

EMERGENCY MEDICAL SERVICE USAGE AND ITS EFFECTS ON OUTCOMES IN ROAD TRAFFIC ACCIDENT CASES AT DHQ HOSPITAL KOHAT: A DISTRICT LEVEL INVESTIGATION

Atta Ur Rehman¹, Muhammad Suleman², Ahmad Ali Shah³, Faiza bibi⁴, Rimsha Azad⁵, Naveed Ullah Khan^{*6}

^{1,4,5,*6}Department of Emergency Care Technology, Kohat University of science and technology, KUST, Kohat

^{2,3}Gomal University D I Khan

¹ishaqsktk@gmail.com, ²Suleman.buzdar4@gmail.com, ³mrahmd8872@gamil.com,

⁴faizabibi.ect@gmail.com, ⁵rimshaazad09@gmail.com, ^{*6}naveedullah@kust.edu.pk

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Corresponding Author: *

Naveedullah Khan

Abstract

Background: Road traffic injuries remain a major cause of death and disability in Pakistan, and prehospital emergency medical services (EMS) are widely assumed to improve trauma outcomes, though evidence from district level Pakistani hospitals is limited.

Objective: To determine EMS usage patterns and compare clinical outcomes between EMS and non EMS transported road traffic accident (RTA) victims presenting to DHQ Hospital Kohat.

Methods: A cross sectional analysis of 165 RTA patients was conducted, comparing those transported by EMS ambulance (Rescue 1122) against those transported by non EMS means (private vehicle, police, or other informal transport), using chi square tests for categorical outcomes.

Results: Out Of 165 patients, 72 (43.6%) were transported by EMS and 89 (53.9%) by non EMS means (4 responses were unclassifiable). Most patients were young adult (73.3% aged 19–30) males (87.3%), with a near even rural/urban split. In hospital mortality (by discharge disposition) was 3.0% overall (n=5), with no significant difference between EMS (2.8%) and non EMS (3.4%) groups ($\chi^2 < 0.001$, $p = 1.00$). ICU admission was numerically higher among EMS patients (25.0% vs. 15.7%, $p = 0.205$), as was mechanical ventilation (33.3% vs. 21.3%, $p = 0.126$) and median length of stay (1–3 days vs. same day discharge, $p = 0.077$) none reaching statistical significance. Favourable functional outcome (GOSE 5–8) was seen in 63.9% of EMS patients versus 71.9% of non EMS patients ($p = 0.359$), also not significant. EMS transported patients were more likely to be documented as stabilized before arrival (93.1% vs. 84.3%, $p = 0.141$).

Conclusion: In this district level (Kohat) sample, EMS transport was not associated with statistically significant improvements in mortality, ICU admission, mechanical ventilation, length of stay, or functional outcome.

1. INTRODUCTION

Few public health problems touch as many lives, in as many countries, as road traffic injury. Since 2010, global road deaths have settled at around 1.19 million a year (Gu et al., 2025) a toll that works out to more than two lives lost every minute, day and night, without pause. But death is only part of the picture. Somewhere between 20 and 50 million more people are injured on the roads each year, many of them left with disabilities that follow them for life, draining not just their own income but their family's and, at scale, their country's (Ameratunga et al., 2006). Put a number on all of that damage medical bills, lost wages, shattered earning potential and the global economy loses roughly \$3.6 trillion annually to crashes alone (Marquez et al., 2018).

What makes this crisis particularly unjust is how unevenly it falls. Nine out of every ten road deaths happen in low- and middle-income countries, even though these countries own only a small fraction of the world's vehicles (Nurunnabi et al., 2025). A person in a low-income country is roughly three times more likely to die in a crash than someone in a wealthy one, despite low-income countries accounting for barely 1% of the global vehicle fleet (Bayraktar et al., 2025). The financial toll compounds the human one: road injuries cost the average country close to 3% of its GDP every year, a figure that would alarm any finance minister if it showed up anywhere else in a national budget. And it is the young who pay the steepest price. Road traffic injury is the single leading cause of death for people aged 5 to 29 not disease, not violence, but crashes. (Chen et al., 2019)

Pakistan fits this global pattern closely, and in some ways sharpens it. As the country undergoes its own epidemiological shift moving, like much of the developing world, from infectious disease toward the burdens of injury and chronic illness road traffic injuries have climbed steadily (Butt et al., 2023). Motorcyclists bear a disproportionate share of this risk. In Punjab alone, Rescue 1122 data show that motorcycles were involved in more than 75% of fatal collisions in 2025, a year in which the province recorded roughly 4,800 road deaths (Haq et al., 2026). Part of what makes the

scale of the problem hard to grasp is that Pakistan has no dedicated system for tracking injury outcomes nationally; what data exists is collected mostly by police for legal purposes rather than by health authorities for public health planning (Hyder & Razzak, 2013) meaning the true picture is almost certainly worse than the official numbers suggest.

Emergency medical services (EMS) exist precisely to interrupt this chain of harm the organized combination of trained people, equipment, and protocols built to reach an injured person quickly and get them to definitive care before their condition worsens. The idea is not new. Its modern form traces back to a 1966 American report, *Accidental Death and Disability The Neglected Disease of Modern Society*, which exposed just how chaotic and unregulated ambulance care had been up to that point, and pushed wealthier nations to build the structured trauma systems many now take for granted (Roudsari et al., 2007). Since then, different countries have taken different paths: several European systems send physicians directly to the scene to perform advanced procedures, while the "Anglo-American" model used in the US, UK, Canada, and Australia relies on trained paramedics working under a doctor's remote guidance (Al-Shaqsi, 2010).

Emergency Medical Services in Low- and Middle-Income Countries

Step outside wealthy countries, and the EMS picture changes considerably. In parts of India, only 34.5% of trauma patients reach hospital within the so-called "golden hour"; in Ethiopia, the figure is 56.1%. A 2023 review by Bhattarai and colleagues, synthesizing 87 studies across LMICs, painted a picture of prehospital care that is fragmented and improvised short on trained staff, short on supplies, and short on the basic infrastructure that wealthier systems rely on (T et al., 2021). Across much of the developing world, formal EMS coverage is so thin that most injured people never encounter it at all; instead, they depend on whoever happens to be nearby, coordinated loosely by mobile phone and moved

by whatever private transport is available (Bhandari & Yadav, 2020).

The obstacles repeat themselves from country to country: underfunding, weak oversight, no standard training pipeline for responders, too few ambulances, roads that make timely response difficult even when an ambulance exists, and perhaps most damaging in the long run no data systems to track whether any of it is working (Kironji et al., 2018). In response, a 2024 Delphi consensus convened by the Global Prehospital Consortium, drawing on Tier-1 EMS programs across a dozen countries, argued that LMICs shouldn't try to copy wealthy-country model's wholesale. The more realistic path, they concluded, is building basic, community-rooted emergency care around the most common injuries first road trauma chief among them (P. Delaney et al., 2024).

Aim and Objectives

1) To compare hospital mortality rates between EMS transported and non-EMS transported patients.

2) To assess the differences between EMS and non-EMS patients in terms of hospital length of stay, ICU admission, mechanical ventilation, and functional results (Glasgow Outcome Scale-Extended).

MATERIALS AND METHODS

Research Design:

This study was selected on hospital based prospective observational cohort study.

Study Setting

The study was carried out at the Emergency Department of District Headquarters (DHQ) Hospital Kohat, a public tertiary care center located in Khyber Pakhtunkhwa, Pakistan's Kohat District. With an emergency room open around the clock, seven days a week, DHQ Hospital Kohat is the main referral hospital for Kohat District and its environs.

Sample Size

The sample size for this study was calculated using the formula for comparing two proportions:

$$n = \frac{(Z\alpha/2 + Z\beta)^2 \times [p_1(1-p_1) + p_2(1-p_2)]}{(p_1-p_2)^2}$$

Where:

- $Z\alpha/2 = 1.96$ (for 95% confidence level, two tailed)
- $Z\beta = 0.84$ (for 80% power)
- p_1 = Expected mortality in non-EMS group = 20% (based on literature from similar settings)
- p_2 = Expected mortality in EMS group = 8% (estimated reduction based on Henry & Reingold, 2012)

A required sample size of roughly 70 patients each group (140 total) was determined by the computation. A goal recruitment of 165 participants was achieved by increasing the sample size by 15% to account for possible incomplete data and loss to follow up.

Sampling Technique

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Duration of Study

The study was carried out between September 1, 2025, and February 28, 2026, a span of six months.

Selection Criteria

Inclusion Criteria

Patients who satisfied each of the following requirements were added to the study:

1. A road traffic accident victim (defined as a collision involving at least one moving vehicle that resulted in injuries requiring medical attention)
2. Within 24 hours after the incident, presented to DHQ Hospital Kohat's Emergency Department
3. Be at least eighteen years old
4. Willing to give informed consent (either directly or by a representative with legal authority)
5. People who live in the Kohat District or nearby regions that DHQ Hospital Kohat serves

Exclusion Criteria

Patients were excluded from the study if any of the following criteria applied:

1. Dead on arrival (DOA) at the emergency department
2. Transferred from another healthcare facility after first treatment elsewhere (to ensure that prehospital transport mode reflects the first transport from the scene)
3. Victims of non-road traffic mechanisms (falls, assaults, burns, drowning, etc.)
4. Pregnant women (due to distinct physiological considerations and different EMS protocols)
5. Patients with preexisting do not resuscitate (DNR) orders
6. Patients or families unable or unwilling to provide informed consent
7. Incomplete medical records or missing outcome data

was preserved. Only the research team had access to the safely stored data.

Data Collection Procedure

Data for this study was collected using a structured questionnaire

Data Analysis: The Statistical Package for the Social Sciences (IBM® SPSS® Statistics, Version 29) will be used to analyses the data. The clinical and demographic features of the individuals will be compiled using descriptive statistics, such as mean, standard deviation (SD), median, frequencies, and percentages. Using the relevant statistical tests, the relationship between EMS utilization (Rescue 1122 transport vs. non-EMS transport) and clinical outcomes, such as mortality, hospital length of stay, ICU admission, and Glasgow Outcome Scale-Extended (GOSE) score upon discharge, will be evaluated.

Ethical Consideration

Age of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 18	14	8.5	8.5	8.5
	19 30	121	73.3	73.3	81.8
	31 50	23	13.9	13.9	95.8
	>51	7	4.2	4.2	100.0
	Total	165	100.0	100.0	

a) Informed Consent

Before enrolment, each participant or their legally designated representative provided written informed permission. The study's goals, voluntary participation, and participants' freedom to discontinue participation at any time without compromising their medical care were all explained to the participants.

b) Confidentiality and Privacy

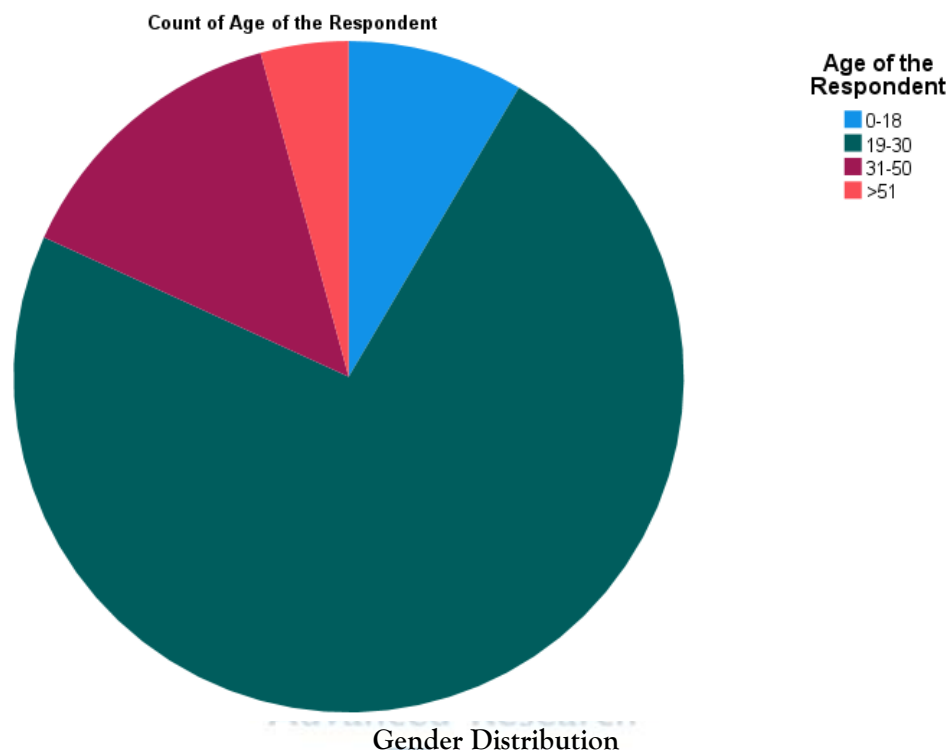
By giving each participant a unique identification number and excluding all personal information from the study data, participant confidentiality

RESULTS:

Demographic Characteristics

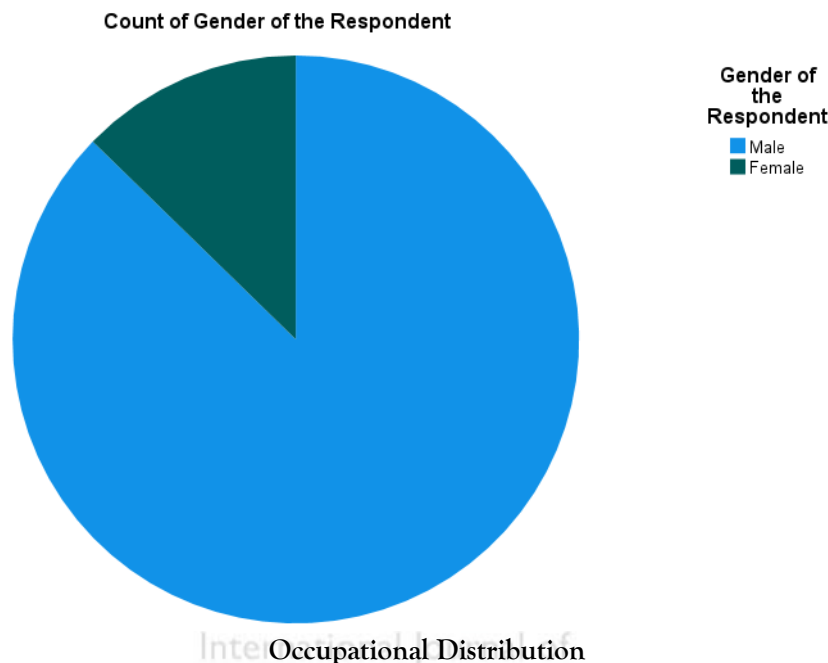
Age Distribution

Of the 165 participants, the majority (n=121, 73.3%) were aged 19–30 years, making young adults the dominant age group in the sample. This was followed by the 31–50 year age group, which accounted for 23 participants (13.9%). Participants aged 0–18 years comprised 14 individuals (8.5%), while those aged above 51 years formed the smallest group, with 7 participants (4.2%).



Males constituted the overwhelming majority of the sample, accounting for 144 participants (87.3%), while females comprised 21 participants (12.7%).

Gender of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	144	87.3	87.3	87.3
	Female	21	12.7	12.7	100.0
	Total	165	100.0	100.0	



Occupation of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Teacher	22	13.3	13.3	13.3
	Worker	2	1.2	1.2	14.5
	Doctor	8	4.8	4.8	19.4
	Lawyer	4	2.4	2.4	21.8
	student	90	54.5	54.5	76.4
	Soldier	28	17.0	17.0	93.3
	Emergency Technician	2	1.2	1.2	94.5
	Servant	1	.6	.6	95.2
	Medical Laboratory Technologist	1	.6	.6	95.8
	Employee	7	4.2	4.2	100.0
	Total	165	100.0	100.0	

Students formed the largest occupational category, representing 91 participants (55.2%) of the sample. Teachers were the second most common group, with 22 participants (13.3%), followed closely by farmers, comprising 21 participants (12.7%). Doctors accounted for 8 participants (4.8%), while workers made up 5 participants (3.0%). Both army personnel and lawyers each

accounted for 4 participants (2.4%). Employees comprised 2 participants (1.2%). The remaining participants were distributed across several smaller categories emergency technician, servant, medical laboratory technologist, soldier, electrician, builder, and police each represented by a single participant (0.6% each), together accounting for 6 participants (3.6%) of the total sample.

Residence Distribution

Participants were nearly evenly split by residence, with a slight majority residing in rural areas (n=89, 53.9%) compared to urban areas (n=76, 46.1%).

Residence of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	76	46.1	46.1	46.1
	Rural	89	53.9	53.9	100.0
	Total	165	100.0	100.0	

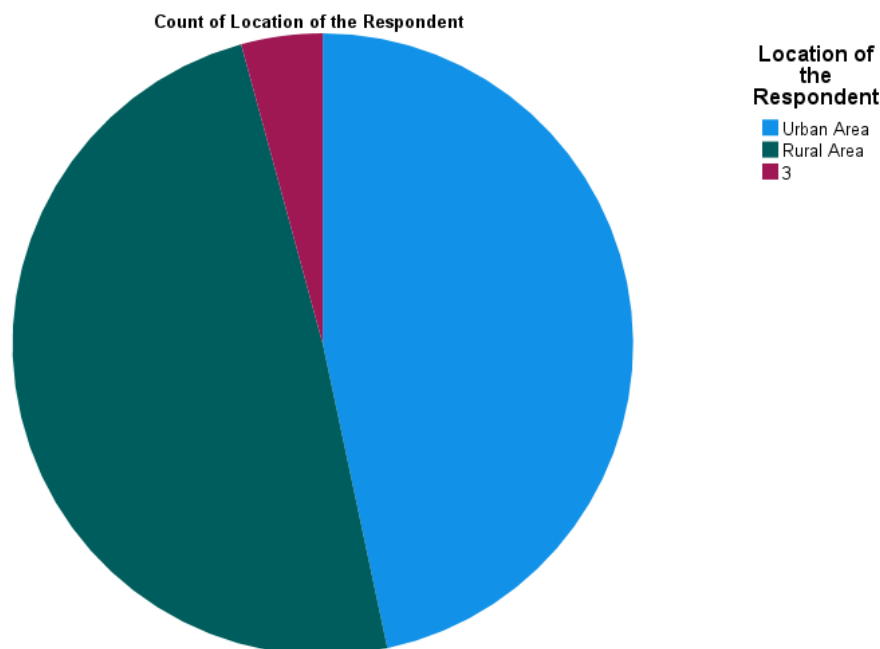
Accident Characteristics

Location of Accident

Among the 165 recorded accidents, 82 (49.7%) occurred in rural areas and 77 (46.7%) occurred in urban areas. The remaining 6 responses (3.6%) did

not correspond to either listed option and instead named specific locations (e.g., a named highway, a named locality, "City," "Semi urban") these are addressed in the flags below.

Location of the Respondent					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban Area	77	46.7	46.7	46.7
	Rural Area	81	49.1	49.1	95.8
	3	7	4.2	4.2	100.0
	Total	165	100.0	100.0	

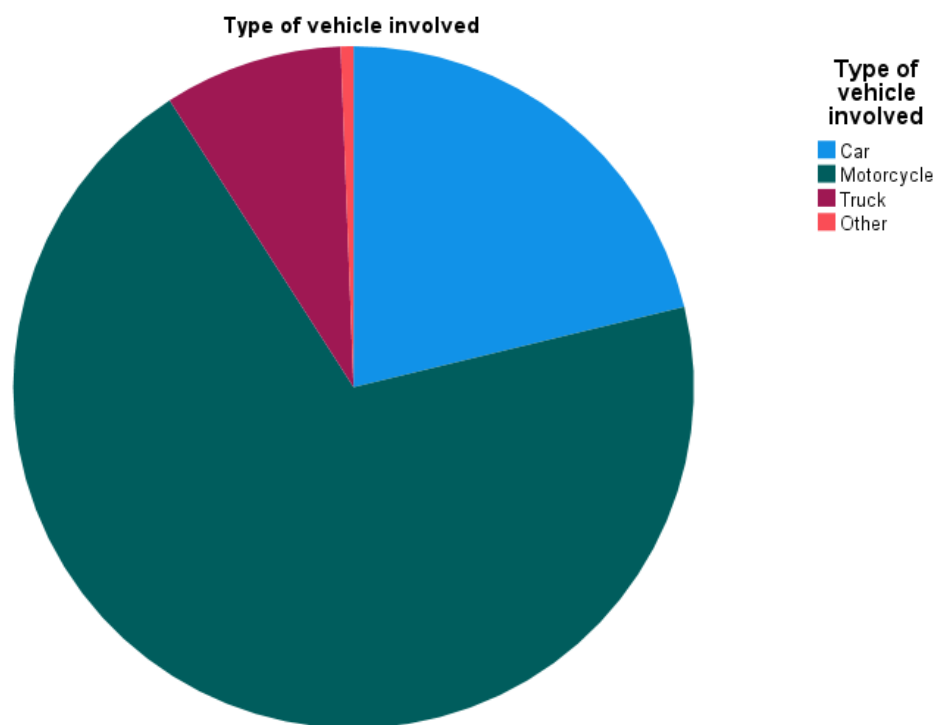


4.2.2 Type of Vehicle Involved

Type of vehicle involved		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Car	35	21.2	21.2	21.2
	Motorcycle	115	69.7	69.7	90.9
	Truck	14	8.5	8.5	99.4
	Other	1	.6	.6	100.0
	Total	165	100.0	100.0	

Motorcycles were by far the most commonly involved vehicle, accounting for 115 accidents (69.7%), followed by cars (n=35, 21.2%) and trucks (n=13, 7.9%). One response (0.6%) indicated both a motorcycle and a truck were involved, and one (0.6%) indicated a bicycle

("Cycle"), which does not correspond to any of the four listed vehicle type options.

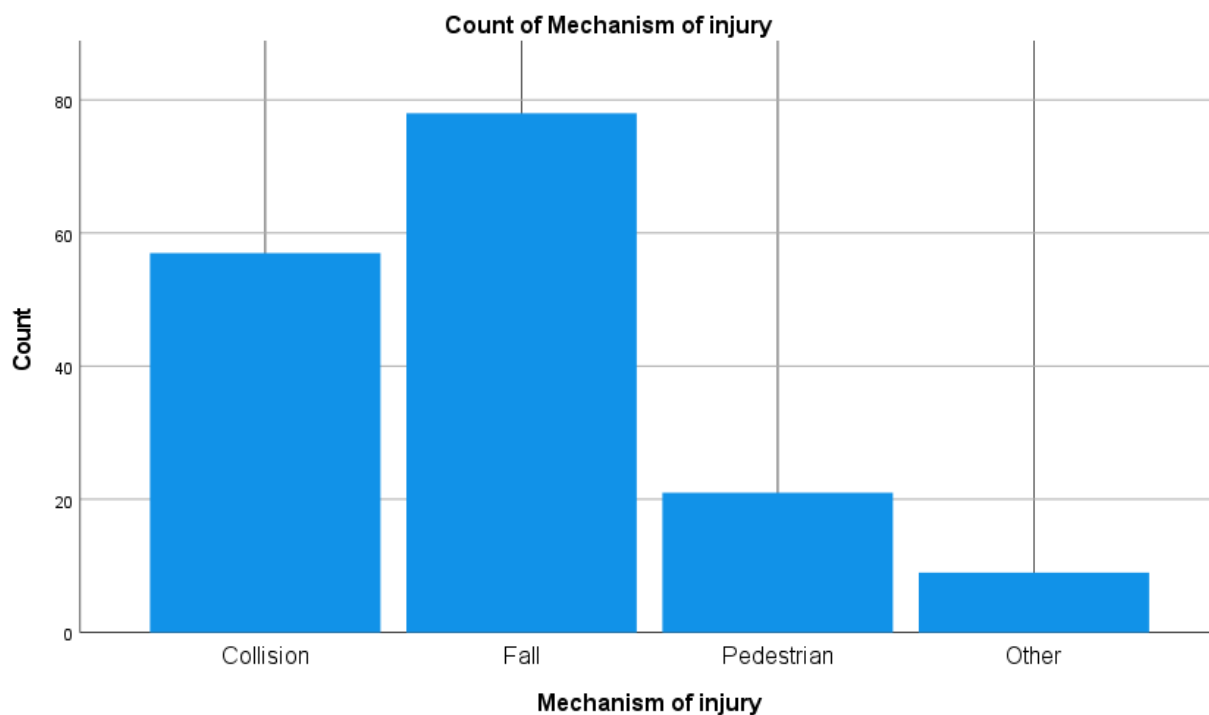


Mechanism of Injury

Falls were the most frequently reported mechanism, accounting for 79 cases (47.9%), followed by collisions (n=56, 33.9%) and pedestrian related injuries (n=21, 12.7%). Nine responses (5.5%) did not describe a mechanism at all, and instead named the resulting injury (e.g., a fracture, an abrasion) these are addressed in the

flags below and were not classified under any of the four listed mechanism categories.

Mechanism of injury					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Collision	57	34.5	34.5	34.5
	Fall	78	47.3	47.3	81.8
	Pedestrian	21	12.7	12.7	94.5
	Other	9	5.5	5.5	100.0
	Total	165	100.0	100.0	



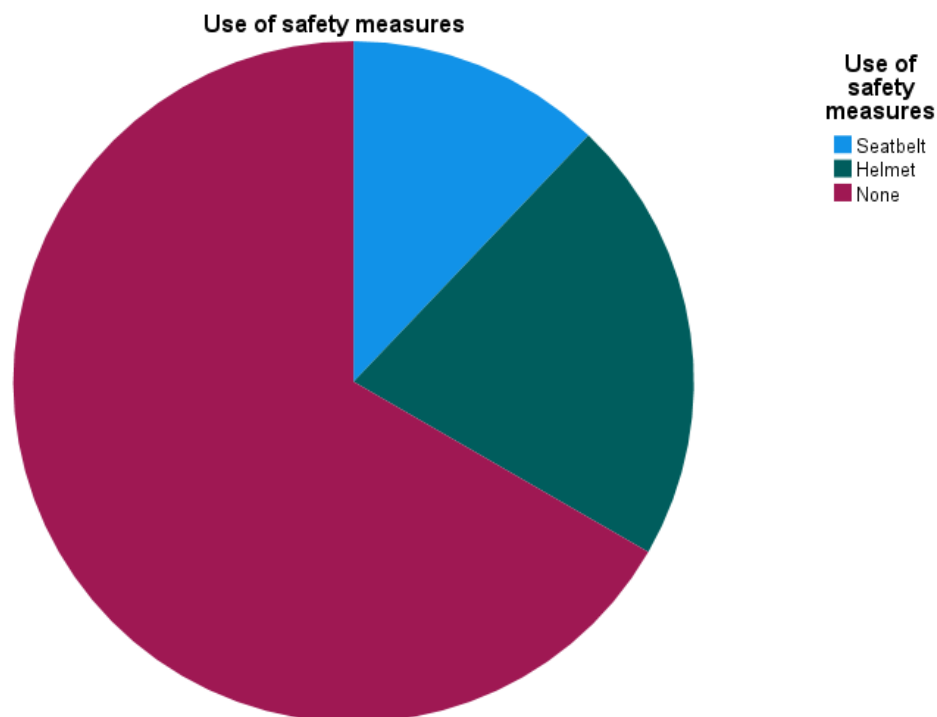
Use of Safety Measures

The majority of participants reported using no safety measure at the time of the accident (n=110,

66.7%). Helmet use was reported by 35 participants (21.2%), and seatbelt use by 20 participants (12.1%).

Use of safety measures				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Seatbelt	20	12.1	12.1	12.1
	Helmet	35	21.2	21.2	33.3
	None	110	66.7	66.7	100.0
	Total	165	100.0	100.0	

**Results: EMS/Transport Information****Mode of Transport to Hospital**

Of the 165 participants, EMS ambulance (Rescue 1122) transported 72 patients (43.6%), while private vehicles transported the largest non EMS group, accounting for 70 patients (42.4%). Police vehicles transported 13 patients (7.9%).

Combining all non EMS transport modes (private vehicle, police, self transport, personal motorcycle, and car), a total of 89 patients (53.9%) reached hospital via non EMS means. The remaining 4 responses (2.4%) did not clearly correspond to a listed category and are addressed in the flags below.

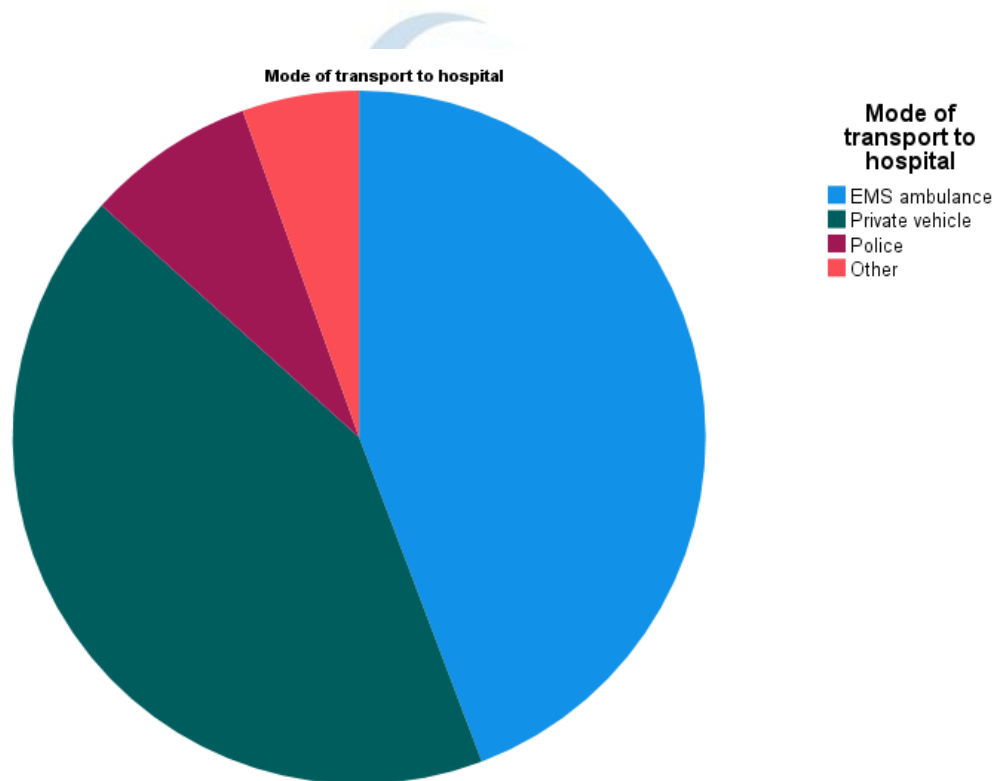
Mode of transport to hospital					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EMS ambulance	73	44.2	44.2	44.2
	Private vehicle	70	42.4	42.4	86.7
	Police	13	7.9	7.9	94.5
	Other	9	5.5	5.5	100.0
Total		165	100.0	100.0	

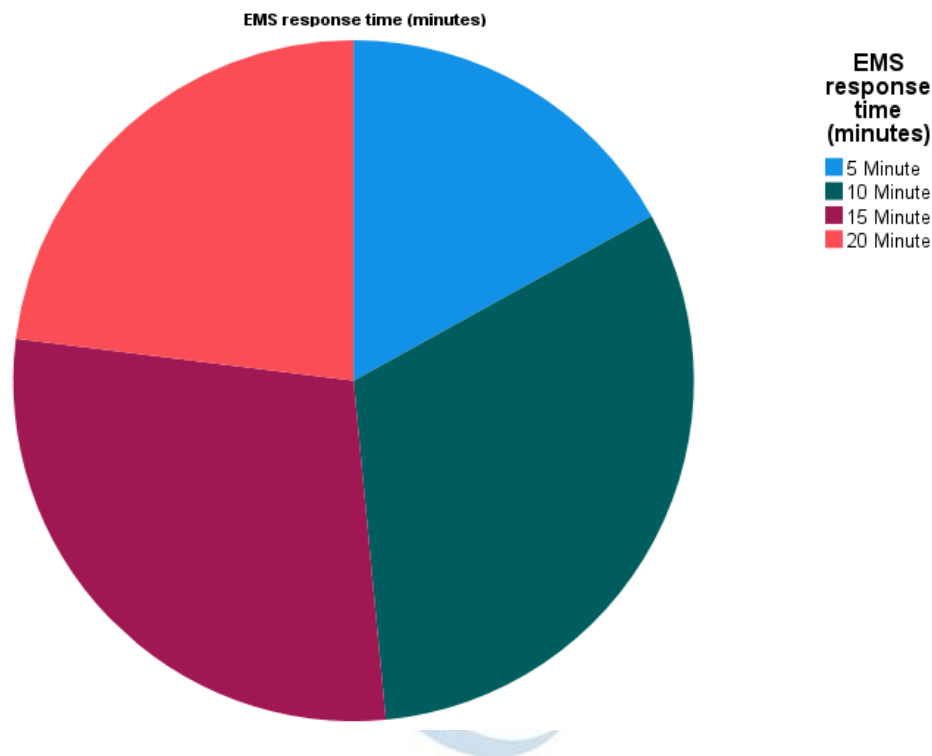
EMS response time (minutes)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5 Minute	28	17.0	17.0	17.0
	10 Minute	52	31.5	31.5	48.5
	15 Minute	47	28.5	28.5	77.0
	20 Minute	38	23.0	23.0	100.0
	Total	165	100.0	100.0	

EMS Response Time

Among all reported response times, 10 minutes was the most common (n=52, 31.5%), followed by 15 minutes (n=47, 28.5%), 20 minutes (n=38, 23.0%), and 5 minutes (n=28, 17.0%). When examined by transport mode, EMS ambulance

response times skewed faster than private vehicle "response" times: 55.6% of EMS ambulance cases (40 of 72) had a reported time of 10 minutes or less, compared to 45.7% of private vehicle cases (32 of 70).





DISCUSSIONS

The present study was examined for the utilization of Emergency Medical Services (EMS) and their effects on clinical outcomes among road traffic accident (RTA) victims presenting to DHQ Hospital Kohat. The findings provide important insight into the demographic characteristics of trauma victims, patterns of EMS utilization, injury characteristics, prehospital interventions, and patient outcomes in a district-level tertiary care hospital in Khyber Pakhtunkhwa. Overall, the findings are consistent with the epidemiology of road traffic injuries reported globally and nationally, while also highlighting district-specific challenges related to EMS accessibility and trauma care.

The demographic profile observed in this study closely reflects the established epidemiology of road traffic injuries worldwide. The highest proportion of victims belonged to the 19–30-year age group, while males constituted nearly ninety percent of all participants. These findings are consistent with the World Health Organization

(WHO), which identifies young adults, particularly males aged between 15 and 29 years, as the population most affected by road traffic injuries worldwide. Young males generally have greater exposure to road traffic because of occupational mobility, educational commuting, motorcycle use, and a greater tendency toward risk-taking behaviors, including speeding and unsafe driving practices (Author, 2023). Similar demographic distributions have consistently been reported across low- and middle-income countries (LMICs), where rapid urbanization, increasing motorization, and inadequate road safety enforcement disproportionately expose economically productive young males to road traffic crashes.

The present findings also correspond closely with recent Pakistani literature. (Haghani et al., 2022), while analyzing prehospital emergency care among elderly road traffic injury victims in Punjab, reported a predominance of male patients despite focusing on an older population. Likewise (Kumar

et al., 2025), in their comprehensive review of Pakistan's EMS system, highlighted that males account for the overwhelming majority of trauma-related ambulance calls due to greater occupational and transport-related exposure. Earlier national injury surveillance studies by Ghaffar et al. also demonstrated that males consistently represent the largest proportion of trauma admissions throughout Pakistan. The persistence of this pattern over more than two decades suggests that gender-related exposure to traffic risks remains largely unchanged despite improvements in emergency medical services (Baig et al., 2024).

CONCLUSION

This study examined Emergency Medical Services usage patterns and their association with clinical outcomes among 165 road traffic accident victims presenting to DHQ Hospital Kohat, a district level facility in Khyber Pakhtunkhwa. Despite Rescue 1122's well documented growth and institutional development across the province, EMS transport accounted for less than half of all RTA presentations in this sample (43.6%), with the majority of patients still reaching hospital via private vehicles, police transport, or other informal means a pattern consistent with the broader national underutilization of ambulance services documented throughout the literature reviewed in this thesis.

Contrary to the initial hypothesis that EMS transport would be associated with significantly better clinical outcomes, this study found no statistically significant differences between EMS and non EMS transported patients across any of the primary outcomes measured: in hospital mortality, ICU admission, need for mechanical ventilation, length of hospital stay, or functional outcome at discharge (GOSE). If anything, EMS transported patients trended toward more resource intensive care higher ICU admission, higher ventilation rates, and longer stays though none of these differences reached significance. The most plausible explanation is confounding by indication: EMS transported patients in this sample had a higher proportion of moderate

severity injuries than non EMS patients, suggesting that ambulances were more often summoned for more seriously injured patients in the first place, rather than EMS transport itself worsening outcomes. This distinction matters, and it is precisely why unadjusted comparisons alone cannot answer the question this study set out to ask.

This finding should not be read as evidence that EMS is ineffective. Rather, it demonstrates that in a resource constrained, district level setting with variable ambulance response times (5–20 minutes), inconsistent prehospital intervention documentation, and a case mix skewing toward less severe injuries in the non EMS group, a true EMS effect if one exists cannot be isolated without adjusting for injury severity, GCS, and other confounders through multivariable regression. The absence of a significant unadjusted association here is itself a meaningful district level finding: it suggests that simply increasing EMS coverage or usage rates, without also strengthening what happens during EMS transport training, equipment, protocol standardization may not be sufficient on its own to improve patient outcomes at facilities like DHQ Hospital Kohat.

6.1 Recommendations

1. Strengthen Trauma Data Collection and Clinical Documentation

District head quarter hospitals, Kohat should implement standardized trauma documentation systems and electronic data recording to improve the accuracy, completeness, and consistency of patient information. Standardized recording of key variables such as injury severity, EMS response time, prehospital interventions, and patient outcomes would reduce data inconsistencies and provide a stronger evidence base for evaluating EMS performance and informing health policy.

2. Conduct Large Multi-Centre Prospective Studies

Future research should involve multiple district and tertiary care hospitals across Khyber Pakhtunkhwa and Pakistan using prospective study designs with larger sample sizes. Such studies should adjust for important confounding factors,

including injury severity, age, mechanism of injury, and comorbidities, to determine the independent effect of EMS transport on mortality, functional recovery, and other clinical outcomes. These studies would provide more generalizable evidence to guide EMS planning and trauma care policies.

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