ORIGINAL ARTICLE

A Study of Road Traffic Orthopedic Injuries at Tertiary Health Care Centre of Central India: Haddon Matrix approach

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Abstract :

Road accidents continue to remain the leading cause of deaths, disabilities and hospitalization in India, as it is home to the second largest road network in the world. This massive network serves as the nation's lifeline, transporting the majority of all goods within the country, and it is the preferred option for mobilizing the country's passenger traffic. A cross sectional study was conducted amongst ward admitted patients in the Department of Orthopedics for one year. The data was collected using a pre-designed and pilot-tested questionnaire by interviewing patients. Multi-variate logistic regression was used to find the co-relationship of various factors responsible for causing trauma. The study included 560 patients; almost 70% were young adult males. The factors causing trauma were over speeding (Odds Ratio -0.97, P<0.05), driving in an inebriated state (Odds Ratio -0.77,P=0.001), ignoring traffic rules (Odds Ratio -0.44, P=0.03) and not using safety devices (Odds Ratio -2.2, P=0.02). In most of the patients, head-on collisions, especially on straight roads, were the cause of trauma. However, distracted driving, poor weather conditions were not associated with trauma. The factors causing causalities on the road need to be identified. It is expected that with increasing freight and passenger traffic, the incidence of trauma will increase. There is a dire need to inculcate standard road etiquettes in drivers. Also, on the part of stake holders, the condition of vehicles and the maintenance of roads can prevent causalities.

Keywords: Road traffic injuries; Orthopedic trauma; Haddon matrix; Multivariate analysis.

Introduction :

Road transport is the most cost-effective mode of transportation in India, both for freight and passengers, considering its level of penetration in populated areas. Exposure to adverse traffic conditions is high in India because of the unprecedented rate of motorization and growing urbanization, fueled by a high rate of economic growth. As a result, incidents of road accidents, traffic injuries, and fatalities have remained unacceptably high. Road traffic injuries are the leading cause of death globally and the principal cause of death in the age group of 15 to 49 years. [(1)] During the calendar year 2021, road crashes in India claimed about 1.5 lakh lives and caused injuries to more than 3.8 lakh people.[1] Because road accidents are the result of the interplay of multiple factors, multi-prong measures are needed to reduce the number of accidents and fatalities. Therefore, the Ministry of Road Transport and Highways has initiated a proactive policy approach towards road safety by incorporating the participation of all stakeholders across the country. A total of 4,12,432 road accidents have been reported by States and Union Territories (UTs) during the calendar year 2021, claiming 1,53,972 lives and causing injuries to 3,84,448 people.[1] In India, the state of Tamil Nadu accounts for the maximum number of road traffic accidents, i.e., 13.5% with 10 % fatalities, followed by 11.8% accidents and 8.2 % fatalities in Madhya Pradesh.[1] Road safety cannot be undermined if we want to achieve goals of sustainable development, prosperity, and growth. Road safety is imperative for a happy, healthy, and prosperous life, for an individual as well as that of the nation. With rising motorization and an expanding road network, travel risks and traffic exposure grow at a much faster rate, as the growth of registered vehicles always out numbers population growth and the construction of new roads. Today, road traffic injuries are one of the leading causes of deaths, disabilities, and hospitalizations, with severe socio-economic costs across the world.

Road accidents are multi-causal and are often the result of the interplay of various factors like human error, the road environment and vehicular conditions. Hence, the Haddon matrix, which is a "phase-factor matrix," is likely to facilitate an assessment of the factors that contribute to injury occurrence and severity. It helps in evaluating contributing factors and using its assessment to design prevention strategies.[2] It combines public health concepts of host-agent-environment as targets of change with the concepts of primary, secondary, and tertiary prevention.[3,4]

Present study uses the Haddon matrix to understand contributing factors, responsible for causing Orthopedic injuries. It accounts for 13% of disability adjusted life years (DALY), and adverse

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Tables-1

	N(560)	%
Age (In Years)		
<18	67	11.9
18-30	230	41.09
31-45	174	31.04
45-60	64	11.5
>60	25	4.47
Distribution of patients on the basis of Type of road of accident		
Highway	174	31.0
Roads in town	185	33.1
Roads connecting village to highways.	201	35.9
Distribution of patients on the basis of road condition at the site of accident		
Straight road	139	24.8
Curved road	81	14.4
Bridge road	109	19.4
Poorly maintained road	63	11.3
Under construction road	66	11.8
Well constructed road with fast traffic	102	18.3
Distribution of patients on the basis of type of impact		
Hit & run	122	21.8
Head on collision	165	29.4
Hit from side	150	26.7
Slipping/Skidding	123	22.1
Distribution of patients on the basis of their position at the time of impact		
Pedestrian	130	23.3
Bicycle rider/Two wheel rider	190	33.9
Light vehicle	44	7.8
Heavy vehicles	53	9.5
Pilon/Co Passenger	143	25.5
Distribution of patients on the basis of status of driving licence		
Valid licence available	259	46.2
Learners licence available	94	16.7
Without Licence	208	37.1

impact on quality of life.[5] Minor injuries do not have a significant effect on life. But major injuries or impairments cause significant disabilities that may require significant palliation and rehabilitation. The study area is apex health care institutes with the availability of facilities to manage Orthopedic traumas. The findings of the study are expected to help in understanding the pattern of road traffic accidents in central India and taking adequate measures to prevent them.

Material and methods:

A cross sectional study was conducted amongst ward admitted patients of the Department of Orthopedics at Gandhi Medical College, Bhopal. Prior approval was taken from institutional ethics committee (IEC). The participants were selected by non-random opportunity sampling from July 2022 to April 2023. A sample size of 560 was calculated by prevalence of 21%, based on previous 6 months data of all road traffic accident patients being treated at Gandhi Medical College & Hamidia Hospital casualty ward, only 21 % required admission at the Orthopedic ward, at a 95 % confidence interval, a margin of error of 5%, and a design effect of 2. Seriously injured patients with a morbid prognosis were excluded. Informed consent was obtained from participants. A pre-designed, pilot-tested questionnaire was used for data collection. The question pertaining to probable cause of accident was elicited. The data collected was compiled and analyzed using MS-Excel 2020.The data was interpreted as proportions and percentages. Multivariate logistic regressions were used to co-relate various epidemiological factors with the probability of trauma.

Table 2. Multi variate logistic regression factors causing accident (N-560).

Factors causing accident	OR	95%CI	Pvalue
Over-speeding	0.97	0.96-0.98	0.04
Inebriated state	0.77	0.67-0.88	<0.001
Wrong side driving	1.55	1.14-2.09	0.006
Not using safety devices	2.2	0.98-1.96	0.02
Ignoring traffic rules	0.44	0.21-0.93	0.03
Distracted driver	1.07	0.80-1.42	0.656
Harsh weather conditions	1.01	0.75-1.37	0.93
Poor road conditions	0.71	0.67-0.08	0.06
Over loaded vehicle	0.83	0.48-1.42	0.49
Vehicular factors	1.05	0.72-1.53	0.08
Naive driver	0.66	0.50-0.86	0.004

Result:

In total, 560 patients participated in this study. The study included 79.6% (446) male patients. Out of 114 female patients, only 8.75% (49) were drivers.

Discussion:

It was observed that a majority of accident victims were young adult males (18-45 years). This is similar to global trends.[6] In the current study, most of the female patients were Pillion riders or co-passengers. (Table-1) It was found that most of the patients were injured on rural roads connecting with the highways, likely reason was that it was less crowded, hence drivers indulged in over speeding. Higher number of incidents occurred on comparatively straight roads, In India, there is a rising trend of accidents occurring on straight roads. The likely reason is that vehicle speeds tend to be high on straight roads in open areas, which corroborates the high percentage of road accidents.[1]

Although road features such as sharp curves, potholes, and steep gradient tend to be accident prone,[1] but poor road conditions did not significantly cause accidents in current study. We found that 18.3% of patients were injured while walking or standing on a footpath. Also, some of these patients suffered head on collisions from over-speeding vehicles. They were unable to recall any faults on their behalf. A large number of patients in the study were two wheel riders, followed by pedestrians, (Table-1) This is similar to global trends and as stated by the Academy of Family Physicians that pedestrians and cyclists are the most common victims of road traffic accidents.[6,7]

Pillion riders are at risk of injury, especially when not using safety devices, i.e., helmets, seat belts, and riding an overloaded vehicle. The 22.1% of patients who were driving or riding skid or slipped vehicles were over speeding on an accident-prone road. In this study, 37.1% of patents did not have a valid driving licence to drive. It is because most of the patients were co passengers. In the current study, over speeding was found to be significantly associated with accidents. (Table-1) As concluded by the WHO,

increase in average speed is directly related both to the likelihood of a crash occurring and to the severity of the consequences of the crash.[6]

The study found a significant association between accidents and driving in an inebriated state. (Table-2) As the WHO states, driving under the influence of alcohol and any psychoactive substance or drug increases the risk of a crash that results in death or serious injuries. As the risk of a road traffic crash starts at low levels of blood alcohol concentration (BAC) and increases significantly.[6] In the case of drunk driving, the risk of incurring a road traffic crash is increased to differing degrees depending on the psychoactive drug used. The study found that there is a significant risk of injury among patients who do not use safety devices such as helmets and seat belts. (Table-2) This is similar to the observation by the WHO that correct helmet use can lead to a 42% reduction in the risk of fatal injuries and a 69% reduction in the risk of head injuries. Wearing a seatbelt reduces the risk of death among drivers and front seat occupants by 45–50% and the risk of death and serious injuries among rear seat occupants by 25%.[6] There is a significant association between accidents and not following traffic rules. (Table-2) The drivers do not take road safety rules seriously and display erratic behavior on the road. Regarding these rules, WHO concludes that, if traffic laws are not enforced or are perceived as not being enforced, it is likely they will not be complied with and therefore will have very little chance of influencing behavior. Also, a significant factor responsible for causing accidents was a novice driver with poor dexterity and underdeveloped driving reflexes. In some cases, they were underage drivers with no driving licence who had started driving recently. The study was unable to find a significant association between trauma and distracted driving and mental condition of drivers. There is an insignificant association between accidents and overloading of vehicles. This is likely, that overloading is not acknowledged as a potential cause of trauma.

Conclusion:

Road accidents have become a leading cause of fatalities and injuries globally, with India being the leading country in this regard. The huge loss of life and attendant economic losses are highly avoidable and require urgent measures to be adopted for effective mitigation. The study used the Haddon matrix approach to understand factors causing Orthopedic trauma. This study is likely to help identify factors that cause trauma on roads.

The study gives an insight into the Indian scenario, which needs to be acknowledged. Hence, taking into consideration the factors mentioned in the study, appropriate measures can be taken in accident prone areas to make road travel safe for all.

Recommendations: The current study draws attention to the importance of formal training, re-training, and sensitization on avoidable risky behaviors being imparted to professional and non-professional drivers in a systematic manner and being a part of curricular education. The traffic rules should be followed strictly, with inclusion of adequate punitive actions. There should be stringent actions to prevent overloading. Inebriated driving should not be tolerated.

The use of safety devices should be strictly observed. Also, distracted driving should not be ignored. All individuals should be sensitized regarding the adverse outcomes of distracted driving.

Roads should be built with a proper long-term vision of town and country planning or keeping in mind futuristic visions to accommodate more vehicles down the lane in the next few decades. Well-maintained signals, signage, and marking (including lane marking) with proper traffic signals are required. Further, wherever possible, two-way traffic should be separated with sufficiently high dividers to reduce face-to-face collisions. Policymakers need to ensure safe footpaths on all arterial roads, along with subways and foot bridges, wherever necessary, particularly near busy junctions. Further comfortable, reliable, and cost-effective public transport service should be ensured for all levels of citizens, which will demotivate the public to use personal vehicles.

Limitation- The study was unable to elicit instances in which the driver was at fault, as in most of the situations, the drivers did not believe that trauma was due to their fault.

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