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Analysis for estimating economic loss due to deaths in road traffic accidents: Human capital method

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Abstract---Background: Injuries and Death that had occurred due to road traffic accidents cannot measure the economic loss, but also affects the physical and mental challenges of the whole family. The aim of this study is to determine the economic burden due to road traffic deaths in hilly areas of two major districts of Uttarakhand. Methods: A retrospective cohort study was conducted to determine the impact of deaths due to road traffic accidents for which secondary data was collected after written consent from the Traffic Police Department records in Dehradun and Haridwar. Primary data was collected from the attendants of deceased through pre-designed structured questionnaire along with informed consent. Significance & scope of the study: The economic loss due to road traffic accidents (RTA) is not measurable. Few studies claimed to assess the economic burden due to road traffic accidents in the last two decades. No database was available from hilly terrain in Uttarakhand. Hence the scope was a major criterion for this type of study. Research Findings: The present study estimated that the road traffic death rate was found to be significantly affective the GDP of the deceased family in comparison with state to that of country.

Keywords---Road Traffic Accidents, Deceased, Economic Burden, Hilly terrain, GDP.

Introduction

Road Traffic Accidents are one of the leading contributors to the world's mortalities and morbidities. The most critical problem faced by governments to

tackle is road accidents. Apart from the humanitarian aspect in reducing the load on road deaths and injuries in developing countries is to adopt a strong policy on economic grounds, as they consume massive financial reserves that the countries can ill afford to lose. Road Traffic Accidents in developing countries are a serious concern in terms of safety and economy. The costs of RTAs are divided into two, namely direct and indirect costs, which include the medical costs, administrative costs, property and vehicle damages, etc ^[1]. Therefore, this study targets estimating the overall costs due to fatal/deaths of Road Traffic Accidents in the two districts namely Haridwar and Dehradun by using the Human Capital Approach. As per the records of World Health Organization (WHO) in 2004 about 1.2 million deaths are due to road traffic accidents and 20–50 million cases are due to injuries or disabilities which occur every year in the world. Road traffic accidents play a very crucial role in terms of healthcare resources and productive loss as per economic consequences.

The cost of road traffic accidents is estimated at around 1% of GDP in low-economic countries, about 1.5% in middle-economic countries, and approximately 2% in high-economic countries ^[2]. In developed countries, an increase in GDP reduces the casualty rate of traffic accidents, but has no effect on the number of accidents or injuries. In low-economic countries, the GDP per capita ratio is lesser than \$1600 in comparison with the number of road crashes by 7.9%, the road injuries by 4.7%, and a number of deaths by 3.1% are expected as a result of a 10% increase in GDP. As per scholarly articles available it was found that there was invariable increase in a number of traffic injuries, crashes, and deaths are independent of roadway availability, vehicle counts, population size, and fuel. It was concluded that the number of casualties no longer depends on economic growth at a certain threshold of \$1500-\$8000 per capita income ^[3].

There were only two studies conducted to estimate the cost of road traffic accidents from available data by insurance companies, hospitals and motor transport claims ^[4,5]. A study conducted by Mohan et al. estimate economic loss due to road traffic injuries to be around 3.2% of GDP by removing factual errors from the previous study ^[6].

A study conducted by Reddy et al. to examine both direct and indirect costs related to road traffic crashes by using structured questionnaire with accident victims and their attendants. However, this study also defines the limitations of the several studies to measure the cost related to disability, mainly due to the cross-sectional nature of the study without consideration to future follow-ups ^[7]. Another study conducted in Bangalore estimates the Out of pocket payment at the time of hospitalization and during follow ups and reported median OOP expenditure incurred due to deaths as USD 446.5 ^[8]. The aim of the study is to assess the economic loss among death victims due to road traffic accidents using human capital approach in hilly areas of Uttarakhand.

Methodology

A retrospective study was conducted on secondary data provided by Transport Research Wing and Police Records by the Government of Uttarakhand. In our study, we selected Uttarakhand as the study area because of supportive nature of

the government of the state and also due to the easily assessable of the study subjects in both districts.

In this study, we included only injured cases categorized as Minor, Major and Severe Injuries. In Uttarakhand, there were 13 districts of both the region namely Kumaun region and Garhwal region. In this study, We were included two districts of Uttarakhand namely Dehradun, Haridwar on the basis of population, number of sub-districts, hilly and plane road segment and number of black spots. Other reason for selection these two districts namely Dehradun and Haridwar was that these are also most populated cities which cover around 40% of the total population of Uttarakhand and acted as a representative of the state. There were 9 sub-districts in these two districts and consists of more than 60% of total black spots in Uttarakhand [9]. Geographically these two districts consist of both plane and hilly road segment.

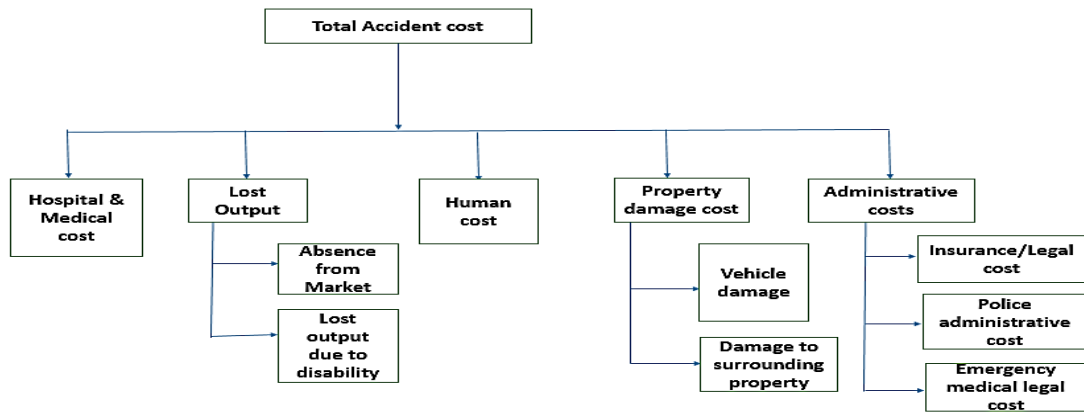


Figure 1: Flowchart of various accidents cost

This study tends to adopt the Human capital or gross output approach to calculate the cost of road traffic accidents. Since it dealt with the direct and indirect costs involved in the RTAs [10]. The Human Capital Approach/ Gross Output Approach was based on identifying and determining the individual factors which were involved in a broad traffic accident, and which causes a loss to the economy, either directly or indirectly, and adding them up to a concrete value. The method included the monetized value of pain, grief, and suffering caused by the loss of human lives.

Table 1
Identified Black spots in 13 districts of Uttarakhand

S. No	District Name	Number of Black Spot	District Name	Number of Black Spot
1.	Dehradun	48	Pithoragarh	2
2.	Udham Singh Nagar	31	Champawat	1
3.	Haridwar	25	Bageshwar	1
4.	Nainital	7	Almora	0
5.	TehriGarhwal	3	PauriGarhwal	3

6.	Chamoli	2	Uttarkashi	0
			Rudraprayag	1

Source: Transport Research Wing, Government of Uttarakhand [11]

Results

Demographic data

Study data was collected from year 2016 to 2018 from Transport Research Wing and Police Records, Govt of Uttarakhand on the recorded subjects. Out of total subjects, only permanent resident of Dehradun and Haridwar were included in the study. Average age of accident victim is less than average life expectancy in all type of injury (Table 2). Total 79 black spots were identified by government of Uttarakhand, 48 were in Dehradun and 31 in Haridwar. In both district, almost 50% of subjects were of minor injury and 16-20% were of severe injury and the rest had major injury driving through two and four wheeler (Table 3). There is significant ($p < 0.05$) differences in all type of cost (Administrative cost, Medical expenses, Human capital cost, Human suffer cost, Vehicle cost) of two wheeler and four wheeler. Understandably, the costs of four wheelers were higher in comparison to two wheeler in all types of injuries (Table 4). The economic loss due to all types of injury was higher in Haridwar than Dehradun in both types of vehicle accidents viz., four and two wheeler Table 3. Although, the population of Haridwar (2.29 Lakh) is less than Dehradun (5.78Lakh), as shown in table 1 more number of accidents (590) happened in Haridwar than Dehradun (232) yet less number of black spots in Haridwar (39) than Dehradun (49). This resulted in higher economic loss cost of Haridwar (almost more than double) than Dehradun (Table 5)

Table 2

Summarize Average life expectancy and Average age of accident victim during various type of injury

Variable	Fatal/deaths
Average Life expectancy (years)	71.5 years
Average age of accident victim (years)	29.8 years
Period of loss (years)	41.7 years
Income per month (INR)	16561.5
Consumption per month (INR)	9358

Table 3

Distribution of total number of injured peoples according to types of vehicles in Dehradun and Haridwar

District Name	Number of black spots	Total Fatal/Deaths	Fatal/Deaths	
			Two wheeler	Four wheeler
Dehradun	49	38	24	14
Haridwar	32	115	76	39
Total	81	153	100	53

Table 4
Distribution of average cost for person accident calculated from injured data of
Dehradun and Haridwar, Uttarakhand

S.no	Variables	Fatal/deaths	
		Two wheeler	Four wheeler
1	Administrative cost	5433	6304
2	Medical expenses	23470	27830
3	Human capital cost	3604631.4	3604631.4
4	Human suffer cost	1164752	1295413
5	Vehicle cost	39418	419246

Table 5
Distribution of total economic loss according to different injuries in both districts

District Name	Fatal/Deaths	
	Two wheeler	Four wheeler
Dehradun	116104905.6	74947941.6
Haridwar	367665534.4	208783551.6

Discussion

The present study is conducted in hilly road segment of Uttarakhand in two districts viz., Dehradun and Haridwar, and analyzed the total cost that was 760 million in three consecutive years as per records available with the Transport Research Wing and Police records of Uttarakhand. In this study, we included data of fatal deaths provided by Transport Research Wing and Police records of Dehradun and Haridwar. In both the districts, there are 82 black spots (49 in Dehradun and 33 in Haridwar). Variations in cost components was observed for fatal/deaths in the study [12]. In this study, we apply HC approach as it normally depends on the research objectives, data availability and to include actual expenses and direct and indirect loss of income etc.

Due to the lack of precise data in low middle income countries like Bangladesh, Bhutan, Greece, South Sudan etc, reason being the majority of studies conducted in various countries like Egypt, Vietnam, Taiwan, the Philippines and Jordan. All these countries have used the HC approach to estimate the cost of RTCs. A few attempts established in India to estimate the costs of road traffic crashes over the past few decades using empirical approach [13-15]. According to Published reports statistics given by World Health Organization, the annual cost of Road traffic crashes in Low Middle Income Countries lies from 1%-2% of GDP [16]. In this study, we estimated economic cost based on black spots which involved only two districts of Uttarakhand, Moreover huge burden is observed in these two districts then it will definitely affect the GDP at higher level.

The study sought to quantify the direct costs of RTI (out-of-pocket (OOP) costs) as well as the indirect costs. A review of cost of illness studies identified six most common categories of direct medical costs, including emergency department/hospital services, outpatient physician services, drugs, diagnostic

procedures/laboratory tests, other healthcare services and ancillary personnel [17]. In addition to these elements, cost of injury studies also included, as part of direct costs, ambulance/transport costs, home care, nursing home and other long-term care as well as vocational rehabilitation and insurance administration costs [18,19]. Direct non-healthcare costs including those associated with police attendance and investigation of crashes, other legal and coroners costs, vehicle and other property damage costs as well as other general costs associated with travel delays and fire, and other emergency services costs, will also be included [20]

This shows that RTCs are a relatively large drain on the public resources in India as compared to other countries. This is similar to recent studies published in Egypt and the Philippines. Our findings indicated that the production lost related to RTCs was about 36.04 lakh of the total cost which is not in good agreements to other studies [13,14].

There is no such study conducted to evaluate the economic costs due to fatal deaths in road traffic accidents in hilly road segment. Many studies attempted to evaluate road accident costs based on insurance company data in many places like Chennai and Delhi [4,6]. Both studies used rudimentary methods for cost analysis which are varied in results to our study.

There are financial losses occurring in different continents of the world as shown by the various studies but all these losses do impact their economies to the different extent and can't measure exactly [13]. This impact is more felt in developing countries as compared to the developed countries.

Many families suffer due to poverty when their bread earners die or disabled. If more money is spent in budgets to take care of the factors responsible for accidents it may definitely reduce the incidence of road traffic accidents this may help in preventing the financial losses. Automated vehicle industry may greatly reduce the number of accidents thus preventing the financial losses to the victims and respective governments but this will take a long time to develop and to be accepted by the people. If nothing is done it is estimated that by 2030 road traffic injuries will become the 7th leading cause of death and those countries that have made systematic efforts have reduced these losses.

Conclusion

The study concluded the economic loss due to fatal/deaths in road traffic accidents. In both the districts viz. Haridwar had maximum number of accidents as compared to Dehradun district whether there are fewer black spots as compare to Dehradun district. Furthermore, there are less population as compare to capital district. Be that as it may, the distinctions in the expenses of RTCs among the nations may be partially a direct result of varieties in their health care systems, administration costs, pattern of injuries, the safety of vehicles and roads, the driving culture and a variety of different elements. It is therefore, important to identify the main factors contributing to the RTCs, to develop and implement strategies to reduce their occurrence and to mitigate their

consequences. The government has to focus on accidents frequently occur in Haridwar and also strict and take proper action for breaking the traffic rules.

In this study, we focus on only two main districts of Uttarakhand whether there are 13 districts so that government will focus and take it as serious problem and proper strategies will be taken to minimize them because road traffic accidents will not only affect only financially but also emotionally to the victims family.

Limitation

The limitation of the study is that we studied only permanent residents of Uttarakhand state. No data were found related to the government property damage because it includes several departments like PWD, electricity etc. So, it is very difficult to measure the exact cost. Permanent disability and insurance related cost were also excluded from the study as such there is no related data available as well as study subjects were also denied to respond regarding this information. The estimated cost was only due to injuries on the basis of black spots and of two selected districts only. Mainly economic loss is due to Deaths in road traffic accidents.

Conflict of interest

There is none conflicts of interest.

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