Original Article

Road traffic accidents in hilly regions of northern India: What has to be done?

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BACKGROUND: Road traffic accidents (RTA) are responsible for 1.2 million deaths worldwide each year. RTA will become the 3rd largest contributor to the global burden of diseases after ischemic heart diseases (IHD) and depression. We conducted a retrospective study on RTA in a tertiary center in the hilly district of Uttarakhand in India.

METHODS: The number of RTA, pattern of RTA, the number of patients killed and injured, the pattern of injury causing death and disability, the severity of accidents, and the type of disability were noted from December 2009 to November 2011. The accident severity was calculated as the number of patients killed per 100 accidents. The methods for reducing the incidence of RTA were observed, and the role of policy makers was studied.

RESULTS: The majority of deaths and disabilities in Uttarakhand were due to road traffic accidents in the hilly districts of the states. The most common cause of RTA was driving fault followed by defective roads.

CONCLUSION: Proper designing of roads and minimizing the fault of drivers are essential to prevent road traffic accidents in hilly regions.

KEY WORDS: Road traffic accidents; Hilly regions; India

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INTRODUCTION

Road safety is a multi-sectoral and multi-dimensional issue. It incorporates the development and management of road infrastructure, provision of safer vehicles, legislation and law enforcement, mobility planning, provision of health and hospital services, etc. Road safety includes road infrastructure, vehicular issues, provision of health and hospital services for trauma cases. Road safety is a shared responsibility of the government and a range of civil society stakeholders. The success of road safety strategies in all countries depends upon a broad base of support and common action from all stakeholders.

Road traffic accidents (RTA) are responsible for 1.2 million deaths worldwide each year. Moreover, more than 50 millions of people are injured and become permanently disabled. The golden hour philosophy, which was

introduced by Dr. R. Adams Cowley in 1961, recognizes that casualties will have a much poorer chance of survival if they are not delivered to definitive care within one hour from the time of the accident. The golden hour includes the time taken for call-out, travel to the incident site, extrication and transport of the patient to hospital. This time-scale has no provision for a lengthy extrication time at the accident scene, if lives are to be saved without much morbidity. In developing countries where traffic management services are not well developed and due to overpopulation, the incidence of accidents is higher than in developed countries. The most commonly affected population in road traffic accidents are pedestrians, cyclists, motorcyclists and users of public transport.

In developing countries like India, the emergency services and trauma care is underdeveloped. In the hilly

regions of Northern India (Uttarakhand), the traffic accidents are due to the poorly developed national highways, poor infrastructure and unattended hazard zones. The quick response teams are unable to deal with the accidents in a judicial and scientific way because of lack of knowledge. In India, the rate of traffic accidents is increasing day by day, but the development of emergency services is lagging far behind. As expected, the accident scene is chaotic since there are no quick response teams. To help victims rescue efforts are made usually by the passersby and bystanders. The ill-fated unconscious patients, who are rescued by kind-hearted persons but invariably untrained, are being mishandled to the extent that the gravity of injury increases in many cases. The bystander's only concern is to transport the patient to the nearby hospital without any knowledge of the field triage. It's a good initiative that many developed countries have realized this deficit as the emergency services/physicians presence is limited and have instead started training their citizens to respond to an emergency until advanced help gets to the incident site. In India, 1 out of 6 serious trauma victims dies, but in the USA the figure is 1:200. In India, however, the lacuna lies with the emergency services.

The first case of RTA death was reported in 1896. RTA is the 11th leading cause of death and accounts for 2.1% of death globally. RTA will become the 3rd largest contributor to the global burden of diseases after ischemic heart diseases and depression.^[1] In developing countries, RTA accounts for 85% of annual deaths and 90% of the disability-adjusted life years lost.^[2] RTA affects mainly males (73% of deaths) between 18–45 years, who are the main breadwinners, and thus producing economic hardship to their family.^[3] The World Bank estimates that road traffic injuries cost 1%–2% of the gross national product (GNP) of developing countries, or twice the total amount of development aid received worldwide by developing countries.^[4] In Asia the anticipated growth in numbers of motor vehicles will be due to the increase in motorized two- and three-wheelers.^[5]

METHODS

This retrospective study was conducted in a tertiary center in the hilly district of Uttarakhand. This is a tertiary referral center for all four hilly districts in this region. The number of RTA, pattern of RTA, the number of patients killed and injured, the pattern of injury causing death and disability, the severity of accident, and the type of disability were recorded from December 2009 to November 2011. The accident severity was calculated as the number of patients killed per 100 accidents. The data were analyzed and compared with national data on road traffic accidents

from the statistics of the Transport Research Wing of the Ministry of Road Transport & Highways, which as the nodal agency for providing information/data on various facets of roads and road transport brings out an annual publication *Road Accidents in India*.

RESULTS

In Uttarakhand, the total number of RTA per one lakh population in 2011 was 14.9. The total number of persons killed per one lakh population was 9.3 (Table 1). In the hilly districts of Uttarakhand there were 512 deaths and 862 disabilities in the year 2010. This was comparable to the data in the year 2011 with 527 deaths and 847 disabilities. When compared with the state data of death and disabilities, it showed that the majority of death and disabilities were in the hilly districts of the state (Table 2). The accident severity was found to be 62. The RTA victims were maximal in the age group of 18–45 years (Table 3). The causes of RTA were most common (69.5%) due to drivers' fault including speeding, drunk driving, not wearing seat belt, careless driving, alcohol use while driving, inexperience, poor visibility, loss of control, use of cell phones and failing to judge other person's path/speed. The defective roads of the hilly districts are the second major cause of accidents, accounting for 13.6%. The other causes were bad weather conditions (5.9%), defective roads (6.3%), pedestrian faults and miscellaneous causes (2.5%), and

Table 1. The incidence of RTA and persons killed and injured

Parameters	2010		2011	
	Uttarakhand	National	Uttarakhand	National
Number of RTA	1 493	4 99 628	1 508	4 97 686
Persons killed	931	1 34 513	937	1 42 485
Persons injured	1 656	5 27 512	1 712	5 11 394

Table 2. The number of deaths and disabilities in Uttarakhand and hilly districts

Parameters	2010		2011	
	Uttarakhand	Hilly districts of Uttarakhand	Uttarakhand	Hilly districts of Uttarakhand
Deaths in RTA	512	931	527	937
Disabilities in RTA	862	1 656	847	1 712

Table 3. Prevalence of RTA in different age groups

Age range (yr)	Percentage of patients
0–14	7.4
15–24	30.3
24–65	51.9
>65	10.4

defective motors (1.2%). These variables and data were analyzed with the help of the WHO mortality database, International Road Traffic and Accident Database (IRTAD), the International Road Federation World Road Statistics (IRF), the United Nations Economic Commission for Europe Database (UNECE), and the Community Road Accident Database (CARE).

According to the police registry and emergency medical service (EMS) data registry, 40%–50% RTA victims died on the spot, whereas 10%–15% died on the way to the hospital. The polytrauma patients constituted 25%–55%. The extremity injury was reported to be 25%–30%. The most common cause of death was neurological (52%), and the rest was due to hemorrhage and shock resulted from cardiothoracic, abdominal, pelvic and extremity injuries. Such injuries resulted in 1% of disabilities.

DISCUSSION

In developing countries the public health community failed to respond adequately to the growing problem while it was exhausting the economic resources. The entire world is now facing the worst public health disaster it had witnessed, in the form of RTA. The number of those killed in RTA annually is already very high and we are making the same mistake in managing RTA, as was done in managing major health problems. The commitment in developing countries like India towards road safety is very disappointing whereas in developed countries it is already growing at a healthy pace. The deaths from the RTA disaster are increasing globally and its rate is highest in developing countries. In developing countries like India the forecast for the future is dismal as the mortality in RTA will increase by 83% by 2020. It's already growing to be the number one cause of premature deaths among the most active and young population of the countries.^[6,7] In every developed country the roads are made by keeping in mind the motor vehicle user. The defective design and construction responsible for accidents in hilly regions are poorly designed curves in the road, failure to make guiderails, narrow shoulders or shoulder drop-offs, blind curves or hill crests, insufficient visibility at intersections on curves or hills, blocked visibility, poor sidewalks or insufficient spaces and improper placement of road signs or lights improper drainage. Accidents can also occur if a road is properly designed and constructed but is not carefully maintained. Defective maintenance concerns are potholes and road erosion, broken guiderails, failure to remove roadway debris and failure to maintain signs and light controls.

The developing countries have to adopt the model followed by developed countries like the Netherlands and Denmark, where roads are built according to their function. In developing countries, buses and trucks are more involved in accidents because the safety standards are lax and lack proper safety standards. During winters vehicular visibility is very poor and is responsible for many accidents. By improving the visibility of drivers at night or during fog can reduce injuries.

The use of day time running lights, high-mounted stop lamps, reflectors and colourful clothing has decreased the incidence of crashes due to poor visibility. The most reliable methods of minimizing the accidents are setting and enforcing speed and blood alcohol concentration limits.^[8]

In some studies in developing countries, blood alcohol was present in 33% to 69 % of fatally injured drivers.^[9] As blood alcohol tolerances vary across countries, comparison studies are not easy. Till date, no study has furnished the evidence to evaluate the tolerance level at which decrease in accidents can occur in developing countries. In a study, a blood alcohol cut-off point of 80 mg/100 mL was applied,^[10] while it ranged from 48% to 69% in other 3 studies in Puerto Rico that used a lower cut-off of 20 mg/100 mL.^[11,12] In developing countries, car occupants comprise less than 10% to 20% of traffic mortalities. This incidence can be further decreased by compulsory use of seat-belts.

Among two- and three-wheel vehicle users, compulsory use of helmet and imposing the appropriate number of passengers for these vehicles also contribute to reduction in accidents.^[13,14] The experience in a number of countries shows that strict enforcement of speed regulation measures can be effective in preventing serious injury and mortality. The recent inventions are opening new avenues for road safety. In RTA, the incidence of polytrauma was 20%–40% and the incidence of extremity fractures was 18%–20%, which was comparable to our data.^[15,16] According to the 2001 census, 2% of the Indian population is differently abled. Injuries were responsible for nearly 1/3 of all disabilities and RTA contributed to half of them.^[17] Wang et al^[18] reported that the predominant injury sites in road accidents were the head, neck and extremities (35.9%).

These technologies comprise intelligent speed adaptation, in which the vehicle assesses the speed limit for the road; alcohol-ignition interlock systems that detect alcohol on the breath of drivers, preventing them from starting their engines; or electronic driver improvement monitors that connect individual driver

profile assessments and an individual vehicle operator's actual driving performance.^[19] Speed limiting devices on vehicles, limits on engine power, and non vehicular traffic-calming measures hold the greatest promise in developing countries.^[20–23] To our knowledge and resources, we had undertaken this study from police registry and emergency medical service (EMS) data registry. As not much work has been done in this field, we analyzed the results with the help of WHO, IRTAD, IRF, UNECE and CARE.

Based on our study and similar studies, we suggest the following measures to minimize RTA in hilly roads. During planning of new road alignments on the hills, unstable land, slopes and cracked areas prone to landslide and washing away should be averted. The protective measures include parapet/guide walls, safe barriers, proper drainage, suitable sign-ages, markings, etc should be installed. The blasting work should be least possible and well designed with sufficient warning arrangement so that fall of boulders would not cause loss of precious lives and property. To either prevent or reduce occurrence of landslides afore-station should be undertaken. The slopes and hill roads should be well designed and constructed with a proper drainage system. During fog, use of luminous paints/strips should be used for signboards. The parapets and guide walls should be properly marked on both ends and on hillside at regular intervals to give a feeling of safety to the drivers and pedestrians. The measures taken to avoid accidents due to drivers fault are lawful limiting of speed, use of breath alcohol detector at check points, wearing seat belt, driving carefully, regular driving license checks, banning use of cell phones during driving and use of helmets for two wheeler drivers.

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