for other acute injuries and ailments. It has been suggested that acute accident care is similar to emergency obstetric care, and communities that cannot respond to one, cannot do to the other as well (WHO 2002). *Ceteris paribus*, women are more likely to be insecure due to absence of paid work, and it worsens in female-headed households. Besides, since men are often the sole breadwinners, economic and social costs of injuries of their husbands put women at risk of substituting husbands' role.

Indian scenario In India, around 500,000 people are killed in a year due to RTIs and more than 50 per cent occurring in the 10-24 age group (Goi, NCRB 2000). India has one per cent of the total number of vehicles in the world but accounts for six per cent of RT As. Road traffic injury is the sixth most common cause of death in India and is also more frequent among the younger groups (Peters et al 2002) and prevalence of RTI related disability is estimated to be nearly 2 million in India (Gururaj 2006). The economic cost of RTIs in India is estimated at around Rs. 550 billion annually (Mohan 2002) or around one per cent of GDP. As per NSSO 1986-87 data, the incidence (per 1,000) of all injuries amounted to 38 in rural areas while it was 24 in urban areas in major five states in India (Gumber 1994). The proportion of hospitalized injuries was 3.7 for rural areas, while 4.1 per cent of the injured got hospitalized in urban areas. There is a possible inequity in the distribution of hospitalization of injured in terms of urban and rural areas. This may be possibly because of at least three reasons. First, severity of injury (both perceived and objective) might be higher in urban areas and so a higher hospitalization. Second, since there is a higher concentration of health facilities in urban areas, physical accessibility is lesser an issue here, and financial accessibility is also higher in urban areas as they have a higher purchasing power compared to the rural segments. Injuries are one category of disabilities that requires long hospitalization indicating severity of the category itself and so the cost of treatment may take a huge variation compared to many other illnesses.

There has occurred phenomenal increase in the number of road accidents in the country since Independence and the number killed or disabled permanently and temporarily is also increasing at a faster pace. The rate of growth of accident and fatality rate (measured by the number of accidents and deaths per 10, 000 has been falling constantly) probably reflecting advances in vehicle engineering aspects such as improved braking system, and better quality of roads etc. As is obvious, the rate of decline had been faster in the initial stages and compared to recent years. The rate of fatalities and injuries associated with road traffic accidents continue to increase in all States during 1970s till 2002. However, the rate of growth of casualties are not uniform and varies with some States like Maharashtra recording fall in number of deaths and some States like Assam having slow growth in RTA deaths. However, States like Andhra Pradesh, Kamataka and Kerala's fatality rate has gone up

significantly during the period. When we analyse the State-level RTA information based on rate of accidents in relative terms, we find that Kerala's accident rate per 100 km of surfaced road length is almost three times higher than the national average, followed though distantly by Tamil Nadu, Gujarat etc.

Summing up

The term "accident" implies an event that is unavoidable, unpredictable and inevitable (Peden et al 2004) and in reality majority of our road accidents are avoidable, predictable and escapable, if the developed country experiences are any guide. Road related casualties as "disease of development" views are not to be encouraged anymore. Developing country road accidents are a complex issue having not only multi-sectoral dimensions, but also intricate are the wide differentials in the entitlements of the population using roads. The former can be changed with lesser effort by technological and behavioural interventions; however, the latter are intrinsic problems associated with the risks held by the population. Since the latter's behaviour and occupational risks are unambiguously related to the occupational features and living conditions and so on.

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