TRIPP BULLETIN
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TRANSPORTATION RESEARCH & INJURY PREVENTION PROGRAMME
INDIAN INSTITUTE OF TECHNOLOGY DELHI

Research & Consultancy Projects

Urban traffic demand management strategies: Impact on congestion pollution and mobility

(women scientist project of Ms. Ranjana Soni)

Sponsor: *Department of Science and Technology*

Project Team: *Ranjana Soni, G.Tiwari and Manoj M*

Objective: The aim of the current study is to analyse the Traffic Demand management strategies(ODD and EVEN,car free day) on pollution, congestion and mobility levels. The study will be carried out in Gurugram, haryana and will include observational studies to analyse the traffic speed data available from secondary sources (google congestion mapping) merging it with location specific primary surveys and using Geographical Information System (GIS) Arc/GIS 10 for spatial analysis.

Sustainable Development Goals (SDG) oriented planning and design for neglected cities and community participation

Sponsor: *International Association for Traffic Safety Science (IATSS), Japan*

Project Team: *Geetam Tiwari, Sudipto Mukherjee, Dinesh Mohan, Girish Agrawal*

Objective: The objective of this project is to provide guidance to three cities in India (population less than 1,000,000) for the following:

1. Identification of major traffic safety problems in the cities. (Documentation of travelpatterns and traffic safety issues). 2. Prioritization of possible interventions in consultation with local stakeholders. 3. Initiate discussion with local and state level stakeholders to integrate traffic and safety issues with sustainable development goals. 4. Publication of three city reports SDG and traffic Safety in cities.

Simulation based preliminary study of lower extremity (LE) injuries caused by blast

Sponsor: *Defence Research Development Organisation (DRDO)*

Project team: *DK Dubey, A Chawla, S Mukherjee*

Objective:To study injuries incurred to the Jawans due to blasts.

Simulating LE blast injury using Finite element method to understand the blast injury mechanism.

a) The main deliverables would be the findings on the injury mechanism on the LE during blast.

b) Summary of the data available on blast injuries to the LE

Findings on the material models used for simulating the effect of blast on the LE and mathematical formulations used for simulating the blast & injury.

Human body FE model development for blast and impact

Sponsor: *Defence Research Development Organisation (DRDO)*

Project team: *A Chawla, S Mukherjee, DK Dubey, N Datla, JP Khatait*

Objective: To develop a methodology for developing, maintaining and manipulating the database associated with human body finite element models. Specific target shall be the Indian

a)Jawan, whose anthropometry shall be obtained and used so that the model can be used effectively for defense applications. The main deliverables from the project would be, Multiple Versions of IDM 50 FE model (50%ile Indian Defense Services Male)

b)Sampling anthropometric data of defense personnel (collected with help from DRDO sources)

c)Full Body Medical Scans obtained from DRDO sources, Blast and Impact Modeling Methodology for FE HBM

d)Develop Tools for positioning and resizing the developed model, Validation data for the HBM under blast and other injuries.

Establishing a research program in India focused on evaluating safety of rural roads and highways

Sponsor: National Institute of Health, Chicago, USA

Project Team: G.Tiwari, D.Mohan and K R Rao

Objective: The aim of the project is to establish a research program focused on evaluating safety of rural roads and highways. In this context IIT Delhi will share responsibility for conducting all aspects of the research undertaken in India, ensuring its scientific integrity, and supervising research staff at IIT Delhi participating in the project. In particular, the technical work that will be undertaken at IIT Delhi includes:

- Acquiring secondary data from various government ministries
- Visiting districts crime records offices and police stations across the country to review police case files and extract crash data
- Conducting highway audits to identify features of locations of crash sites and control sites.
- Conduct epidemiological analysis
- Develop and maintain project website
- Organize training workshops, expert consultation, and meetings with policy makers
- Develop/update e-course for road safety training of professionals
- Conduct needs assessment online survey

Human body tissue characterization under blast, impact, and penetration

Sponsor: *Defence Research Development Organisation (DRDO)*

Project team: *A Chawla, S Mukherjee, DK Dubey, N Datla, JP Khatait*

Objective: The overall aim of this proposal is to characterize the mechanical response and injury of human body tissue under extreme wartime loads such as blast, impact, and penetration.

a)The developed understanding of the mechanical response and injury of the tissues will be used to develop FE models specific to Indian population.

b)The developed FE model can then be used for several purposes such as to estimate the injury and to develop injury mitigating strategies.

Design of anti mine boots (AMBs) using finite elements simulations with human body model (HBM)

Sponsor: *Defence Research Development Organisation (DRDO)*

Project team: *A Chawla, S Mukherjee, DK Dubey, N Datla, JP Khatait*

Objective: This project aims at development of stable validated simulations of anti-mine boots (AMBs) testing in blast scenarios, and development of new design of AMBs.

a)Simulated Results of blast due to landmine on boots

b)Performance of AMB under specified conditions

c)Suggestions on re-design of current boots

d)Proposed further work in the redesign of boots will be delivered

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The **Transportation Research and Injury Prevention Programme (TRIPP)** at the Indian Institute of Technology Delhi, is an interdisciplinary programme focussing on the reduction of adverse health effects of road transport. TRIPP attempts to integrate all issues concerned with transportation in order to promote safety, cleaner air, and energy conservation. Faculty members are involved in planning safer urban and inter-city transportation systems, and developing designs for vehicles, safety equipment and infrastructure for the future. Activities include applied research projects, special courses and workshops, and supervision of student projects at postgraduate and undergraduate levels. Projects are done in collaboration with associated departments and centres at IIT Delhi, government departments, industry and international agencies.

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Excerpts

MORTALITY DUE TO ROAD INJURIES IN THE STATES OF INDIA: THE GLOBAL BURDEN OF DISEASE STUDY 1990-2017

Rakhi Dandona

Road injuries were the eleventh leading cause of death in 2017 globally, with the greatest burden in low-income and middle-income countries. Halving the number of deaths due to road injuries from 2015 to 2020 is one of the UN Sustainable Development Goals (SDGs). However, the WHO 2018 global status report on road safety shows very little progress has been made towards this goal. One of the key recommendations made in the report is to improve the availability of reliable and comprehensive data on the road injury burden to target and monitor progress towards reducing deaths due to road injuries. The epidemiology of deaths due to road injuries in India has been reported from a nationally representative survey of causes of death in 2001–03 that used verbal autopsy data. This survey estimated a death rate for road injuries of 26·2 per 100000 population for males and 5·7 per 100 000 population for females in 2005, and reported wide variations in these rates among the Indian states.3 The number of deaths due to road injuries in India was projected to increase to 155 000–183 000 in 2015 on the basis of data from a nationally representative survey of causes of death done in 1998.4 Available trends from the administrative source of data on deaths due to road injuries in India, which are known to be underreported, 5–8 also show an increase in the number of deaths due to road injuries.1 Road safety in India is under the purview of the Ministry of Road Transport and Highways. Recognising the need to address the large and increasing number of deaths due to road injuries, the Indian Government recently formulated the National Road Safety Policy9 and several states have developed corresponding policies.

A comprehensive up-to-date analysis and understanding of the trends in deaths due to road injuries over time in India and its states, and the status of these trends in relation to achieving the SDG target, which is needed to stimulate specific state-level action to reduce deaths due to road injuries, is not available. To address this knowledge gap, we report time trends and variations among the Indian states for deaths due to road injuries from 1990 to 2017, disaggregated by the type of road user, their age and sex, and a comparison of the trend in each state to the SDG target.

The analysis and findings presented in this Article were produced by the India State-Level Disease Burden Initiative Collaborators as part of Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2017. The Health Ministry Screening Committee of the Indian Council of Medical Research and the ethics committee of the Public Health Foundation of India have approved the work of this Initiative. A detailed description of the metrics and analytical approaches used in GBD 2017 has been reported elsewhere.

Cause of death estimation We used population-representative verbal autopsy data on cause of death from various sources, including the Registrar General of India's Sample Registration System and Survey on Causes of Death, Institute of Health Systems dataset, Indian Council of Medical Research study, and two state-specific verbal autopsy studies covering all age groups (appendix pp 6–8). Since 2000, the major data source in India has been the Sample Registration System, which provided data on 455 460 deaths for 2004–13 covering every state in India. The International Classification of Diseases (ICD) version 10 was used to classify road injuries as pedestrian, cyclist, motorcyclist, motor vehicle occupant and other road injury. The quality and comparability of the cause of death data were assessed and enhanced through multiple steps in GBD as reported previously. Several statistical models were used to assess completeness of datasets for calculating all-cause mortality rates. Data were mapped from cause of death sources that had variants of ICD classification to a consistent classification for causes of death. Cause of death codes that could not be mapped based on final classification were redistributed proportionately or using regression models. We formatted data from different sources in a consistent sex and age distribution for standardised analysis. Data on cause of death that were reported in aggregated categories, such as transport or road injuries, were split into subcategories of road user by age-sex groups using patterns from locations with the most similar geography for which this cause of death distribution was available. The Cause of Death Ensemble model (CODEm) was used to assess many potential models that apply different functional forms, such as mixed-effects models and space-time Gaussian Process Regression models, to death rates and cause fractions with varying combinations of predictive covariates. An ensemble of models was selected that performed best on out-of-sample predictive validity tests for each cause of death. A smoothing algorithm was used to avoid erratic estimates. Finally, the CoDCorrect algorithm was used to rescale deaths for each cause to ensure that deaths from all individual causes added up to the number of deaths from all causes generated from the demographic analysis. Because data on cause of death in India were not available for all states for all years of interest, GBD used covariates—variables that have an established association with road injury deaths—to calculate the best possible estimates of the cause of death.

The disability-adjusted life-years (DALYs) for road injuries were estimated as the sum of years of life lost (YLLs) and years lived with disability (YLDs). YLLs were calculated by multiplying deaths with the remaining life expectancy at the age of death using GBD's standard life table. YLDs were calculated by multiplying the number of prevalent cases of each health outcome with the disability weight assigned to that health outcome. Because YLLs accounted for most road injury DALYs in India, we focused on deaths due to road injuries in this study.

We present findings for 31 geographical units in India: 29 states, the union territory of Delhi, and union territories other than Delhi. The states of Chhattisgarh, Uttarakhand, and Jharkhand were created from existing larger states in 2000, and the state of Telangana was created in 2014. For trends from 1990 onward, we disaggregated the data for these four new states from their parent states on the basis of data from the districts that now constitute these states. The state of Jammu and Kashmir was divided into two union territories in August, 2019. Because we are reporting findings up to 2017, we report findings for the state of Jammu and Kashmir. We also present findings for three groups of states based on their Socio-demographic Index (SDI) in 2017, as calculated by GBD.19 SDI is a composite indicator of development status, which ranges from 0 to 1, and is a geometric mean of the values of the indices of lagdistributed per-capita income, mean education in people aged 15 years or older, and total fertility rate in people younger than 25 years. The three state groups were low SDI (≤0·53), middle SDI (0·54–0·60), and high SDI (>0·60–1·0) states.

We present trends in the death rate for road injuries from 1990 to 2017 for each Indian state to assess heterogeneity .We estimated the age standardised death rate by sex for road injury overall ,and then specifically for pedestrians , motorcyclists ,motor vehicle occupants ,cyclists ,and other road injuries .We based our age standardised rates on the GBD global reference population .We also report crude death rates for road injuries because these data show the actual situation in each state ,which is useful for policy makers ,whereas age - standardised estimates allow comparisons over time and between states after adjusting for the differences in the age structure of the population .We also report trends in the age specific death rates between 1990 and 2017 by sex and by type of road user .We provide estimates of the number of deaths due to road injuries by sex for each state in 2017 .Estimates are reported with 95% uncertainty intervals (UIs)where relevant ,which were based on 1000 draws for each estimate ,with the mean regarded as the point estimate and the 2 .5th and 97 .5th percentiles considered the 95% UI .

We projected the age standardised death rate for road injuries for India and for each state up to 2030 on the basis of the trends from 1990 to 2017 .We calculated the annualised rate of change for the projections from 2018 to 2030 using a weight function that gave a higher weight to the more recent trends . We compared the projected age standardised death rate for road injuries for the years 2020 and 2030 with the SDG target in 2020 for each Indian state (reporting projections for the previously undivided state of Jammu and Kashmir)and then calculated the gap to achieve the SDG 2020 target by 2020 and by 2030 .

Kuznets phenomenon ,an inverted U shaped pattern in relation to economic development ,has been previously reported for deaths due to road injury globally ,22 and among the states of India for overall deaths due to road injury . We assessed the association between the age standardised death rate for road injury overall and for pedestrians , motorcyclists , motor vehicle occupants ,and cyclists in 2017 in each state in India for both sexes combined with their per capita gross domestic product (GDP)24 and with the state level per capita vehicles25 and we present these results for the best fits .

We compared the number of road injury DALYs and YLLs in India with those of the Organisation for Economic Co operation and Development (OECD) countries .The global death rate for road injuries has decreased substantially from 1990 to 2017 ,but only slightly in India ,with India's share of the number of global deaths due to road injury increasing during this period .Motorcyclists and cyclists have a higher death rate for road injuries in India than the global average .The contribution of deaths due to road injuries to the total number of deaths in India has increased ,and road injuries are the leading cause of death among young adult males in India .The death rates for road injuries vary substantially between the states of India .The trends presented here for each state in India over time for the different road users ,age groups ,and sexes can inform prevention policies for road injuries and monitoring of the road injury burden at the state level .Importantly ,we found that ,if the trends up to 2017 were to continue ,India and its states are unlikely to achieve the SDG target of reducing the death rate for road injuries by half from 2015 to 2020 ,or even up to 2030 .

Pedestrians ,motorcyclists ,and cyclists are known to be vulnerable road users because they are less protected than the driver or passengers of a car . The higher death rate for road injuries in India among motorcyclists and cyclists than the global average reflects a higher proportion of these types of road users in India and indicates that the road infrastructure and vehicle design in India gives priority to people with cars and not to those who might not be able to afford a car ,so affecting their safety .This pattern of ignoring the vulnerable road users in the planning ,designing ,and operation of roads and in vehicle design is prevalent in India ,and is also seen in many low income and middle income countries .The poor enforcement of speed limits ,drink - driving laws ,motorcycle helmet use ,and seatbelt laws contribute further to the burden of deaths due to road injuries in India .The Government of India has attempted to address these issues through the recently amended Motor Vehicle Act Amendment Bill of 2019 31 This Bill has increased fines by up to five times and now includes imprisonment as a deterrent against traffic violations ,recall of defective vehicle parts by automobile companies ,holding builders accountable for poor quality of road infrastructure ,and making vehicle owners criminally liable for violations committed by juvenile drivers . Because the Bill came into effect in September ,2019 ,we cannot yet comment on its possible impact ,but , notably ,the Bill has not been implemented uniformly by all the states .

In 2017 ,males accounted for 77% of the deaths due to road injuries ,and they had a three times higher agestandardised death rate than females in India .A higher road injury mortality in males than in females has been reported in India previously ,and has also been reported globally across all age groups because females have a lower risk of road injury due to cultural or economic reasons and lower risk taking behaviour than males do .With deaths due to road injuries being the leading cause of death in males aged years and the second leading cause of death in this age group for both sexes combined in 2017 ,road injuries can have far reaching economic implications including loss of the primary breadwinner ,funeral costs ,and costs of care ,which can push families into poverty .A substantial proportion of these deaths due to road injuries are likely to occur during commuting to and from work ,as is shown in developed countries ,but little information on commuting patterns are available from India .Age specific death rates for road injury

increased with older age .Ageing is one of the crucial risk factors that affects road injury outcomes ,but specific studies on the road use patterns of older people or their injury outcomes are not readily available from India .Urgent further work is required to understand patterns of road use by age and type of road user to facilitate effective policy making .

Rapid urbanisation and economic growth in India have led to substantial increases in vehicle density but also heterogeneity in roads users .The required infrastructure and levels of traffic law enforcement are lagging behind . In this study ,we explored the Kuznets phenomenon for overall death rate for road injuries and by type of road users separately with state per capita GDP and per capita vehicles ,which highlighted associations that are hidden when only overall death rate for road injuries is considered .An inverted U shaped relationship with the state percapita GDP and per capita vehicles was seen only for the age standardised death rate for motor vehicle occupants .An inverted U shaped relationship has been reported previously with state level net domestic product for overall death rate for road injuries using administrative data Our findings ,on the one hand ,highlight the need to understand this relationship better ,and on the other hand ,indicate the urgent need for India and its states to improve investments in road safety in line with rising GDP to address the increasing number of deaths due to road injury . With the per capita GDP being an important determinant of per capita vehicles ,the government need to invest in public transport systems that reduce individual motorcycle and car usage in India .Towards this aim ,some Indian cities are at varying stages of implementing the Bus Rapid Transport Projects ,but barriers to successful implementation of such projects need to be addressed effectively ,including gaining acceptance from the community , in particular from those who do not use public transport .Furthermore, global policies that support a modal shift away from private motor vehicles owards walking, cycling, and low-emission public transport can positively influence the overall health of city populations in addition to reducing road injuries across the world, as well as in India.

Continued from page 1

Road Safety Inspection of Identified Blackspots and Travelling Workshop

Sponsor: Uttar Pradesh Public Works Department

Project Team: G.Tiwari, D.Mohan, K.R. Rao, K.N. Jha and S. Mukherjee

Objective: Uttar Pradesh government has been working to reduce traffic crashes on all roads. In this context the UPPWD has identified 203 blackspots in selected districts. Methodology for safety inspection and audit of these spots for preparing site specific observations and recommendations will be finalised.

Field Safety Inspection: The travelling participants (at least 6 field engineers nominated by UP PWD and 4 academic experts) will travel on selected highway corridor. Field audit will be conducted on selected stretches of the highway corridor by this team.

Lecture cum Discussion Session: A three-hour discussion session will be organised in Delhi, Moradabad, Agra, and Lucknow to conclude the workshop. Discussion session will preceded by an expert lecture on an important topic of Road Safety.

Review of Effectiveness of Road Safety Interventions in South-East Asia Region: An Evidence and Gap Map for Intervention Priorities

Sponsor: World Health Organisation, SEARO, New Delhi.

Project Team: Geetam Tiwari

Objective: i) Examine data available from all the member states of SEA region and all published reports to understand the safety issues.

ii) Develop an evidence and gap map of literature associated with road safety interventions and their effectiveness in member states of SEA region.

iii) Develop road safety intervention priorities for member states of SEA region, selection of evidence-based interventions and directions for implementation priority and final recommendations.

Centre of Excellence for Advance Data Management System for Highways (ADMS Highways)

Sponsor: National Highway Authority of India

Project Team: G.Tiwari, K.R.Rao, K.N. Jha, A.K. Swamy, Manoj M., Anoop Krishnan Naduvath Mana

Objective:

i) NHAI in partnership with IITD agree to work and support for setting up a Centre of Excellence (CoE) for Advance Data Management System for Highways (ADMS Highways) at IITD.

ii) To assist NHAI on advance analytics based on AI and ML on identified thrust areas

iii) To assist NHAI prepare simulation models on identified thrust areas

iv) To assist NHAI enhance data storage and retrieval capacities

v) To enable NHAI toward data-driven decision making Based on the current data availability at NHAI. The COE will focus on the following Thrust Areas.

News

Why cities with high bicycling rates are safer for all road users

Wesley E. Marshall and Nicholas N Fernchak. . *Journal of Transport & Health, Vol. 13, June 2019 {https://doi.org/10.1016/j.jth.2019.03.004Get rights and content}.*

What makes high-bicycling-mode-share cities so much safer than many of their counterparts? Our results suggest that more bicyclists on the road is not as important as the infrastructure we build for them. More specifically, our results suggest that improving bike infrastructure with more protected/separated bike facilities is significantly associated with fewer fatalities and better road safety outcomes for all road users. It stands to reason that such infrastructure may help improve bicyclist safety. Then again, our study finds protected/separated bike facilities significantly associated with better safety for all road users, so such infrastructure may have a traffic calming effect and facilitate safer speeds. Given our results, we also cannot ignore the possibility that the lower road safety risks of the people that tend to inhabit high-bicycling-mode-share cities also plays a role, as our variables representing gentrifying neighborhoods were also significant. This outcome may be indicative of inequity issues in need of additional research.

In terms of study limitations, it is important to understand that the relationship between safety outcomes and bicycling activity is quite complex and possibly bi-directional. Better safety outcomes – or at least the perception of better safety – can lead to increased bicycling. Statistically, the related methodological problem is called endogeneity (Sweet, 2014). The issue is that this could create a situation where the error term in the statistical model is correlated with the variable representing bicycling activity, which could in turn violate the independence assumption and perhaps bias the model (Chatman and Noland, 2014; Duranton and Turner, 2011; Baum-Snow, 2007; Hymel, 2009; Sweet, 2011, 2014). Future studies should attempt to control for potential endogeneity issues. While our study was an extensive data collection project that included twelve large U.S. cities and thirteen years of data, more cities, in more countries, and more years of data would still have been preferable. At this point, the results should not be considered generalizable to other countries or smaller cities.

Taking a broader view, it is important to understand that the potential pathways for safer places are complementary and should not be considered in isolation. Compact street networks in many U.S. cities, for example, are typically representative of lower-speed urban environments with better bike facilities, increased traffic calming, and improved emergency response (Pucher and Dijkstra, 2000; Retting et al., 2003). Those looking towards trying to fulfill the promise of Vision Zero and the goal of zero fatalities or serious injuries on the roads – as opposed to the business-as-usual, whack-a-mole approach to road safety – are in need of evidence-based research. This paper helps fulfill this need and can inform cities in their effort toward a safer and healthier transportation system.

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CONFER, India: TRIPP Chair for Transportation Planning
Ford Motor Co., USA: Ford Chair for Biomechanics and Transportation Safety
Ministry of Urban Development India: MoUD Chair for Urban Transport & Traffic Planning
MoUD Chair for Urban Transport and Environment
VREF: Volvo Chair for Transportation Planning for Control of Accident and Pollution

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A TRIPP Bulletin Insert

***Excerpts from a recently completed project** "Study on Socio-Economic Cost of Road Accidents in India"*

The objective of the research study is to develop a common framework that work as a tool to estimate the cost of road traffic accidents in India and undertake estimation of the socio-economic cost of road accidents for the country as a whole, in terms of loss of output, cost of medical treatment, damage to property, insurance and administrative and police cost etc. The study would be based on crash and post-crash information gathered from existing data sources in cities, state and national level; published and unpublished police records as well as primary data through survey and it should be built on the experience of the international best practices. The study has to be built on the best practices for economic evaluation of road accidents and develop a methodology that can be applied across the country to assess the costs.

The methodology should be aligned to the following principles:

- To provide evidence in economic terms the overall magnitude of socio-economic cost of road accidents in the country;
- To provide evidence in economic terms the magnitude of each category of costs pertaining to road traffic injuries and fatalities;
- To provide the direction in which investments and programmes relating to road safety should be focused
- To strengthen the quality and detail of data collection of road traffic injuries at country level;
- To provide a framework for current and future economic evaluations of road safety crashes.

Social cost of road traffic accidents in financials terms will aid decision makers and policymakers for budgetary and resource allocation at a national level across ministries and within ministries, such as MoRTH/ Health ministry/MoHUA.

In the past, two significant studies have been carried out for costing road accidents in India. First one was part of Road User Cost Study carried out carried out in 1982 and updated in 1992. The second study was a detailed study sponsored by then Ministry of Surface Transport, GoI in 1999. According to this study, the estimated cost of road traffic accidents was equivalent to 0.69 percent of the GDP of India at that time. These studies have certain limitations especially with respect to extent of data coverage, life expectancy of victims and addressing the underreporting phenomenon of accidents, which were addressed in the present study.

Medical costs

In order to estimate the cost of medical treatment from the datasets of the cost incurred by various type of victims, multiple linear regression models are developed using ordinary least squares method, such that the models are statistically significant. Based on the data characteristics it has been observed that the log linear function is the best suited for the statistical model. As the governing parameters for the cost are widely varying between fatal and injured victims, the model has been estimated separately.

The value of the lost output is calculated by estimating the loss of future production for individuals at each level of injury severity. For fatalities, the calculations take into account average current and future estimates of income and life expectancy. For non-fatal casualties, estimates are based on the amount of time off work and the average current and estimated future income. The cost to an individual that loses future output – potential, real or hidden – due to road accidents has to be measured using the national average income. Hence the cost of road accident deaths is calculated based on expected lost years and national average per capita income.

Per capita GDP growth rate (g) and Discount rate (r) were used to calculate the future incomes in each age group at present values and each future year's lost output has been discounted to a present value. Discount rate have been taken from World Bank data from 2000 to 2018 year. (Ref - Section 5.3 - Lost output costs)

Estimate of lost output for non-fatal casualties are based on:

- Victim number of days off work (hospitalization and recovery period)
- Number of days spent by caregiver(s)
- In case of grievous injury, lost output of permanently and severely disabled people who would never return to work by using the lost output figures for fatalities
- Average per day income

Accident data quality and data collection improvement by Police and Hospitals

Establishment of a quality data base at the primary level requires improving the quality of police recording system. It is a complex task as the data base maintained by the police is expected to accomplish multiple objectives, ranging from providing information admissible in the court, providing epidemiologic information and documenting the baseline information upon which the evaluation of countermeasures can be judged. At the same time, it is important to recognize the limitations of police personnel in recording details at the time of crash since they are also responsible for maintaining law and order at the crash site and ensuring medical assistance to the crash victims the earliest. Police personnel often do not record presence of alcohol, absence of use of helmet, seat belts etc. because the victim may lose compensation from the insurance. These items are also underreported in police records.

Efforts to improve recording and reporting of traffic crash data have been since 1939, when the first standardized format was introduced by the Indian Roads Congress. However, use of standardized forms for recording crash information by the police personnel remains very low. Repeatedly police officers have expressed lack of capacity and manpower to fill the recording formats.

Traffic crash information is reported in standardized formats by DCRB and MoRTH. The tables are prepared manually from the information available in the case files at district and state level and combined to produce national level data set.

- Police reporting systems can be improved by using digital formats and simplified formats.
- Link Police Data with hospital, census and other data sources. Employing specialists is recommended for detailed analysis. Specialized institutions are able to create accurate and reliable data useful for various levels of policy making.
- Standardised format recommended by the MoRTH can be added to the list of documents in the case file. The format should be filled up by the Investigating officer. The format can be completed when the investigation is completed since most of the information is available at that time.

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Continued from overleaf:

- Enhance CCTNS systems with standardised data recording format. MoRTH and Home ministry have to collaborate to include minimum required fields in the standardised data recording format in CCTNS.
- Deploy Computerised Accident Recording and Reporting Systems throughout the nation

All traffic crashes are recorded as a Medico Legal case in hospitals. Most hospitals do not use any standardized formats Hospitals can use the standardized simple format for MLC. Ministry of Health and WHO have made suggestions for this. Hospital data has to be linked with the police case file.

An important aspect of RTI control is to understand the burden of injuries and the epidemiological details of the same for analysis of risk factors by age, sex, location, and type of road user. Hence, all hospitals (private and public) shall code all cases reporting to hospitals (outpatient and admitted patients) by the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)-WHO Version 2019 (1).

Study highlights and gaps addressed in this study:

a) Compare to limited data collection in past studies, extensive dataset of 6610 accident victims samples through primary surveys at 54 trauma care hospitals for 7 to 10 days, 24 hrs duration (government and private hospitals) at 20 state capitals covering all type of victims' socio-economic profiles has been collected.

b) Direct interactions with victim/ caregiver (telephonic follow-up surveys) for true costs incurred on for hospitalization, post hospitalization and victim and caregiver lost days.

c) Used robust statistical models to address the sample bias and predict the unit medical costs, whereas simple average were used in the past studies.

d) As the previous studies uses the constant life expectancy, this study used varied Life Expectancy Charts for different age groups (0-85+years), such that realistic estimate of loss productivity is estimated.

e) Earlier studies not made any attempt to address the under-reporting of the accidents and its impact. This study attempts to estimate the realistic ratios through review of the national and international literature and develop national level accident cost assessment based on these ratios.

Road safety interventions

39. FIR analysis of 14 cities shows that Motorised Two-Wheelers (MTW) and pedestrians contribute almost 78% of the road accidents (40% MTW and 38% pedestrians). All concerned authorities at National, State and city level must prioritize the interventions, which are directed towards reducing injuries and fatalities of MTW and pedestrians.

i) Interventions by the Enforcement Agencies:

- Day-time running lights are already mandatory for two wheelers manufactured after 2017. The government may consider making a rule that all MTW riders must keep their headlights on whenever the vehicle is in use.
- At present ABS is compulsory for vehicles with engine capacity greater than 125 cc. But these vehicle comprise less than 10% of the MTW population in India. The government may consider making ABS mandatory for all vehicles.

ii) Interventions by Road Infrastructure owning Agencies:

- Speed calming measures on all roads where pedestrians are crossing the road such as bus stops, schools, colleges, hospitals, markets. Specific policies should be developed that mandate use of traffic calming designs and speed cameras in all habited areas in a phased manner over next 10 years by linking release of funds to achievement of milestones.

iii) Interventions in Health System:

- Improving injury data recording by implementing International Classification of Diseases (ICD) coding system in trauma care centres. Trauma centres to be upgraded for handling Head injury patients.

Conclusions

1. The study estimates socio-economic costs of road accidents to the tune of INR 1,47,114 crores in India i.e equivalent to 0.77% nations GDP. Considering the under-reporting phenomenon and using the accident ratios for MoRTH accident numbers the estimated accident costs are INR 5,96,820 crores i.e equivalent to 3.14%.

2. Total costs of all the three components i.e victim costs, property damage and administrative costs are estimated. Out of total costs, 97.7% costs are victim related costs, and rest 2.3% are for other two components.

3. Average unit cost per accident victim comprising all cost components are-

Fatality per victim -	INR 91,16,363
Grievous injured per victim -	INR 3,64,398
Minor Injured per victim -	INR 77,938
No Injuries per accidents -	INR 88,463

Injury severity wise and road user category wise unit costs are estimated. These can be used for estimation of future accident costs based on the actual number of accidents in each category.

5. Use of standardized forms for recording crash information by the police personnel remains very low. In order to improve the accident data quality, police reporting systems can be improved by using digital formats and simplified formats, link Police Data with hospital, census and other data sources. Standardised format recommended by the MoRTH can be added to the list of documents in the case file. Also, enhance CCTNS systems with standardised data recording format.

6. MTW and pedestrians contribute almost 78% of the road accident fatalities. More focused approach is required to reduce these accidents. Interventions by the enforcement agencies, road infrastructure owning agencies and health authorities are required. Interventions like mandatory headlight for MTWs, ABS systems, Speed calming measures and ICD coding in hospital data are few important measures