



Patterns, Predictors, and Comorbidity Correlates of Unintentional Injuries: A Cross-Sectional Analysis from Urban South India

¹ Raghul Saravanan*, ² Aarthe Raghul, ³ Pragadeesh Palaniappan, ⁴ Thamarai Kannan Sampath, ⁵ Amudhamozhi K S

¹ Assistant Professor, Department of Community Medicine, Vels Medical College & Hospital, Tiruvallur, Tamil Nadu, India

² Tutor, Department of Anatomy, Sree Balaji Medical College & Hospital, Chennai, Tamil Nadu, India

³ Senior Resident, Department of Community Medicine, Sri Ramachandra Medical College and Research Institute, Chennai, Tamil Nadu, India

⁴ Assistant Professor, Department of Community Medicine, Vinayaka Missions Kirupananda Variyar Medical College & Hospital, Salem, Tamil Nadu, India

⁵ Public Health Specialist, Community Medicine, Airport Health Organization, Coimbatore, Tamil Nadu, India

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KEYWORDS

Wounds and Injuries, Accidents, Emergency Medical Services, Accident Prevention.

ABSTRACT:

Background: Unintentional injuries contribute substantially to morbidity and mortality in low- and middle-income countries. Despite the high burden of road traffic accidents (RTAs) and occupational injuries in India, limited evidence examines how chronic comorbidities influence injury severity across multiple injury mechanisms.

Objectives: To describe the demographic and clinical profiles of patients with unintentional injuries and to determine whether comorbidities such as diabetes and vision impairment independently predict grievous injury among victims, particularly those involved in RTAs.

Methods: A hospital-based cross-sectional study was conducted among 320 patients presenting with unintentional injuries at a tertiary care hospital in Chennai (June 2021–June 2022). Data were collected using a validated semi-structured questionnaire. Associations were assessed using chi-square tests with post-hoc adjusted standardized residuals (ASR) and Cramer's V effect sizes. Binary logistic regression was performed to identify independent predictors of grievous injury among RTA victims. A p-value <0.05 was considered statistically significant.

Results: RTAs were the most common mechanism of injury, followed by workplace injuries, falls, and burns. Post-hoc analysis revealed that middle-aged adults (30–60 years), males, individuals with high-school education, and those from socioeconomic Class III significantly contributed to specific injury patterns. Among RTA cases, grievous injuries were more common in adults aged 30–60 years. Diabetes mellitus (AOR = 2.41, 95% CI: 1.08–5.35) and vision impairment (AOR = 2.86, 95% CI: 1.01–8.05) independently predicted grievous injury after adjustment.

Conclusion: Unintentional injuries disproportionately affect middle-aged adults and males, with RTAs being the predominant mechanism. Diabetes and vision impairment significantly increase the risk of grievous injury among RTA victims. Integrating comorbidity screening into emergency triage and targeted prevention strategies is essential for reducing injury severity.

1. Introduction

Unintentional injuries constitute a major global public health challenge, accounting for millions of preventable deaths each year. The burden is disproportionately higher in low- and middle-income countries, where rapid urbanisation, inadequate road safety measures, and expanding industrial sectors contribute to increased

injury risk¹⁻³. Despite significant global progress in reducing injury-related mortality during the twentieth century, recent decades have recorded a resurgence in preventable injuries, particularly road traffic accidents (RTAs), partly due to population growth, motorisation, and changing occupational environments⁴. India is among the countries most affected, and Tamil Nadu consistently records one of the highest numbers of



reported RTAs nationwide, reflecting the complex interaction between road behaviour, vehicle density, and infrastructural limitations⁵.

Globally, unintentional injuries extend beyond RTAs to include falls, workplace injuries, and burns, all of which contribute substantial morbidity and mortality⁶⁻⁸. Falls represent a leading cause of injury-related disability among older adults due to frailty and chronic comorbidities⁹, while occupational injuries continue to pose significant health risks in developing economies with large informal labour sectors⁷.

Although several Indian studies have explored selected injury types—commonly RTAs, workplace injuries, or falls—few have assessed these mechanisms collectively or examined how chronic comorbidities influence injury severity. Evidence suggests that conditions such as diabetes, vision impairment, and neuropathy may alter functional responses, healing capacity, and impact tolerance, thereby increasing the likelihood of grievous injury¹⁰. However, such associations remain underexplored in Indian tertiary-care settings.

Given the high and rising prevalence of noncommunicable diseases, coupled with a persistent burden of injuries in urban South India, understanding the combined influence of demographics, comorbidities, and injury mechanisms is essential to strengthening trauma care and public health interventions. This study addresses this evidence gap by evaluating whether chronic comorbidities independently increase the risk of grievous injuries among patients with unintentional injuries.

2. Objective

This study aims to examine the pattern and determinants of unintentional injuries and to assess whether comorbidities (diabetes, vision impairment, hypertension, etc.) independently predict grievous injury among affected patients

3. Methodology

A hospital-based cross-sectional study was conducted in the Emergency Department of Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, from June 2021 to June 2022. The setting serves an urban–industrial catchment area with a high burden of trauma and emergency presentations. The study population consisted

of adult patients aged 18 years and above who presented with unintentional injuries, including road traffic accidents, workplace injuries, falls, and burns, and were conscious, oriented, and able to provide informed consent. Patients with intentional injuries (assaults or self-harm), those referred from other facilities with incomplete records, and critically ill patients requiring immediate ICU admission were excluded

Sample size was calculated using the formula: $n = Z^2PQ/d^2$, where $Z = 1.96$ (at 95% confidence interval), $P = 29.3\%$ (prevalence of unintentional injuries based on Bhatia et al¹¹), $Q = 100 - P = 70.7$, $d = 5$ (absolute error). $N = (1.96)^2 \times 29.3 \times 70.7 / (5)^2 = 318.32 \sim 320$. The final sample size was 320 participants. Convenience sampling, common in emergency research due to case unpredictability, was used to recruit eligible participants consecutively.

Data were collected using a pretested, semi-structured questionnaire. The tool underwent rigorous validation, including expert content review by three specialists in public health and emergency medicine, and reliability testing through a pilot study of 30 participants, resulting in a Cronbach's alpha of 0.78, indicating acceptable internal consistency. The questionnaire captured sociodemographic characteristics, mechanism and pattern of injury, affected anatomical region, type of injury, and comorbidities such as diabetes, hypertension, vision impairment, hearing problems, and cardiac conditions. Clinical details and injury severity classification (grievous or non-grievous) were verified against medical records and medico-legal documentation.

Data were analyzed using SPSS version 21. Descriptive statistics such as frequencies and proportions were used for categorical variables, while median and interquartile ranges were calculated for skewed continuous variables. Chi-square tests assessed associations between categorical variables and injury type. For all significant chi-square findings, post-hoc analysis was conducted using Adjusted Standardized Residuals (ASR) to identify specific categories contributing to the observed significance, and effect sizes were quantified using Cramer's V, interpreted as small (0.10), moderate (0.30), or large (0.50). To determine independent predictors of grievous injury among RTA victims, binary logistic regression analysis was performed. Variables with $p <$



0.20 in bivariate analysis—age, gender, education, socioeconomic class, diabetes, and vision impairment—were included in the multivariable model. Adjusted Odds Ratios (AORs) with 95% confidence intervals were reported, and model fit was assessed using the Hosmer–Lemeshow goodness-of-fit test. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee (Approval No.002/SBMC/IHEC /2020/1441), and written informed consent was obtained from all participants.

4. Results

A total of 320 patients with unintentional injuries were included in the study. Road Traffic Accidents (RTAs) constituted the major proportion of cases, followed by workplace injuries, falls, and burns. The distribution of affected body parts varied across mechanisms: RTAs primarily involved the lower limbs; workplace injuries mainly affected the upper limbs; falls were associated predominantly with head and neck trauma; and burns most frequently involved the upper limbs (Figures 1&2).

Figure 1: Pattern of injury (part of body involved in injury) in unintentional injuries (n=320)

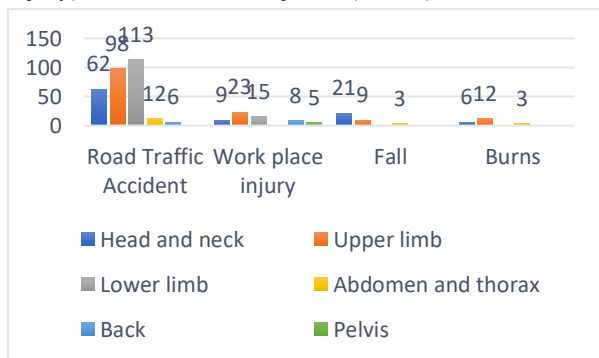
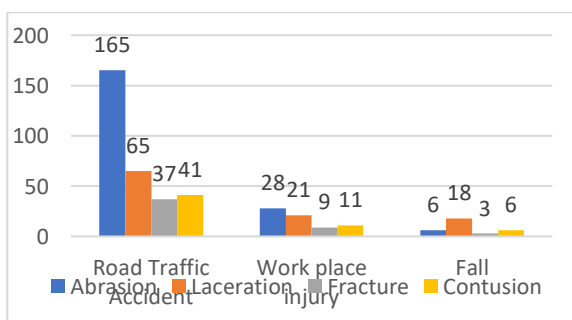


Figure 2: Pattern of injury (based on types of injury) in unintentional injuries (n=320)



Significant associations were observed between age, gender, religion, educational level, and socioeconomic class with the type of unintentional injury (Table 1). Effect size analysis using Cramer’s V showed moderate to strong associations for age (V=0.41), educational status (V=0.37), and socioeconomic class (V=0.45), indicating meaningful variations among categories.

Table 1: Association between demographic details and types of unintentional injuries (n = 320)

Variable	Category	RTA (n=226)	Workplace (n=52)	Fall (n=30)	Burn (n=12)	Chi-square	P-value
Age	< 30	105	26	6	9	73.27	<0.001*
	30–60	107	26	9	3		
	> 60	14	0	15	0		
Gender	Male	182	49	15	3	41.91	<0.001*
	Female	44	3	15	9		
Marital status	Unmarried	102	26	9	9	7.54	0.56
	Married	124	26	21	3		
Religion	Hindu	175	47	30	12	15.19	0.019*
	Christian	33	3	0	0		



Table 3: Association between comorbidities and grievous injury in RTA(n=226)

	Co morbidities	Grievous injury (n=88)	Non grievous injury (n=138)	Chi square	P value
Diabetes Mellitus	Yes	18(20.5)	12(8.7)	6.45	0.011*
	No	70(79.5)	126(91.3)		
Hypertension	Yes	9(10.2)	11(8)	0.33	0.560
	No	79(89.8)	127(92)		
Heart problem	Yes	3(3.4)	3(2.2)	0.31	0.573
	No	85(96.6)	135(97.8)		
Vision problem	Yes	9(10.2)	5(3.6)	4.03	0.045*
	No	79(89.8)	133(96.4)		
Hearing problem	Yes	6(6.8)	6(4.3)	0.65	0.419
	No	82(93.2)	132(95.7)		

Post-hoc adjusted standardized residuals (ASR) identified the specific demographic groups driving the significant chi-square associations observed in this study (Table 4). Adults aged 30–60 years were significantly over-represented in RTA cases, while those above 60 years contributed disproportionately to fall-related injuries. Males were over-represented in both RTAs and workplace injuries, whereas females showed a higher-than-expected representation in burn injuries. Educational differences were notable, with individuals possessing high-school education contributing more to workplace injuries, while graduates were predominantly represented among RTA victims. Socioeconomic Class III participants were disproportionately involved in workplace injuries, whereas Class I and II individuals showed higher representation in RTAs. These patterns provide clear insight into the demographic subgroups most strongly influencing the overall statistical significance of injury type distributions

Table 4: Post-hoc Analysis of Significant Chi-square Associations Using Adjusted Standardized Residuals (ASR) (Positive ASR >+2 indicates over-representation; Negative ASR <-2 indicates under-representation)

Variable	Category	Injury Type / Outcome Showing Significant Contribution	ASR
Age group	<30 years	Workplace injuries	+2.8
	30–60 years	Road traffic accidents	+3.6
	>60 years	Falls	+4.1
Gender	Male	RTA and workplace injuries	+3.2
	Female	Burns	+2.7
Religion	Hindu	All injury types	+2.1
	Christian	Workplace injuries	-2.4
Educational level	Middle school	Grievous injuries (RTA)	+2.9
	High school	Workplace injuries	+3.3
	Graduate	RTAs	+2.5
Socioeconomic class (BG Prasad)	Class I	RTAs	+2.6
	Class III	Workplace injuries	+3.8
	Class II	Falls	-2.2
Comorbidities (RTA victims only)	Diabetes mellitus	Grievous injury	+2.5
	Vision impairment	Grievous injury	+2.2

5. Discussion

The present study assessed the epidemiological and clinical profile of unintentional injury victims attending a tertiary care hospital in Chennai and identified factors associated with grievous injury. RTAs emerged as the predominant cause of unintentional injuries, followed by workplace injuries, falls, and burns. Middle-aged adults



and males were most frequently involved, reflecting higher mobility and occupational exposure. Body part involvement varied across mechanisms, with RTAs commonly affecting lower limbs, workplace injuries involving upper limbs, and falls resulting primarily in head and neck injuries. Importantly, diabetes mellitus and vision impairment were found to be independent predictors of grievous injury among RTA victims. This highlights the significance of comorbidity-related vulnerability in determining trauma severity and underscores the need for integrating chronic disease assessment into injury prevention and emergency care protocols.

The predominance of RTAs in the present study is consistent with findings from several Indian studies. Patan et al. reported that RTAs constituted the majority of trauma cases in a tertiary care hospital in Tirupati, paralleling our observations¹². Similarly, Sharma et al. found that RTAs were the most common cause of injury in Anand, Gujarat, with a higher representation among males—a pattern also observed in our study¹³. Jha et al. reported similar demographic trends in South India, with males in the productive age group being disproportionately affected¹⁴. Our finding that middle-aged adults (30–60 years) are more likely to sustain grievous injuries aligns with the results of Kumar et al., who identified this age group as having higher risk, possibly due to increased mobility and occupational pressures¹⁵. The significant association of diabetes with grievous injury concurs with evidence from He et al., who found that diabetic trauma patients experience increased complications and resource utilization¹⁰. These parallels reinforce the relevance of our findings within the broader Indian trauma context.

Workplace injuries accounted for a considerable proportion of cases in this study, predominantly affecting younger males. This aligns with the findings of Ravi and Joseph, who reported a similar pattern in rural India, highlighting that early-career workers engaged in manual labour are at high risk of occupational injuries¹⁶. Kumar and Dharanipriya observed that welders in coastal South India faced frequent occupational injuries due to hazardous work environments and inadequate protective gear, supporting the trends identified in our population¹⁷. Regina et al. also documented that workplace injuries were common among males and predominantly involved upper limbs, consistent with the injury pattern seen in

this study¹⁸. Global evidence by Welch et al. echoes these findings, showing that construction and industrial workers are highly susceptible to upper-extremity injuries due to repetitive and forceful manual tasks¹⁹. Collectively, these studies indicate that inadequate occupational safety regulations and suboptimal use of protective equipment may contribute significantly to workplace injury patterns observed in our setting.

Falls constituted a smaller but clinically important category of injuries in this study, particularly among older adults. This is consistent with the findings of Chacko et al., who reported that elderly individuals in Coimbatore were at high risk of fall-related injuries due to frailty and comorbidities²⁰. Joseph and Muliyl similarly found that chronic illness, impaired mobility, and environmental hazards significantly increased fall risk among the elderly in Vellore²¹. The predominance of head and neck injuries among fall victims in our study echoes results from Komisar et al., who documented similar patterns in video-verified falls among older adults residing in long-term care facilities²². Dhargave and Sendhilkumar also highlighted that institutionalised elderly populations frequently sustain severe injuries from falls due to balance deficits and reduced reaction time²³. Although our fall prevalence is lower than that reported in community-based studies, the similarity in injury patterns underscores the vulnerability of elderly populations to falls and the need for targeted preventive measures.

This study has several strengths, including its comprehensive assessment of multiple types of unintentional injuries within a single analytical framework and the use of a validated questionnaire with acceptable internal consistency. The incorporation of post-hoc analysis and effect size measures strengthened the interpretation of statistical associations, while the identification of diabetes and vision impairment as independent predictors of grievous injury offers novel insights seldom reported in Indian trauma research. However, certain limitations should be acknowledged. As a single-centre, hospital-based study using convenience sampling, the findings may not be fully generalisable to community settings or mild injury cases that do not seek hospital care. The reliance on self-reported comorbidity data introduces the potential for recall bias, and unmeasured behavioural factors such as alcohol use and protective device compliance may have



influenced the associations. Additionally, the cross-sectional design precludes establishing causal relationships, and the use of medico-legal injury severity categories may limit comparability with standardised trauma scoring systems. Despite these limitations, the study provides important contextual evidence on the interaction between chronic diseases and injury severity in an urban Indian population.

6. Conclusion

In conclusion, this study highlights that unintentional injuries, particularly RTAs and workplace incidents, remain a significant public health problem in urban South India, disproportionately affecting males and middle-aged adults. Comorbidities such as diabetes and vision impairment significantly increase the risk of grievous injuries, underscoring the need for their consideration in emergency triage and injury prevention strategies. By integrating multi-mechanism injury analysis with comorbidity-based severity assessment, this study offers novel insights relevant to trauma care optimisation and injury prevention policy. Strengthening safety enforcement, enhancing workplace protection, and integrating chronic disease management within injury prevention frameworks are essential to reducing the burden and improving outcomes for injury victims.

7. Recommendations

- **Integrate comorbidity-based triage in emergency departments**, particularly focusing on diabetes and visual impairment as severity modifiers.
- **Strengthen road safety enforcement** with targeted interventions for high-risk groups such as middle-aged male commuters and commercial drivers.
- **Implement annual vision screening and health certification** for drivers, industrial workers, and individuals in high-mobility occupations.
- **Develop workplace safety programmes for young labourers**, including protective equipment use and hazard-awareness training.
- **Establish hospital-based injury surveillance systems** that routinely capture comorbidity profiles to enable predictive modelling of injury severity.

- **Conduct multicentric, longitudinal research** to assess long-term outcomes, rehabilitation patterns, and disability trajectories among unintentional injury victims.
- **Integrate NCD management with injury prevention policies**, acknowledging their combined contribution to increasing severity and healthcare burden.

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