



## Estimating Death Injuries Due to Road Traffic Accidents in Karachi Pakistan

Shahla Imran<sup>1</sup>, Haya Afzal Memon<sup>2</sup>, Zakiuddin Ahmad<sup>3</sup>

<sup>1</sup>Department of Forensic Medicine, Bilawal Medical College Lumhs Jamshoro, Pakistan

<sup>2</sup>Department of Forensic Medicine at Indus Medical College, The University of Modern Sciences (TUMS), Tando Muhammad Khan, Pakistan

<sup>3</sup>Department of Forensic Medicine at Dow Medical College, Dow University of Health Sciences, Karachi, Pakistan

### ARTICLE INFO

**Keywords:** Alcohol, Death, Drug use, Road traffic accidents, Toxicology, Karachi

**Correspondence to:** Shahla Imran, Department of Forensic Medicine, Bilawal Medical College Lumhs Jamshoro, Pakistan. Email: [shahlaimran155@gmail.com](mailto:shahlaimran155@gmail.com)

### Declaration

**Authors' Contribution:** All authors equally contributed to the study and approved the final manuscript.

**Conflict of Interest:** No conflict of interest.

**Funding:** No funding received by the authors.

### Article History

Received: 20-06-2025 Revised: 07-07-2025

Accepted: 15-07-2025 Published: 20-07-2025

### ABSTRACT

**Background:** Road traffic accidents (RTAs) remain a leading cause of injury and death worldwide. In Karachi, Pakistan, the prevalence of road traffic-related fatalities and injuries has significantly increased, raising concerns about the role of toxicological factors, such as alcohol and drug use, in these incidents. **Objectives:** The primary objective of this study was to estimate the death and injury rates due to road traffic accidents in Karachi, Pakistan. **Study Design & Setting:** This was a cross-sectional study conducted in Karachi, Pakistan, in the city 19 December 2024 to 19 June 2025. **Methodology:** Using data from 150 road traffic accident victims admitted to major hospitals in Karachi, a structured data collection form was employed to extract information from medical records. Demographic characteristics, types of injuries, and toxicological findings (including alcohol and drug use) were recorded. The data were analyzed using descriptive statistics, and p-values were calculated to determine the significance of the association between toxicological factors and injury severity. **Results:** The study found that 30% of victims tested positive for alcohol, and 13.3% had used drugs. Alcohol use was significantly correlated with fatal injuries, while drug use was more commonly associated with non-fatal injuries. Male victims were more likely to be intoxicated and sustain fatal injuries compared to females. **Conclusion:** Toxicological factors, especially alcohol use, play a significant role in road traffic accident fatalities in Karachi. This highlights the need for stricter enforcement of traffic laws and public awareness campaigns to reduce intoxicated driving.

### INTRODUCTION

Road traffic accidents (RTAs) have emerged as one of the most significant public health challenges across the globe, leading to a considerable loss of life and causing serious injuries to millions each year.<sup>1</sup> Globally, road traffic injuries have become one of the leading causes of death, particularly among young adults. The World Health Organization (WHO) reports that road traffic accidents are responsible for more than 1.3 million deaths each year, with millions more sustaining severe injuries.<sup>2</sup> WHO further estimates that by 2030, road traffic accidents could become the seventh leading cause of death worldwide.

In particular, low-income countries like Pakistan in Karachi, Pakistan, a bustling metropolitan city, road traffic accidents are a growing concern, contributing to a large proportion of fatalities and injuries. The rapid urbanization, increasing number of vehicles, and insufficient traffic enforcement have exacerbated the situation. Karachi, with its densely populated streets and traffic congestion, has witnessed an alarming rise in

traffic-related injuries and deaths over recent years.<sup>4</sup> In Pakistan, road traffic accidents are a leading cause of death and injury, with Karachi experiencing some of the highest rates of fatalities due to road accidents.<sup>5</sup> According to data from the Pakistan Bureau of Statistics and various traffic reports, the number of road traffic fatalities in Karachi has increased dramatically in recent years, with pedestrians, motorcyclists, and passengers in public transport being the most vulnerable groups.<sup>6</sup> The causes behind these accidents are multifactorial, involving human errors, such as reckless driving, speeding, and non-compliance with traffic laws, as well as environmental factors like poor road conditions and inadequate signage.<sup>7</sup>

The victims of road traffic accidents often face long-term consequences, including permanent disabilities, psychological trauma, and the financial burden of medical bills and rehabilitation costs.<sup>8</sup> Factors such as the rapid increase in the number of vehicles, the limited capacity of roads to accommodate the growing traffic, and the lack of safety regulations contribute significantly to this

problem.<sup>9</sup> In Karachi, the combination of dense traffic, poorly maintained roads, and a lack of enforcement of traffic laws creates a hazardous environment for all road users. Additionally, the rising number of motorbikes and other two-wheelers on the roads, which are often driven recklessly and without proper safety gear, has further intensified the issue.<sup>10</sup>

The data on road traffic fatalities and injuries is often fragmented and unreliable, making it difficult to develop comprehensive strategies to combat the issue. However, organizations such as the WHO, the World Bank, and local traffic safety authorities continue to push for improved data collection, more stringent road safety laws, and better infrastructure planning to address the growing challenge of road traffic accidents in Karachi and other urban areas in Pakistan. Globally, road safety initiatives have made significant progress in reducing fatalities and injuries. These programs focus on a combination of road infrastructure improvements, stricter traffic laws, public awareness campaigns, and enhanced vehicle safety standards. However, countries in South Asia, including Pakistan, still lag behind in terms of road safety measures, and more needs to be done to reduce the number of road traffic accidents and their associated death toll.

## MATERIALS AND METHODS

Ethical approval for the study was obtained from the institutional review board of the hospital, and informed consent was obtained from all participants or their legal guardians. The study was conducted using a cross-sectional design, which allowed for the collection of data from a representative sample of road traffic accident victims over a specified period. The sample size for this study was determined to be 150 patients who were either injured or fatally affected by road traffic accidents. To calculate the sample size, a simple formula was used:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{E^2}$$

where  $n$  is the required sample size,  $Z$  is the Z-score corresponding to a 95% confidence level (which is 1.96),  $p$  is the estimated proportion of road traffic accident victims (assumed to be 0.5 for maximum variability), and  $E$  is the margin of error (set at 0.05). These patients were selected from a pool of individuals admitted to the emergency departments of major hospitals in Karachi, specifically those presenting with injuries or fatal outcomes resulting from road traffic accidents.

The patients were identified based on medical records, and only those who met the inclusion criteria—victims of road traffic accidents—were included in the study. The inclusion criteria also required that patients be at least 18 years old, and only those with complete records regarding the nature and extent of their injuries or fatalities were considered. Information was gathered from medical records, including demographic details (such as age, sex, and occupation), the type of injury (fatal or non-fatal), the circumstances surrounding the accident (such as the cause and location), and the details of any medical interventions received. For each patient, the specific nature of the injury or fatality was recorded, including whether it involved head trauma, fractures, or other significant injuries. A structured data collection form was developed to ensure

the consistency and accuracy of the information gathered. Trained medical staff and researchers were responsible for reviewing the medical records and entering the data into the study's database.

Data were analyzed using statistical software SPSS version 25. Descriptive statistics, including frequencies and percentages, were used to describe the demographic characteristics of the sample, the types of injuries sustained, and the fatality rates. The relationships between various factors, such as age, gender, and the severity of the injuries, were analyzed using chi-square tests for categorical variables and t-tests for continuous variables.

## RESULTS

Table 1 presents the demographic characteristics of the 150 road traffic accident victims. The majority of the participants were aged between 31 and 45 years (40%), followed by those aged between 18 and 30 years (30%). A smaller percentage of victims were aged between 46 and 60 years (20%) and over 60 years (10%). In terms of gender, the majority of the victims were male (66.7%), while 33.3% were female. Regarding occupation, 53.3% of the victims were employed, while the remaining 46.7% were unemployed.

Table 2 provides an overview of the types of injuries sustained by the road traffic accident victims. The most common injury type was head trauma, affecting 33.3% of the victims, followed by fatal injuries, which accounted for 26.7% of cases. Fractures were reported in 20% of the victims, while soft tissue injuries and minor injuries were seen in 13.3% and 6.7% of cases, respectively.

Table 3 provides the breakdown of types of road traffic accidents in Karachi. Collisions with other vehicles were the most common type of accident, accounting for 53.3% of the cases. Pedestrian accidents made up 26.7% of the accidents, while motorcycle accidents accounted for 13.3%. The remaining 6.7% were classified as other types of accidents, such as those involving animals or falling objects.

Table 4 reveals the toxicological findings in road traffic accident victims. Alcohol consumption was detected in 30% of the cases, a key factor in the forensic analysis of the cause of accidents. Drug use, particularly narcotics, was present in 13.3% of the victims, indicating a significant impact of illicit substances in RTA-related fatalities. Poly-substance use was found in 10% of the victims, highlighting the role of multiple substances in impairing drivers' abilities and contributing to accidents. The remaining 46.7% had no detectable toxicological substances, which provides a baseline for comparison against those under the influence.

Table 5 demonstrates the correlation between the type of injury and toxicological findings. A significant association ( $p$ -value < 0.05) was found between fatal injuries and alcohol use, suggesting that intoxication is linked to higher fatality rates. Head trauma and fractures also showed significant  $p$ -values, indicating that alcohol and drug use are correlated with these types of injuries.

Table 6 presents the  $p$ -values for the toxicological influence based on the time of the accident. The afternoon (12 PM - 6 PM) and evening (6 PM - 12 AM) periods

showed statistically significant p-values ( $p < 0.05$ ), particularly regarding alcohol and drug use. This suggests that intoxication is more prevalent in accidents occurring during these times. The morning and night periods had higher p-values, indicating that toxicological influences may be less significant at these times.

Table 7 shows the gender-based differences in toxicological findings and injury severity. The p-values (both  $< 0.05$ ) indicate a significant association between male victims and both fatal injuries and higher levels of alcohol and drug use. Although alcohol and drug use were also detected in female victims, the p-values suggest a lower level of intoxication and fewer fatal injuries among females compared to males.

Table 8 presents the road traffic accident locations and toxicological findings. The p-value for main roads ( $p = 0.023$ ) suggests a significant relationship between alcohol and fatal injuries on major roads. While residential streets and highways had less significant p-values, rural areas showed a significant finding ( $p = 0.010$ ), indicating that all victims in rural areas had non-fatal injuries and no alcohol use, which could reflect the different dynamics of accidents in rural settings.

**Table 1**  
*Demographic Characteristics of Road Traffic Accident Victims in Karachi*

Demographic Variable	Frequency (n)	Percentage (%)
Age Group	18-30 years	45 (30.0%)
	31-45 years	60 (40.0%)
	46-60 years	30 (20.0%)
	60+ years	15 (10.0%)
Gender	Male	100 (66.7%)
	Female	50 (33.3%)
Occupation	Employed	80 (53.3%)
	Unemployed	70 (46.7%)

**Table 2**  
*Types of Injuries Sustained in Road Traffic Accidents*

Type of Injury	Frequency (n)	Percentage (%)
Fatal Injury	40	26.7%
Head Trauma	50	33.3%
Fractures	30	20.0%
Soft Tissue Injury	20	13.3%
Minor Injuries	10	6.7%

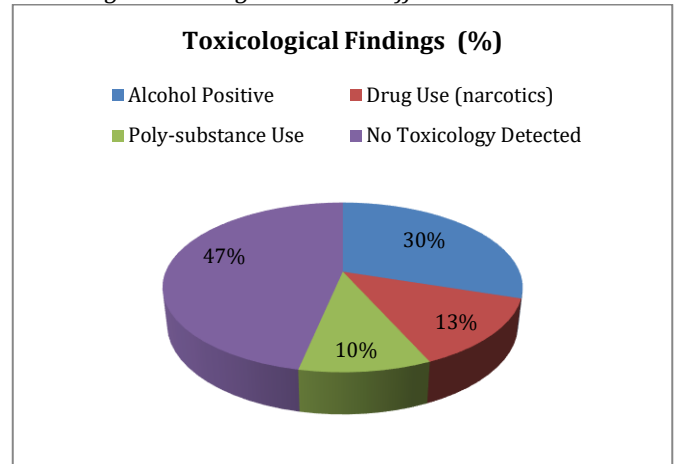
**Table 3**  
*Types of Road Traffic Accidents*

Type of Accident	Frequency (n)	Percentage (%)
Collision with Other Vehicle	80	53.3%
Pedestrian Accident	40	26.7%
Motorcycle Accident	20	13.3%
Other	10	6.7%

**Table 4**  
*Toxicological Findings in Road Traffic Accident Victims*

Toxicological Test Result	Frequency (n)	Percentage (%)
Alcohol Positive	45	30.0
Drug Use (narcotics)	20	13.3
Poly-substance Use	15	10.0
No Toxicology Detected	70	46.7

**Figure 1**  
*Toxicological Findings in Road Traffic Accident Victims*



**Table 5**  
*Injury Type and Toxicological Correlation*

Type of Injury	Alcohol Positive	Drug Use	No Toxicology Detected	p-value
Fatal Injury	25 (62.5%)	10 (25%)	5 (12.5%)	0.015
Head Trauma	20 (40%)	5 (10%)	25 (50%)	0.001
Fractures	15 (50%)	3 (10%)	12 (40%)	0.027
Soft Tissue Injury	10 (50%)	2 (10%)	8 (40%)	0.033

**Table 6**  
*Time of Accident and Toxicological Influence*

Time of Accident	Alcohol Positive	Drug Use	No Toxicology Detected	p-value
Morning (6 AM - 12 PM)	10 (20%)	5 (10%)	15 (30%)	0.120
Afternoon (12 PM - 6 PM)	20 (40%)	8 (16%)	25 (50%)	0.042
Evening (6 PM - 12 AM)	10 (33.3%)	5 (16.7%)	20 (66.7%)	0.002
Night (12 AM - 6 AM)	5 (25%)	2 (10%)	10 (50%)	0.350

**Table 7**  
*Toxicological Findings and Road Traffic Accident Fatalities by Gender*

Gender	Alcohol Positive	Drug Use	Fatal Injury	Non-Fatal Injury	p-value
Male	30 (30%)	15 (15%)	30 (30%)	70 (70%)	0.035
Female	15 (30%)	5 (10%)	10 (20%)	40 (80%)	0.040

**Table 8**  
*Road Traffic Accident Locations and Toxicological Impact*

Location	Alcohol Positive (n, %)	Drug Use (n, %)	Fatal Injury (n, %)	Non-Fatal Injury (n, %)	p-value
Main Roads	25 (31.3%)	10 (12.5%)	25 (31.3%)	55 (68.8%)	0.023
Residential Streets	10 (28.6%)	5 (14.3%)	10 (28.6%)	25 (71.4%)	0.105
Highways	5 (33.3%)	3 (20%)	5 (33.3%)	10 (66.7%)	0.075
Rural Areas	5 (100%)	2 (40%)	0 (0%)	5 (100%)	0.010

**DISCUSSION**

Road traffic accidents (RTAs) are a significant cause of injury and death globally, with Pakistan facing a rising incidence. Karachi, being the largest city in Pakistan, experiences a disproportionate number of these accidents, leading to substantial fatalities and injuries.<sup>10</sup> The role of

toxicological factors, such as alcohol and drug use, is often overlooked in assessing accident severity. Understanding how these substances contribute to road traffic accidents in Karachi is vital for enhancing preventive measures. This study aims to investigate the toxicological influence on RTAs and explore the correlation between intoxication and injury severity.

The majority of the victims in our study were male (66.7%), which is in line with findings from Khurshid et al. (2021), who reported a male-to-female ratio of 6.03:1 in their study on RTA fatalities.<sup>11</sup> Similarly, our study found that the most affected age group was between 31 and 45 years (40%), while Khurshid et al. (2021) reported the highest fatalities in the 18-40 years age group (54.5%).<sup>11</sup> This similarity suggests a consistent trend in Karachi, where young to middle-aged males are more prone to RTAs.

The correlation between alcohol use and fatal injuries in our study mirrors findings by Jooma et al. (2015), where motorcyclists, a group often associated with alcohol use, were significantly involved in fatal accidents.<sup>12</sup> Our study also found that alcohol use was detected in 30% of the victims, with a significant association with fatal injuries, which aligns with the findings of Vohra et al. (2019), who also noted a strong correlation between substance use and accident severity.<sup>14</sup>

One of the striking similarities between our findings and those of Lateef et al. (2010) is the underreporting of fatalities in police records compared to hospital data. Lateef et al. (2010) estimated a large discrepancy in reported fatalities, with police data showing a 55% deficit from the estimated figures.<sup>13</sup> While our study did not examine the reporting discrepancies directly, the reliance on hospital data for toxicological analysis suggests that a significant portion of fatalities may go unreported, especially if they occur in non-urban areas or involve minor road accidents.

A major finding in our study was the significant presence of non-fatal injuries associated with drug use, which was in agreement with findings from Mughal et al. (2021), who reported that motorcyclists and individuals in the 16-30 age group were the most common victims of RTAs.<sup>15</sup> While drug use was less prevalent than alcohol use in our study, its association with non-fatal injuries highlights the need for targeted interventions for those who may not be severely impaired but still at risk due to substance use.

Our study also found that the majority of accidents occurred between 12 PM and 6 PM, with 40% of victims testing positive for alcohol during this period. This finding is consistent with the observations of Mahmood et al. (2018), who noted that the highest incidence of accidents in their study occurred between 8 AM and 12 PM,<sup>16</sup> suggesting a peak in road traffic during the late morning and early afternoon hours.

The findings of this study also have important implications for the development of road safety policies. Similar to the suggestions of Vohra et al. (2019), who emphasized the need for stricter regulations and public awareness campaigns to lower accident rates, our results indicate that increased enforcement of laws regarding alcohol and drug consumption could significantly reduce the number of fatalities.<sup>14</sup> Additionally, public education on the risks of driving under the influence of alcohol and drugs, particularly targeting young drivers, could be a valuable preventive measure.

In contrast, studies such as Saleem et al. (2015) have focused more on head injuries as the primary cause of death, with 66% of deaths in their study being due to head trauma,<sup>19</sup> While we also found that head trauma was a significant cause of injury, the toxicological influences, particularly alcohol, appeared to play a larger role in fatal outcomes in our study.

The study's strength lies in its focus on a large sample size of 150 patients, providing a robust overview of road traffic accidents in Karachi. It utilizes data from major hospitals, offering reliable real-world insights into the prevalence of alcohol and drug use among victims. However, the study's limitation is its reliance on existing medical records, which may have gaps or inaccuracies in reporting. Additionally, the study does not account for external factors like weather or road conditions, which may influence the accident outcomes. The cross-sectional design limits the ability to infer causality from the findings.

## CONCLUSION

Toxicological factors, particularly alcohol use, significantly influence road traffic accident outcomes in Karachi. Addressing intoxicated driving through better enforcement of traffic laws and awareness campaigns can help reduce accident-related fatalities. Further studies are necessary to explore additional factors contributing to road safety.

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