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Road Safety Issues in India

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ABSTRACT

Road safety mishaps are now considered a public health issue considering the economic and societal costs of road accidents. The victims are the face of the incidents; however, the costs are borne by their families, society, and countries. In this paper, we look at the need to bifurcate individual and authoritative responsibilities such that our roads become a safer place for all. We focus on India as the case study region and study the various government initiatives taken to improve the country's road safety. This research highlights the gaps and recommends necessary solutions to decrease road traffic deaths and injuries. Further, we investigate how the responsibilities must be shared amongst the various stakeholders, including the drivers and the leadership, placed at two opposite ends to balance the changing aspects of road safety.

This paper aims to give recommendations for improving the road safety conditions in India per the local context by analysing the three key questions:

a. What are the societal impacts of road traffic accidents?
b. To what extent does individual responsibility matter, and why can road safety not rely exclusively on the drivers' behaviour?
c. How and where do the authorities' responsibilities change the road safety dynamics?

Introduction

Health, without injury or disability, is regarded by economists and public health specialists as an essential element of human development in the present day. As a result it improves people's lives by allowing them to learn, acquire skills, grow as individuals, and contribute to society.

A road safety program is designed to prevent road users from being killed or seriously injured. A 'Safe System' approach to the road transportation system is built on the belief that "death and injury are unacceptable and avoidable" (PIARC, WORLD ROAD ASSOCIATION, 2021). The origin of the concept is dated back to Sweden and Netherlands in the 1980s and 1990s (International Transport Forum, 2016) when policymakers believed that road users' safety was their own responsibility and the authorities and policies were specifically to influence their behaviour to act safely on roads at all times. To address the high number of road fatalities globally, the International Transport Forum (ITF) in 2016 emphasized and extended visionary policies like 'Vision Zero' and 'Town Zero'.

Over the past decade, road safety incidents have increased worldwide. Several mitigation measures taken by the governments and authorities may have aided in reducing the number but only by a fraction, and so is the case in India. The target of achieving SDGs 3 and 11—ensuring healthy lives, reducing deaths by road accidents, and providing safe, affordable, accessible and sustainable transport systems (United Nations, 2015) were far from achievable by 2020. We may still have a chance to significantly alter the transportation scenario over the next decade as a result of UN Global Road Safety Week promises.

Until recently, worldwide, and even now in developing countries, 'roads' as a concept are viewed as space for movement. The absence of designated road space for different users gives the false pretence of a 'shared space'. It is no news that motor vehicles predominantly rule the right of way (ROW) while shoving

other users towards the edge of the road, and sometimes, moving freely even then is unlikely for non-motorised (NMT) users. Pedestrians, cyclists, and other NMT users are often considered vulnerable road users, since they are at the mercy of the mighty vehicles moving at full speed. In proximity to motor vehicles, vulnerable road users are perceived to be at higher risk of physical injury. Among other reasons, the absence of dedicated space, poor physical protection, and uneven visibility are the prominent factors affecting the extent of vulnerability.

Compared to other road users, drivers (of motorized vehicles) are less likely to worry about their safety. Instead, they are more to be expected to report feeling concerned about sharing the road with other road users and not having enough space still. As there are still some roads that have designated footpaths, personal safety is largely a concern for cyclists. As a result, they must share the right-of-way with vehicles that are constantly speeding or overtaking. Drivers are frequently concerned about coming into contact with cyclists, pedestrians, and other users of NMTs when those users are moving at a slower speed, and vehicles try to overtake, or when those users are crossing the street at or before crossroads without a signal, and when pedestrians cross without a designated crossing.

In different places, different concepts of road sharing are explored, such as equal sharing, priority on the road, and responsibility for road safety. Despite this, there is still a constant overlap of attitudes and experiences among road users. It is not uncommon for drivers to see cyclists as inconsiderate road users, contributing to this concern. Even though most of the population and even policymakers are of the opinion that cars are given priority on the road, there is a high level of support for equal road sharing and responsibility for road safety. It has become a cultural norm that many believe should continue. However, research indicates that despite some planners and designers being open to this change, many remain firmly convinced that cars should remain first.

Road Safety Mishaps around the World

Over 50 million people suffer non-fatal injuries from road traffic crashes each year (World Health Organization, 2021). In its UN General Assembly resolution, the UN set targets to reduce accidents and fatalities resulting from road traffic by 2030, based on the level of development of each country (SLoCaT, 2020). Only 50% of the world's motor vehicles are in low- and middle-income countries, but they account for 90% of all road deaths (World Bank, 2017). There is a large amount of research data to support the assumption that road accidents cause compounded harm to individuals, households, and society. According to the World Bank, the majority of road traffic injuries (RTIs) are responsible for mortality and long-term disability in the working-age population (World Bank, 2017). Globally, children and young people in the age group mentioned are the primary victims of road traffic accidents. The World Health Organization states that road traffic crashes cost almost 3% of a country's gross domestic product (GDP) (World Health Organization, 2021).

Road traffic data in different countries come from many sources, such as the health sector, police, non-governmental organisations, and academia. There have been cases where fatalities recorded by WHO were different from those recorded by local authorities. To achieve the best results, data sources and systems should be connected. Such better coordination is difficult to achieve in reality.

The importance of this can't be overstated since data play a crucial role in decision-making for road traffic policies. Authorities must know the number of people dying on the roads with accurate location and reasons to analyse the risk factors. A government can improve its targeting and monitoring of its efforts, for example, by correlating the percentage of motorcycle riders wearing helmets with crashes associated with alcohol use. For data to be accurate, it must be collected according to best practices and harmonised across sectors (such as police and health). A good data collection system helps understand the problem's magnitude and provides a basis for making better decisions. Moreover, good data can be used to measure policy and program effectiveness. The underreporting of road traffic deaths is a fundamental problem in low- and middle-income countries.

Further, while road safety seems like an independent issue, it directly links with the country's financial and health authorities since the impact of road accidents is multilateral. A deeper dive into the repercussions suggests that the health systems incur institutional costs of road fatalities. Simultaneously, the societal costs of road injuries and deaths affect the victims and their families in the larger spectrum. Universal Health Coverage recognition has long been correlated to curbing road traffic injuries (World Bank, 2017).

Economic Cost

As a result of road traffic injuries and fatalities, victims and their families suffer physically, psychologically and financially. As well as direct costs, indirect costs such as loss of productivity, damage to vehicles and property, and lowered quality of life must also be taken into account when calculating the actual cost to society. Costing studies at the country level use several different methods, which makes it difficult to compare them globally. Nonetheless, they highlight how road traffic crashes affect different sectors nationwide and help convince policymakers to invest in prevention.

Globally, the primary victims of RTI aged 15-49 require costly trauma care (Pal, et al., 2019). A limited amount of literature exists for South Asian countries that explores the economic burden of severe injury and loss of earnings on severely injured and hospitalised RTI victims. Many road deaths are the result of vulnerable road users. These road users are mostly victims of bad infrastructure, insufficient general awareness, and deliberate enforcement.

Public Health Issue

People, communities, and countries are adversely affected by road traffic injuries and deaths. They often overburden health care systems, add to scarcity of hospital beds, require dominant resource allocation, and result in productivity losses. It is considered a "public health issue" (World Health Organization) and is expected to worsen without proper action.

Road casualties are infamous to cause a ripple effect on families and dependents, pushing them into lower-income bands and urban poverty. Road crash victims require constant cash input to hospital care and occupy hospital beds longer than average patients (World Health Organization).

The Indian Scenario

According to the World Bank (World Bank, 2017), GDP per capita in India can go up by 14.9% if only the country could halve road deaths and injuries over the next 24 years. The calculations consider higher income gains resulting from accumulated annual growth over time and considering the quality of life in terms of healthy life expectancy, environment quality, drug abuse extent, and social services availability. It is closely connected to the social discount rate used for measuring the rate at which society would be willing to trade present for future consumption (Lopez, 2008).

Factors such as globalisation, migration, changing economic dynamics, income growth, and vehicle availability have brought humans into contact with numerous new products that have changed the physical and urban. In recent years, there have been an increasing number of deaths, hospitalizations, and disabilities caused by road accidents in India. According to the UN Sustainable Development Goals, road traffic deaths should be reduced to 12 in low-income countries by 2020, 7 in middle-income countries, and 4 in high-income countries by 2020 (SLoCaT, 2020).

Sustainable transport planning balances the urban planning objectives standing on the sustainability pillars of economic, social and environmental development (SLoCaT, 2020). Sustainable transport is vital for providing low-income people with access to jobs and services and enabling their income-earning activities to be safe, affordable, convenient and equitable. Much evidence states how improving accessibility (through transport) reduces poverty, increases incomes and work opportunities, increases health facilities and reduces mortality rates.

Road safety is usually associated with road traffic rules and regulations, which abide vehicular drivers to follow set standards. However, there are minimal, if not none, traffic rules that work in favour of pedestrians and cyclists in India. The only prominent ones we hear about are zebra crossings at every traffic junction and providing a bare minimum of curb space between vehicles and footpaths. Even these are not present in their entirety. Indian cities rarely consider pedestrians and cyclists in their traffic signal cycles and parking and shelter provisions.

The above reasons explain why pedestrians and cyclists are often victims of road accidents. However, they are not the only ones. Motor vehicles themselves are prone to road accidents when put in between vehicles moving at speeds faster than their capacities and on roads not designed with the best safety measures in mind. We have several rules for drivers, such as wearing seat belts and helmets, using indicators, passenger capacities, stop lines, traffic signals, speed limits, etc. Whether or not they are enough is a totally different question. A problem even more extensive than that is the mindset of people who do not abide by the traffic rules and often become party to accidents on the roads.

Unfortunately, the country's socio-economic spectrum is diverse and highly divided. According to The World Bank, disproportionately, RTIs affect the lower strata (2021). The latest numbers revealed 1.5 lakh deaths due to road accidents on the roads in India (MoRTH, 2019). It is among the highest number of deaths caused by RTIs in the world. Even though the country only has 1% of the world's vehicles, it accounts for over 10% of all road accidents (The World Bank, 2021). Most roads, as well as their design geometrics, are unacceptably bad, except for a few arterials in and around major capitals and metro areas. Roads aren't built with a good long-term vision, nor are they adaptable enough for more vehicles down the road in the next couple of decades. The old-fashioned methods of maintaining roads, instead of focusing on a lower pollution approach, are used. Moreover, poor households are often reported to have little or no access to health facilities and insurance coverage. The delay in covering hospital costs and lost income exacerbates inequality, especially in urban areas.

Significant causes of road accidents

India has a complex driving culture; driving has always been hazardous, and recent statistics show it is getting more dangerous as far as accidents, deaths, and injuries are concerned. Every year, 1.5 lakh people are killed in road accidents, according to MoRTH (MoRTH, 2019). Despite the fact that the accounted number was 1.9% less than in 2016, the accident severity, or the number of people killed by 100 accidents, has grown by 1.4%. Below are a few reasons that can be listed as **'Drivers' Negligence'** that account for road crashes.

Over speeding

Accidents are caused by speeding - the faster a car travels, the more it impacts other vehicles. Fatality risk for car occupants is 85% in car-to-car side impacts (World Health Organization, 2021). According to Pal, et al., 2019 (Pal, et al., 2019), speed accounts for one-third of RTIs. The likelihood and severity of a crash increase as speed increases. A 1% increase in average speed raises crash risk by four times, and a 3% increase raises severe crash. Pedestrians are even more drastically impacted when they hit car fronts.

Under the Indian Motor Vehicles Act 1988, cars and motorcycles are restricted to driving at speeds of 100 km/h and 65 km/h, respectively. There is a need to implement remedial measures such as inclusive road design, enforcing speed limits, establishing strategic cameras, and implementing traffic-calming measures.

Non-use of helmets

A study by the UN (Motorcycle Helmet Study 2016) highlighted that the death probability of motorised two-wheeler riders in a road crash is 26 times more than four-wheelers. As per the WHO, correct helmet use can reduce the risk of fatal injuries by 42% and that of head injuries by 69%. Other literature supported a reduction in death by 50% and fatal injuries by over two-thirds with proper helmet use. A research study based in India verified that only half of the two-wheeler riders in the country wear helmet and only 45% fastened seat belts (Pal, et al., 2019).

It is known that traumatic brain injuries (TBI) are the most common cause of mortality, morbidity and disability (Pal, et al., 2019). Thus, proper use of crash-proof helmets is a must for two-wheelers.

Non-use of Seat belts

Data suggest a 45 – 50% death risk reduction for drivers and front-seat occupants and 25% for rear-seat passengers when wearing a seat belt (World Health Organization, 2021). Seat-belts are likely to decrease coincidental tossing or smashing through the windshield, leading to fatality. Child restraints have also been recorded to save half of the children in accidents (Pal, et al., 2019).

Unlike 96 countries globally, India has no legislation for child-restraint use. We need more stringent laws for seat-belt and learning programs on road safety for better road safety.

Driving under the influence

Driving under the influence is a common cause of road fatalities worldwide, as is the case in India. Alcohol and any psychoactive substance, as per their concentration, hampers drivers' visibility, decision-making capabilities, reflexes, and hindrance in diagnosis, management, recovery, and prognosis (Pal, et al., 2019). Blood alcohol concentration (BAC) ≥ 0.04 g/dl is enough to risk road crashes (World Health Organization, 2021).

Random breath testing at police checkpoints on the roads and blood testing for RTI victims is standard across India. However, the testing number and instances are much less than needed, considering the rapidly increasing substance use in the country. Indian researchers working on road safety concluded that alcohol-related RTIs are the main threat to civilisation because of premature losses with downstream socio-economic effects on family and society that a holistic approach must prevent.

Distracted driving

According to WHO, drivers who use mobile phones while driving are four times more likely to be involved in road crashes. As a result of gadget distraction, drivers are unable to stay in the right lane, pay attention to vehicles coming from the other direction, assess and react to vulnerable users, follow traffic signals, and regulate vehicle speeds based on traffic conditions.

It is becoming increasingly common to fit audio visual entertainment, automated, or voice receptive gadgets to vehicles. These may considerably reduce the monotony of long driving that may lead to distractions and achieve the desired action. To address distracted driving, governments must take concrete steps to enact stricter laws, fund community awareness campaigns, and collect data regularly.

Dedicated Road space and Road safety conditions for other users

All-Cause Mortality rate (aged 15-64) has decreased in India from 2000 to 2015. In the same period, for the same age group, RTI Mortality has remained stagnant with no demonstration of a decrease in number (World Bank, 2017).

The prominent observation of more male drivers than females is also reflected in RTIs. Men are victims of three out of four road deaths (World Bank, 2017), placing a direct burden on the family's income and livelihood in cases of the victim being the sole bread earner. It is a loop going back to RTIs being common amongst earning population (since they travel more than the average) rather than spread across the population strata.

The 'shared space' concept relies on equal distribution of space such that users can share roads. By nature, the motorised vehicle has power over other road users in terms of size, force, protection, etc., since the harm done to them is not on the same level as that done to pedestrians or cyclists. However, in the absence of speed limits and traffic rules, motor vehicles will always stay the predominant user.

On a similar line of thought, cars dominate two-wheelers and buses and trucks dominate cars. The hierarchy follows the simple rule of size in this matter. The other factors are directly related to how much space the user occupies on the road. Safety is the most important aspect for everyone, not just 'vehicles' on city streets. Structural changes and enforcement that promote behavioural changes are crucial to improving road safety. In addition to ensuring the safety of non-drivers, proposed changes must promote equality on the road. Accordingly, drivers must be on board with the proposed new rules that favour cyclists and other road userPedestrians and cyclists account for half of the world's road fatalities.

The required hierarchy of road users will directly contradict the preference of vehicular drivers. It is imperative to remember that changing the ROW dynamics affects how vehicle drivers navigate the roads. To comply with the new proposed changes, pedestrians and cyclists need to pay extra attention while crossing the roads and moving along. It is important to accept pedestrians, cyclists and NMT as considerate road users. According to a UK study, cross-modal experiences can strengthen empathy towards vulnerable road users and foster a greater appreciation for improved road safety (Department for Transport, GOV.UK, 2021).

Pedestrians, cyclists, and non-motorized transport users, who have been neglected in transportation and planning policies, must be given the utmost attention to reduce traffic fatalities. By making walking and cycling easier, we can achieve better health resulting from more physical activity. The indirect benefits of reduced air pollution and greenhouse gas emissions can also help achieve better health resulting from more physical activity.

The Past Endeavours

In recent years, the Ministry of Road Transportation and Highways (MoRTH) has developed and implemented various initiatives aimed at raising traffic awareness and improving road safety:

- Promotional Programs
- Organising road safety programs by providing grants-in-aid
- Scheme for National Highway Accident Relief
- Driver training for heavy vehicles
- National Highway Development Program
- NGOs are taking action at their level to address this issue.
- Road safety weeks and competitions are held in several cities by police departments.
- A Road Safety Cell of the ministry has created an awards scheme to be presented to organisations and individuals for their outstanding contributions in the field.

The previous section listed the leading causes of road accidents in drivers' control. It is imperative to look at the **'Responsibilities Held by the Government and Authorities'** that can help avoid road fatalities:

Road Conditions

Indian road conditions are considered degraded except for national highways and politically active neighbourhoods. Potholes, unfilled-interrupted construction sites, failed signal lights, faded lane demarcations, missing zebra crossings are only a few in the long list of road design aspects that the government should fulfil. It is common in India to layer up the roads with concrete every few years to respond to the damage caused by natural factors and/or vehicles.

Vehicle design

The vehicle manufacturing standards are low and broad. In addition, the Indian market acts in a money-oriented manner, with manufacturers not caring enough about the civilian's safety. A proper monitoring and evaluation base is required for safer vehicle designs.

Road safety standards

Road safety in India is still a vaguely used term with limited standard guidelines. There is a lack of public awareness as well as negligence in road design protocols, making the Indian roads a site for fatalities. Authoritative administration from the government over the developers is required to maintain high-quality road infrastructure.

Law enforcement

Traffic police do not follow through with road traffic rules and regulations. They are often seen abusing their power, indulging in bribes, and not giving much thought to rule-breaking from safety perspectives. It is the need of the hour to educate the police on road safety along with the citizens.

Emergency services

The quick-response team in India is often short-handed and unable to reach multiple locations when in need. Further, the limited hospital beds and medical staff often exacerbate the nightmare.

Global Success Stories

In order to improve road safety, WHO recommends that countries worldwide focus on five risk factors and two additional aspects for injuries and deaths occurring on the road (World Health). For short-term interventions such as law enforcement, awareness campaigns, and enforcement, cost-effectiveness plays a key role. For a long-term solution, diverse stakeholders, vehicles, road users, and the environment must be considered.

A more comprehensive, robust, and effective road safety legislation is necessary to influence citizens' behaviour and road usage. Globally, the WHO assesses laws and bills for gaps in defining priorities for city roads for effective action. Moreover, WHO helps governments raise awareness about risk factors and dangerous behaviours among road users so that the magnitude of road traffic deaths and injuries, as well as their impact on public health and people's lives, can be reported.

It is one of the most debated topics in India today since traffic accidents are considered inadequately reported. It is believed that only the accidents reported to the police or those leading to deaths are listed in the road accidents database. Many other incidents where victims may have been injured but are not taken to the hospital or the police station immediately are often left out of the records.

Review of global experiences for road safety improvements

Motorcycle helmets are believed to reduce injury risks by over 70% and death risks by just under 40% (World Health). It is possible to reduce head injuries by requiring helmets to meet recognized safety standards, to be in good condition, and to be worn appropriately, e.g. not cracked and fastened appropriately. If motorcycle helmet laws are enforced, over 90% of the citizens will wear helmets. Nevertheless, several developing nations, including India, do not properly implement the law.

The lack of safety measures in low- and middle-income countries can cause more road traffic deaths. However, there is no correlation between vehicle numbers and road deaths in countries that have made adequate investments in road safety. While many high-income countries continue to motorize, road traffic fatalities have decreased as a result of proper road safety measures.

The 4Es – four pillars of Road Safety were taken into account for a global comparative study of Road Safety interventions worldwide. The following are some of the wider, commonly adopted practices to reduce road accidents and fatalities:

- A statutory body with integrated and dedicated functions that provide ongoing expertise with utter credibility to combat the rising threat of motor vehicle accidents and fatalities.
- Application of advanced ITS and AI technologies for traffic management.
- Guidelines and standards for designing, constructing, operating, and maintaining national highways.
- Various standards for providing trauma and medical care to traffic-related injured at various levels.
- Compliance with safety standards is regularly audited.
- Design and manufacture of vehicles must meet minimum safety standards.
- The rules governing traffic on the highways, including the schemes for segregating
- Developed procedures and centers for multidisciplinary crash investigations.
- Pay attention to the needs of women, children, seniors, persons with disabilities, and pedestrians in regard to road space and movement.
- Collection and analysis of data for accident investigations, research, finance, or administration.
- Road safety education, traffic management, road users' behaviour, and trauma care and rehabilitation.

What can India learn from these experiences?

A number of reports from the 1980s state that the lack of investments in road design improvements, maintenance, and enforcement have resulted in high vehicle deaths in LMICs (World Bank, 2017). The Indian scenario has evolved over time, but the scales are still skewed in favour of wider roads and motor vehicles, overlooking the needs of other road users, including micro mobility.

High-income countries attributed 30% of road fatalities to speed, while it is the primary cause of over 50% of fatalities in low- and middle-income. Braking distance is proportional to speed, so to determine 'safe speed' we need to consider the road type, function, traffic mix and plausible traffic mix combinations.

The use of speed cameras for speed management is a cost-effective, efficient solution. Consistent enforcement, deterrence, and reduced police intervention are some of the benefits of these tools. Since penalties do not have to be collected at physical interception points, they can also prevent corruption. The proceeds from speed cameras are also invested in making roads safer in countries where they are most effective.

In India, enforcement is majorly restricted to city limits only. There is no enforcing mechanism on national and state highways. Over 50% of crashes and fatalities are recorded on the highways. It is thus necessary to have proper enforcement protocols under the national and state highway authorities' purview as well as local authorities for city roads.

A comprehensive strategy is proposed under the National Road Safety Plan to tackle road safety issues by use of effective enforcement techniques:

- Use of Intelligent Transportation Systems and Artificial Intelligence Technology for better and efficient traffic management and enforcement
- Evidence-based & Contact Less Enforcement
- Use of scientific methods for collecting accident data for obtaining reliable data
- E-challan System, etc.

The following key performance indicators (KPIs) are suggested for monitoring, evaluating, and incentivising the states' initiatives and targets:

- Accident Severity (Fatalities per 100 crashes).
- Crash Density (crashes per km/yr).
- Fatality Density (fatalities per km/yr).
- Speed Violations cases booked per year.
- Avg. Total Response Time (Remote Point to Accident Location to Trauma Care Center).
- Several Road Safety Awareness Campaigns & Counselling Secessions conducted per Km per year.

Discussion on Bridging the Gap

A driving force behind the nation's economic growth and development is the transportation infrastructure and the road users, vehicles, and road environments. Each of these elements play an important role in the national development and growth of the nation. In terms of road safety, this combination of people, vehicles, and road environments should be studied carefully with appropriate measures to ensure safety and smooth movement.

People make mistakes and are physically fragile, which is significant to road users when talking about road safety. It is hence necessary to create a comprehensive system that shares responsibility between individuals and designers (International Transport Forum, 2016) to ensure a fail-safe:

Human error

To err is human! Humans are not perfect and cannot always be the best of drivers. They can never perform correctly in all traffic situations (International Transport Forum, 2016). It is thus crucial to keep in mind the limitations of being a human, including considering external factors such as clear headspace, pressure, and several other responsibilities of day-to-day life. Driving is often just seen as an activity done in order to reach places for other purposes, and the act of driving rarely has its own purpose. Thus, it is pretty standard for people to be distracted, rush, pay little attention to fellow drivers and road conditions while commuting. Although we cannot change basic human nature, we can alter it for better decision making. Two important steps follow the decision of behavioural change:

- relying on professionals and designers to abide by the adequate infrastructure and design standards, and
- creating a sense of shared responsibility amongst the citizens and community.

Physical crash tolerance

Humans are not invincible, regardless of what they think. The human body can take up only so much force and get damaged easily. We get bruises by something as small as a paper cut, and yes, while we can train our bodies to get physically stronger and not get a scratch on the outside when hitting a wall, it puts pressure on the bones inside, and we feel it just as equally. Imagine being hit by a vehicle twice your size, and besides, one that is moving at speed capable of throwing you to the other end of the road—that is not safe! It will put a person in a hospital bed if not kill them.

- Slowing vehicles down is therefore seen as one of the prevention measures. Speed limits and obstacles together can reduce the crash impact considerably.
- Bifurcating vehicles as per size and energy is another successful approach. Dedicated lanes are thus seen as a must on all types of roads.

The four Es Shared Responsibility

Providing a safer road environment is at the core of creating a Safe System. Shared responsibility among designers and drivers is a must to ensure 'Zero Crashes'. As stated before, individual responsibility goes only as far as human errors stay out of the picture. Therefore, the design layout of road networks and vehicular operations plays an essential role in guiding and informing road user behaviour.

In alignment with this, Education, Enforcement, Engineering and Emergency Care are crucial factors in reducing the number of accidents and fatalities.

Education

A road safety awareness campaign utilises audio-visual (short films, ads, radio), print media, and non-profit organisations. The Government activities form an essential contribution. Steps recommended for creating public awareness regarding road safety often include education, training and publicity campaigns to influence the attitudes and behaviours of all road users. Students and schoolchildren are also included in road safety education programs. Additionally, publicity campaigns concerning road safety can help propagate good practices among communities.

Enforcement

The causes of most crashes cannot be considered crimes except in the sense of breaking road rules and negligent driving without due care and attention. Drink-driving, also considered a social behaviour issue, is reported more than any other non-compliance issue. Even so, the approach for preventing road crashes and crime in particular is similar to the approach for preventing situational crimes. The road rules are expected to be followed by citizens if not adhering to them would result in unwanted outcomes, such as fines or revoked licences. The theory is sometimes correct, but it is frequently observed that people stop being afraid of minor fines after they get used to them. Therefore, disobeying road rules is perceived to be very risky and the likelihood of getting caught and penalised is high. Additionally, penalties should be sufficiently severe to discourage disobedience. It is important to enforce road rules that have been shown to increase the likelihood or severity of crashes in order to maximise road safety benefits. An increase in road safety can be achieved by using artificial intelligence-based policing.

Engineering: safer roads and safer vehicles

Safer Roads: Every day, vehicles travel on various Indian roads: national/state highways, urban/municipal roads, non-highway, arterials, and non-arterials, constructed using different road technology. Multi-level agencies are responsible for developing, maintaining, operating, investing, and certifying these roads, since both the federal and state governments, and local district authorities are responsible for safety and infrastructure. A comprehensive plan is therefore needed, along with policies, rules & guidelines, and roles and responsibilities for different stakeholders.

As earlier mentioned, road safety is a concern for everyone, including the vulnerable. It is therefore essential that road design guidelines aim to make roads and rules inclusive and provide adequate facilities that cater to all needs. Footpaths, cycle lanes, crossing points, elderly and children zones and other traffic-calming measures are critical to reducing RTIs.

Safer Vehicles: In India, vehicles vary based on type, size, engine, function, capacity, technology, etc. however, they all share the same ROW and often without bifurcated lanes and speed limits. Therefore, keeping in mind the driver's safety is a must for vehicle designers and manufacturers. However, as mentioned earlier, this is often not the case – either because the guidelines are vague or because there is no set penalty for failing to meet the vehicle standards.

Although the Motor Vehicle Act has tried to specify safety standards, enforcement of these guidelines becomes vital. It is proven that vehicle defects, fewer safety features, and lack of maintenance significantly increase accident risks. Several UN regulations on vehicle safety would potentially save many lives if applied to countries' manufacturing and production standards.

Emergency care of road accident victims

Advanced response to natural and artificial disasters requires an adequate emergency system. This is only possible through a close collaboration between the health care systems, the local governments and voluntary organisations. It demands the training of community members, first respondents, and health care workers. Delays in providing aid to road crash victims lead to the severity of injuries.

As part of the National Highway Accident Relief Service Scheme (NHARSS), States/UTs/NGOs are provided with cranes and ambulances when accidents occur. Their role is to evacuate road accident victims to the nearest medical aid centre for the purpose of clearing the accident site. An integrated public healthcare system should be able to provide life support through a unified emergency response system and an emergency care network.

Channels for Individual Contribution

Following are the four channels through which healthy individuals can contribute better to the economy and growth of the country:

Labor Productivity

It is no rocket science that healthier individuals are likely to be more productive. At the same time, productivity relies on multiple factors such as emotional and mental well-being as well as physical welfare. Several economic theories correlate health and income. Individuals seek to compensate for lower earnings by working overtime. While this can strain their productivity, a proper, just wage will add to their satisfaction level and positively impact their productivity.

Labor Supply

In alignment with the previous point, poor health reduces work responsibilities and, thus, labourers in certain age groups. The primary victims of RTIs are the individuals comprising of the young working population who also have better energy and strength for multiple tasks. Thus, a decreased number of RTIs invariably means a physically fit working population and, hence, an efficient labour force.

Education and Training

As per the Human-Capital theory, the number of educated individuals is directly proportional to the productive population. Healthy children are likely to attend school regularly, attain in-depth knowledge and practically apply the learning in their youth. Investing in education is also linked to devoting to the future of the individual and the country.

Savings and Investments

We discuss the relationship between health, income, and productivity in the above points. Healthier individuals tend to live longer, adding more to their life savings while investing magnanimously in their wants. They are likely to have the urge to earn more and more, ergo, multilateral investment and addition to the country's GDP. Simultaneously, income distribution and resource consumption are also crucial for the country's economic growth.

Conclusion

It is established that road traffic injuries and fatalities are preventable. We also know that a holistic approach and teamwork between multiple stakeholders is a must to address road safety issues. We believe that governments should take the lead in bringing the multiple sectors, including transport, health, police, education, and other local organisations, together for better management and implementation.

We must establish a clear national goal and meet the set targets will total dedication. Effective interventions include public awareness, safer road designs, vehicle features, inclusive transportation planning, enhanced post-crash response, and stringent law enforcement. The new Motor Vehicle Act and the National Road Safety Strategy (currently being finalised) set a base for the standards. The state agencies must chip in with further extensions of their roles and responsibilities.

Across multiple agencies, there is a lack of coordination, and the existing mechanisms are not appropriately addressing the underlying issues. Many guidelines, laws, amendments, court orders, and empowered and non-empowered committees at the state and national levels have been developed to address road safety issues in India. Road users can also be booked for traffic violations under a variety of laws that vary from state to state.

The various stakeholders involved in the road safety ecosystem can reduce road accidents and deaths if they work together. In order to reduce the severity of road accidents, a combined effort from different organisations and individuals is needed. Each stakeholder/ department/organisation has to be cautious, spread the importance of road safety in reducing accidents, and promote good driving behaviours. Combined efforts from all stakeholders are likely to ensure a safe road environment for country citizens.

We need a lead agency that is accountable, reliable, and, more importantly, adequately equipped with human and financial resources to manage the different aspects of road safety. Countries like Argentina, Australia, Finland, Great Britain, New Zealand, and Sweden have already allocated funds to the lead agency for road safety. These funds are strategically diverted from the vehicle insurance fees and fines.

The state funds the lead agency through a small portion of traffic fines and motor vehicle registration. Some Indian states, including Bihar, Kerala, Maharashtra, Punjab, Odisha, Rajasthan, Uttarakhand, and Tamil Nadu, have also set up similar funds. Local initiatives have been towards improved patrolling, R&D for road safety, enhanced post-accident care, and improved road infrastructure. However, the level of success and consistency is still not adequately recorded for proper analysis.

It is an excellent initiation for the central government to promote such initiatives and enable authorities across the country to establish and manage road accidents. There is also a need to look into accident hot-spots, analyse the causes and consequences, and set policies accordingly. India does not have a national database, and as discussed earlier, road fatalities and injuries are highly under-recorded. It is challenging to address the issue with utmost clarity in such scenarios. MoRTH in 2017 suggested a uniform traffic accident recording, and if adopted correctly, Indian states can potentially develop targeted programs combining law enforcement, awareness, trauma response and rules compliance.

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Recommendations

[1] Establish a statistical connection between the direct cost incurred by health systems in India for young deaths and permanent disability caused by RTIs.
[2] Recognise the proportion of the population pushed into poverty because of individual deaths from road accidents.
[3] Compare productivity and human capital loss because of road crash injuries.
[4] Establish funds for driver training, testing road layouts and vehicle conditions, and judicial segregation.
[5] Enhance the medical-care and emergency response team by providing additional human and financial resources.
[6] Identify and address risk factors associated with age and disability to create inclusive roads.
[7] Invest equitably in infrastructure as per the needs of different road users.
[8] Demarcate and segregate road users in a hierarchical order and implement individual speed limits relevant to each category.
[9] Include crash barriers and impact control under road design attributes.
[10] Invest in road safety R&D for identifying crash hot spots, causes, and related qualities.
[11] Establish a monitoring and evaluation wing for road safety as an umbrella agency under the State government and delegate responsibilities to local authorities annually.

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