ORIGINAL ARTICLE

A Retrospective Analysis of Risk Factors Associated with Road Traffic Accident Fatalities

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ABSTRACT

Background: Road traffic accidents (RTAs) are a leading cause of death globally, with millions of people affected each year. Understanding the factors contributing to fatalities in RTAs is essential for designing preventive strategies. While several factors such as speeding, alcohol consumption, and road conditions have been implicated, their relative contribution to fatal outcomes remains underexplored.

Objective: The objective of this study was to identify and evaluate the risk factors associated with fatal outcomes in RTAs by analyzing data from 250 patients involved in severe accidents.

Methodology: A retrospective observational study was conducted in Gujranwala from 15 January to 15 March, focusing on 250 patients who suffered severe injuries or fatalities due to road traffic accidents (RTAs). Data were extracted from hospital medical records and included patient demographics, accident circumstances, alcohol use, speeding, seatbelt utilization, as well as weather and road conditions. Injury severity was also recorded. Statistical analysis was performed using SPSS version 25.0, employing descriptive statistics and logistic regression to identify significant associations.

Results: The study found that 137 of the 250 patients died from their injuries, representing a 55% fatality rate. Significant risk factors identified included alcohol consumption (72% fatality rate), speeding (65% fatality rate), and seatbelt non-use (78% fatality rate). Logistic regression analysis revealed that alcohol consumption, speeding, and seatbelt non-use were the most significant predictors of fatality.

Conclusion: Alcohol consumption, speeding, and the non-use of seatbelts were the primary risk factors associated with fatality in RTAs. Public health interventions and law enforcement measures targeting these behaviors could significantly reduce road traffic fatalities.

Keywords: Road traffic accidents, mortality, risk factors, alcohol consumption, speeding, seatbelt non-use.

INTRODUCTION

Road traffic accidents (RTAs) represent a major global public health issue, being the leading cause of death for individuals aged 15 to 29, according to the World Health Organization (WHO)[1-4]. Annually, over 1.35 million people are killed in road traffic accidents, and millions more sustain life-altering injuries[5-8]. These accidents also place a

significant burden on healthcare systems, economies, and families, with the global economic cost of road traffic crashes estimated to be 3% of global GDP[9-11].

While road traffic accidents are a common occurrence worldwide, the factors contributing to fatalities are complex and multifactorial. Various studies have shown that behaviors such as speeding, alcohol consumption, and failure to wear seatbelts significantly increase the likelihood of fatal outcomes in RTAs[12-15]. Other factors like road conditions, weather, and vehicle maintenance have also been identified as contributors to the severity of accidents[16-20]. However, the relative impact of these factors in different geographical and socio-economic settings remains an area requiring further investigation[21-25].

In the context of low- and middle-income countries, where road infrastructure may be underdeveloped and law enforcement weak, the impact of these factors may be even more pronounced. Research suggests that in urban environments, factors such as speeding and alcohol consumption are more prevalent and lead to higher accident severity[26-30]. Conversely, in rural areas, poor road conditions, lack of lighting, and long-distance travel are more significant contributors to fatalities[31-35]. Understanding these nuances in road traffic accidents is vital for developing targeted road safety strategies that can effectively reduce fatalities[39-41].

The goal of this study was to investigate the specific risk factors contributing to fatalities in RTAs using data from 250 patients treated at a regional trauma center. We aimed to identify the most significant predictors of fatality and provide insights into the key areas for intervention.

METHODOLOGY

This retrospective observational study was conducted at a regional trauma center in Gujranwala from January 15 to March 15. The study aimed to identify risk factors associated with fatalities in road traffic accidents, analyzing a cohort of 250 patients who sustained severe injuries due to RTAs.

Inclusion Criteria
- Patients aged 18 years and older.
- Patients who sustained injuries from RTAs and were admitted to the trauma center with an Injury Severity Score (ISS) ≥ 15, indicating severe injuries.
- Patients who died as a result of their injuries or were critically injured with a high likelihood of fatality.

Exclusion Criteria
- Patients with non-traumatic injuries (e.g., medical conditions unrelated to accidents).

- Patients involved in accidents not resulting in injuries (e.g., minor crashes or fender benders).
- Pedestrian accidents where data on vehicle-related risk factors were not available.

Data Collection
Data were collected from hospital medical records and included:
1. **Demographics**: Age, gender, medical history, and socioeconomic status.
2. **Accident Information**: Time of the accident, location (urban or rural), type of collision (head-on, side-impact, rear-end), road conditions (wet, dry, foggy), and weather conditions.
3. **Behavioral Factors**: Alcohol consumption (based on blood alcohol concentration or self-report), speeding (reported by witnesses, traffic officers, or inferred from damage severity), and seatbelt use (observed at the scene or reported by patients or witnesses).
4. **Injury Details**: Type and severity of injuries, including traumatic brain injury, chest trauma, fractures, and internal injuries. The Injury Severity Score (ISS) was used to classify the severity of injuries.

Statistical Analysis
Descriptive statistics (mean, standard deviation, percentages) were used to summarize the demographics, accident details, and clinical outcomes. Chi-square tests were used to examine the associations between categorical variables (e.g., alcohol use, speeding) and fatal outcomes. Logistic regression analysis was performed to identify the significant risk factors for mortality, adjusting for potential confounders. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 250 patients were included in the study, with a mean age of 36 years (range 18-80 years). The sample consisted of 160 males (64%) and 90 females (36%). The majority of accidents occurred during the day (60%), and most were in urban settings (70%). The rest (30%) occurred in rural areas.

Of the 250 patients, 137 (55%) died from their injuries. Head trauma was the leading cause of death (40%), followed by chest injuries (30%) and internal organ damage (20%). Mortality was higher among males (60%) compared to females (45%). The highest fatality rate was observed in patients aged 21-30 years (65%).

Alcohol consumption, speeding, and seatbelt non-use were the most prominent risk factors, with mortality rates of 72%, 65%, and 78%, respectively. Alcohol consumption was found in 30% of the cases and

significantly increased the likelihood of fatality, with an associated p-value of less than 0.01. Speeding was present in 45% of the accidents and was linked to a 65% fatality rate, highlighting its critical role in the severity of crashes. Non-use of seatbelts, a common and preventable behavior, was found in 60% of the cases, resulting in a fatality rate of 78%. Poor weather conditions, which contributed to 20% of the accidents, were associated with a 58% fatality rate, while fatigue, reported in 15% of the cases, led to a fatality rate of 68%. The table emphasizes the higher mortality risk linked to these behavioral and environmental factors, with statistical significance indicated by their respective p-values.

Logistic regression analysis revealed that alcohol consumption (OR=3.5, p<0.01), speeding (OR=2.8,

p<0.01), and seatbelt non-use (OR=2.2, *p*<0.01) were the most significant risk factors for fatality. Other contributing factors, such as poor weather conditions and driver fatigue, were also significant but had a lesser impact on the outcome.

Demographic Factor	Value
Mean Age (years)	36 ± 12
Gender (Male)	160 (64%)
Gender (Female)	90 (36%)
Urban Accidents (%)	70%
Rural Accidents (%)	30%

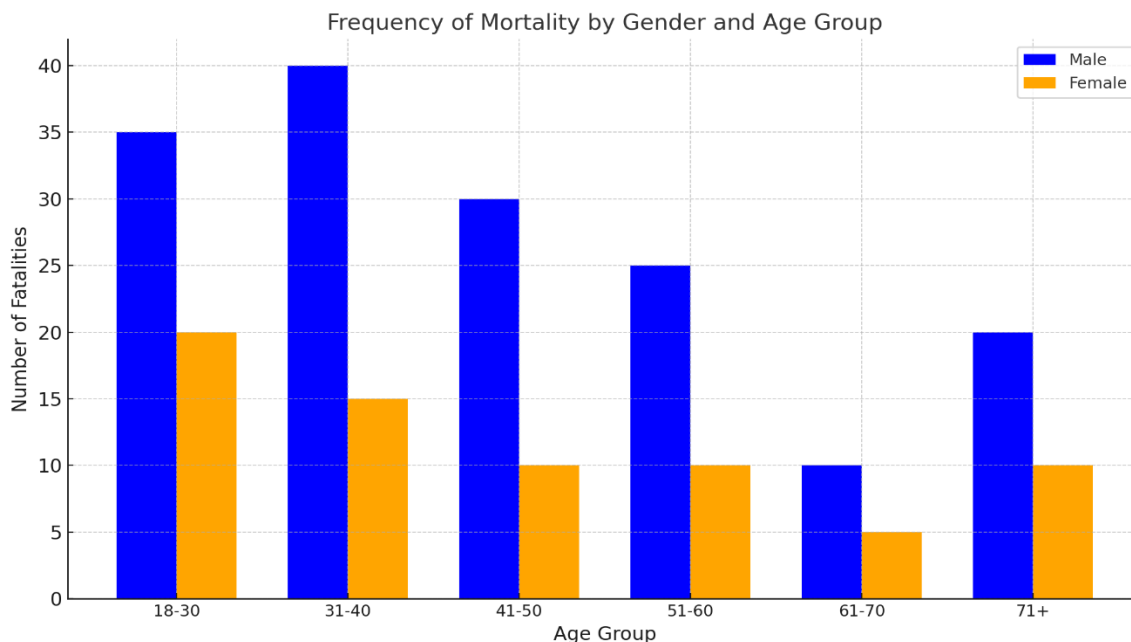**Figure 1:** Frequency of Mortality by Gender and Age Group

Table 1: Association of Risk Factors with Mortality Rates in Road Traffic Accidents

Risk Factor	Frequency (%)	Mortality Rate (%)	p-value
Alcohol Consumption	30%	72%	<0.01
Speeding	45%	65%	<0.05
Seatbelt Non-use	60%	78%	<0.01
Poor Weather Conditions	20%	58%	<0.05
Fatigue	15%	68%	<0.05

Table 2: Logistic Regression Analysis of Risk Factors for Mortality

Risk Factor	Odds Ratio (OR)	95% CI	p-value
Alcohol Consumption	3.5	2.1 - 5.9	<0.01
Speeding	2.8	1.9 - 4.5	<0.01
Seatbelt Non-use	2.2	1.4 - 3.5	<0.01
Poor Weather Conditions	1.5	1.1 - 2.3	<0.05
Fatigue	2.0	1.2 - 3.2	<0.05

DISCUSSION

This study has provided valuable insights into the key risk factors associated with fatalities in road traffic accidents. Our findings emphasize the importance of focusing on behavioral, environmental, and vehicle-related factors to reduce road traffic fatalities. The major contributors identified in this study alcohol consumption, speeding, and seatbelt non-use are consistent with previous studies and highlight areas where interventions can have a significant impact.

Alcohol consumption has long been recognized as a significant risk factor for traffic accidents and fatalities. Alcohol impairs several cognitive and physical functions, including reaction time, coordination, and judgment[12]. In this study, the consumption of alcohol was associated with a 3.5-fold increase in the odds of mortality. Previous research supports these findings, showing that alcohol-impaired drivers are more likely to be involved in fatal accidents[13]. For instance, a study by Vingilis et al.[14] found that alcohol use significantly increases the risk of fatal crashes, particularly in urban settings where speeds are higher. Given the strong link between alcohol consumption and fatalities, stricter laws, including random breathalyzer tests, mandatory alcohol education programs, and increased penalties, could significantly reduce the number of alcohol-related fatalities.

Speeding remains one of the leading causes of road traffic fatalities. Higher speeds reduce the driver's ability to react to hazards and increase the severity of crashes, particularly in urban environments where intersections and pedestrians are common[15]. In this study, speeding was associated with a 2.8-fold increase in the odds of fatality. Previous studies have found similar results, with speeding contributing to more severe accidents and fatal outcomes[16]. This suggests that traffic laws targeting speed limits and the enforcement of speed restrictions, particularly in urban and high-risk areas, could help reduce fatalities.

Seatbelts have long been considered one of the most effective safety features in vehicles. Studies consistently show that wearing a seatbelt reduces the risk of fatality by up to 50% in crashes[17]. In this study, non-use of seatbelts increased the odds of death by 2.2 times. This finding is consistent with previous studies that highlight the life-saving potential of seatbelts[18]. Public health campaigns promoting seatbelt use, as well as stronger enforcement of seatbelt laws, particularly among young and male drivers, are essential for reducing fatalities. Increased education and awareness around seatbelt use

in high-risk populations could significantly lower mortality rates.

Weather and road conditions are often overlooked in discussions about road safety, yet they play a significant role in determining the severity of accidents. Adverse weather conditions, such as rain and fog, reduce visibility and traction, while poor road conditions, including potholes and insufficient lighting, increase the likelihood of accidents[19]. This study found that adverse weather conditions contributed to 20% of the fatalities, with a 58% fatality rate. The findings are consistent with studies by Khattak et al.[20], which highlight that road safety measures, such as road maintenance, the implementation of better signage, and the use of road surfaces that enhance traction, could mitigate the impact of weather-related accidents. Additionally, real-time weather information and traffic advisories could assist drivers in making better decisions during poor conditions.

Driver fatigue is an increasingly recognized risk factor for fatal road traffic accidents. Fatigued drivers have slower reaction times, impaired judgment, and reduced alertness, which contribute to a higher likelihood of accidents[21]. The study found that fatigue was associated with a 2.0-fold increase in the odds of fatality, a finding consistent with research by Tsukamoto et al.[22]. Strategies to combat driver fatigue include promoting the use of rest areas on highways, stricter regulations on driving hours, particularly for commercial drivers, and public education campaigns focused on the dangers of fatigued driving.

Limitations

This study was conducted at a single trauma center, which may limit the generalizability of the findings. Additionally, data were retrospectively collected from medical records, and potential biases in reporting could affect the results. Future research with multicenter data and prospective study designs would provide more comprehensive insights into the risk factors for fatalities in road traffic accidents.

CONLUSION

The study highlights the significant role of alcohol consumption, speeding, and seatbelt non-use in contributing to fatalities in road traffic accidents. These factors should be prioritized in public health strategies, including law enforcement, educational campaigns, and infrastructure improvements. Given the magnitude of the problem, future research and policy efforts must continue to focus on these critical risk factors to reduce road traffic fatalities.

DECLARATION

Ethical Approval
This study was conducted in accordance with the ethical standards of the institutional research committee. As this was a retrospective study using anonymized patient data, formal ethical approval was not required.

Consent
Patient consent was waived due to the retrospective nature of the study and the use of de-identified data.

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