Epidemiological and Forensic Assessment of Firearm-Related Deaths in Peshawar

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Abstract

Objectives: This study aims to assess the epidemiological pattern of injuries in firearm-related deaths presented to the Forensic Medicine Department of Khyber Medical College, Peshawar. It also seeks to identify risk factors associated with firearm injuries and examine the relationship between demographic factors and firearm deaths in District Peshawar.

Materials and Methods: This cross-sectional analytical study involved 797 firearm death cases at the Forensic Medicine Department of Khyber Medical College Peshawar from 1st July 2023 to 30th June 2024. All firearm death cases were taken as samples presented during the said time. Data was collected via a non-probability convenience sampling technique and analyzed using SPSS version 22. Chi-square was used to assess any association between causes of firearm death and demographic variables.

Results: Among the 797 participants, 94.7% (755/797) were male, while 5.3% (42/797) were female. The mean age was 36.65 ± 13.6 years, ranging from 16 to 80 years. Additionally, 87.8% (700/797) of the subjects were from urban areas, and 12.2% (97/797) were from rural areas. Additionally, 20.3% (162/797) of the subjects sustained a single injury, while 79.7% (635/797) had multiple injuries. Among the 797 subjects, 2.4% (19/797) were cases of suicide. Furthermore, 94.2% (751/797) experienced immediate deaths, whereas 5.8% (46/797) had delayed deaths. In the case of firearm ranges the contact range was 20.5% (163), the close range was 14.7 % (117), the Near shot range was 35.1% (280) and the distant shot was 29.7% (237). A low level of education is significantly associated with firearm deaths.

Conclusion: This study provides valuable insights into the patterns and outcomes of firearm injuries in District Peshawar. The findings align with some global trends while highlighting unique regional differences**.** A low level of education is significantly associated with firearm deaths.

Keywords: Firearm injury, Pattern of injury, Firearm ranges

Introduction

A firearm injury is a penetrating injury from a weapon that uses a charge to fire. Weapons include handguns, rifles, and shotguns. Epidemiological Patterns of firearm injuries typically involve variables such as the type of firearm used, the nature of the injuries, and the demographics of the victims. Studies have demonstrated that firearm injuries often result in severe outcomes due to the critical organs affected and the immediate nature of the trauma[1,2]. Patterns can also vary based on geographical location, socio-economic status, and availability of firearms.[3,4]

Several factors contribute to the patterns of firearm deaths, including demographic variables (age, gender, socio-economic status) and contextual factors (urban vs. rural settings, local laws, and access to firearms). Research indicates that younger males are disproportionately affected by firearm injuries, often in metropolitan areas with higher crime rates.[5,6] Additionally, socio-economic factors such as poverty and lack of education have been linked to increased risk of firearm violence [7,8]

Firearm-related injuries and deaths represent a significant public health concern worldwide, with varying patterns and associated factors that can influence the severity and outcomes of such incidents. Understanding the specific patterns of firearm injuries and the demographic and contextual factors related to these incidents is crucial for developing effective prevention strategies and improving public health responses.[9]

Peshawar District, located in the Khyber Pakhtunkhwa province of Pakistan, has seen a range of firearm-related incidents, reflecting broader patterns across the country. With its unique socio-economic and political landscape, the district serves as an important case for studying the trends in firearm deaths and the factors that contribute to them. Peshawar, as a major urban center in Khyber Pakhtunkhwa, has experienced varying trends in firearm-related incidents. The district's socio-political climate, coupled with local cultural factors, influences the pattern of firearm injuries and deaths[8]. Despite its significance, there is a lack of comprehensive research focusing on the specific patterns and associated factors of firearm-related deaths in District Peshawar.

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By examining the types of firearm injuries, the demographic characteristics of the victims, and contextual factors, this research seeks to provide a detailed understanding of the local trends and contributing factors. The findings are expected to inform public health strategies, improve trauma care, and guide policy interventions to reduce firearm-related violence in the region.

Understanding the epidemiological patterns and factors associated with firearm deaths in District Peshawar is crucial for developing targeted interventions and preventive measures. This research will contribute to the broader understanding of firearm-related violence and its implications for public health and safety in the region.

Materials and Methods

It was a Cross-sectional study done in the Forensic Medicine Department at Khyber Medical College, Peshawar, from July 1, 2023, to June 30, 2024. All firearm deaths were taken as a sample, which was presented during the said time. A sample size of 797 was selected. Inclusion criteria were all firearm deaths presented to the department, and cases with incomplete documentation were excluded. Non-probability convenience sampling was done.

The study was conducted after obtaining approval from the ethical board of IREB Khyber Medical College, Peshawar Ethical Number A36/DME/KMC. A pre-designed Performa was used, having a demographic component and closed-ended questions regarding the autopsy cases presented at the forensic medicine department of Khyber Medical College, Peshawar.

Data was extracted using SPSS version 22. Qualitative variables like firearm injury patterns, including ranges, fatal period, organs involved, and type of injury, were presented in the form of tables and graphs, while quantitative variables like age were presented in the form of mean and standard deviation. Chi-square was used to determine any association between firearm deaths and demographic factors. P p-value less than 0.05 was taken as significant.

Results

Out of the total 797 subjects, 94.7% (755/797) were male, while 5.3% (42/797) were female. The mean age was 36.65 ± 13.6 years, ranging from 16 to 80 years. Additionally, 87.8% (700/797) of the subjects were from urban areas, and 12.2% (97/797) were from rural areas.

The organs involved in firearm injury are elaborated on in Table 1. Additionally, 20.3% (162/797) of the subjects sustained a single injury, while 79.7% (635/797) had multiple injuries. Among the 797 subjects, 2.4% (19/797) were cases of suicide. Furthermore, 94.2% (751/797) experienced immediate deaths, whereas 5.8% (46/797) had delayed deaths. In the case of firearm ranges, the contact range was 20.5% (163), the close range was 14.7 % (117), the Near shot range was 35.1% (280), and the distant shot was 29.7% (237). Figure 1 shows the education level of the cases, of which the majority, 45.4% (362), had no formal education, while very few, 10% (30), were graduates and above. Table 2 shows different parameters of a pattern of injury, including firearm ranges, Causes of incident, Fatal period, and type of injury. Figure 2 is a pie chart showing different firearm ranges with the near shot range at maximum, ie, 35.1%. Table 3 is an association of education levels, gender, and area of living with the causes of incidents. Only education is significantly associated with the causes of incidents, with a p-value less than 0.05. The lower the education level, the greater is its association with homicidal and other causes of firearm deaths.

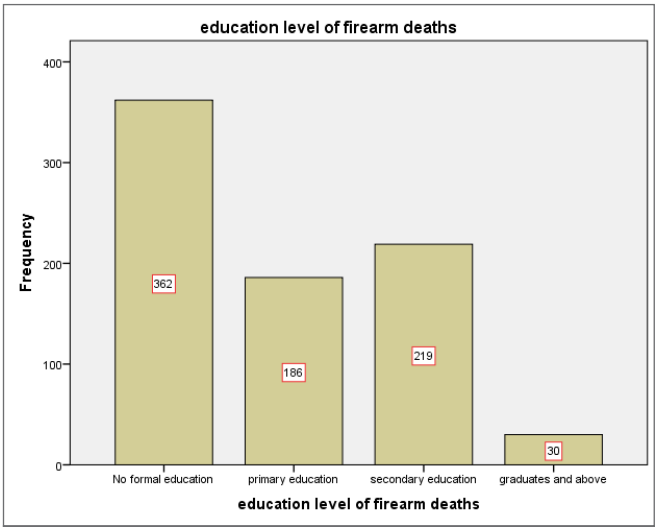

Fig.1: Education level

Organs injured	Frequency (n=797)	Percentages (%)
Lungs	435	54.6
Heart	287	36.0
Brain	265	33.2
Liver	232	29.1
Gut	168	21.1
Great vessels	97	12.2
Limbs	69	8.7
Spleen	23	2.9
Head and Neck	23	2.9
Pancreas	14	1.8

Table 1: Organs involved in firearm deaths

S. no.	Variables	Frequency	Percentages
1	**Firearm ranges**		
	a. Contact	163	20.5
	b. Close range (5-8cm)	117	14.7
	c. Near Shot range (up to 0cm)	280	35.1
	d. Distant shot (>90cm)	237	29.7
2	**Causes of incident**		
	a. Accidental	53	6.6
	b. Homicidal	725	91
	c. Suicidal	19	2.4
3	**Fatal period**		
	a. Immediate	751	94.2
	b. Delayed	46	5.8
4	**Type of injury**		
	a. Single	162	20.3
	b. Multiple	635	79.7

Table 2: Firearm ranges, Causes of incident, Fatal period and type of injury (Pattern)

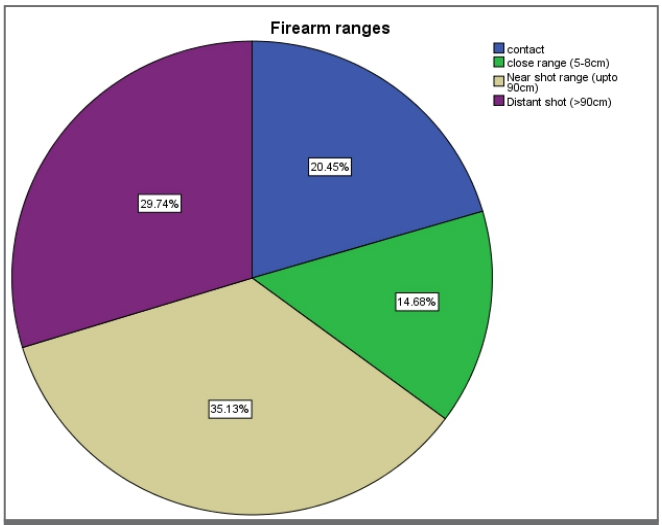

Fig.2: Firearm Ranges in subjects

Table 3: Association of demographic variables with causes of death

S. No	Variable*variable	frequency	Chi-square P value
1	• Male • Female	Accidental: Homicidal: Suicidal 53 : 685 : 17 0 : 40 : 02	0.12
2	• Urban • rural	Accidental: Homicidal: Suicidal 53 : 630 : 17 0 : 95 : 02	0.18
3	• No formal education: • Primary education: • Secondary education. • Graduate and above	Accidental: Homicidal: Suicidal 12 : 339 : 11 16 : 164 : 06 25 : 193 : 01 0 : 29 : 01	0.001

Discussion

The findings of this study on firearm injuries in District Peshawar provide critical insights into the demographic characteristics, injury patterns, and outcomes associated with such incidents. The results reflect trends that are consistent with and diverge from other research on firearm-related trauma, highlighting both common patterns and unique regional differences.

The predominance of male victims (94.7%) mirrors the overwhelming male dominance in firearm injury statistics reported in contemporary research. Studies indicate that over 90% of firearm injury patients are male, a pattern attributed to higher participation in risk-taking behaviors, occupational exposure, and involvement in interpersonal violence[1,2]. For instance, Holland et al.[3] documented similar male predominance in U.S. emergency department surveillance data, with trends persisting over multiple years.

The mean age of 36.65 years and concentration of cases among young adults (51.2% aged 16–30 years) correspond with recent epidemiologic findings. Peta et al.[4] and Koenig et al.[5] noted that firearm injuries are heavily concentrated in the late-teen to early-adulthood range, a group considered particularly vulnerable due to increased social exposure, gang activity, and interpersonal conflicts. The higher incidence of firearm injuries in urban areas (87.8%) compared to rural areas (12.2%) aligns with global patterns that show a concentration of firearm violence in urban environments. Urban areas, with their higher population density and socio-economic disparities, tend to have higher rates of violent crime and firearm-related incidents [6,7]

Urban predominance in firearm injuries (87.8% in this study) is consistent with analyses showing higher firearm injury rates in metropolitan centers. Morrison et al.[8] and Johnson et al.[9] have described socio-cultural and demographic factors underlying urban firearm violence, while Adams et al.[10] reported a persistent concentration of firearm-related morbidity and mortality in densely populated areas.

The finding that 79.7% of subjects sustained multiple injuries is consistent with the high-energy nature of firearm trauma. Firearm injuries often involve multiple body parts due to the impact of bullets, which can result in complex trauma requiring advanced medical intervention [11, 12] Documented frequent involvement of vital thoracic and cranial structures, as seen here with lung (54.6%), heart (36.0%), and brain (33.2%) injuries. Such patterns carry high mortality risk, as confirmed by recent findings on organ-specific firearm trauma outcomes.

The striking immediate mortality rate (94.2%) parallels high lethality rates documented in recent firearm injury outcome studies[13,14]. Rapid exsanguination, CNS disruption, and cardiac compromise remain leading causes of pre-hospital and emergency department death.

The high rate of immediate deaths (94.2%) among the subjects underscores the severe impact of firearm injuries. This finding is in line with other studies showing that firearm injuries frequently result in rapid fatalities due to the critical nature of the injuries [14, 15.] The lower rate of suicides (2.4%) in this study contrasts with findings from other regions where suicides constitute a significant proportion of firearm-related deaths. For instance, a study by Johnson[16.] found that suicides account for a substantial percentage of firearm deaths in the United States, indicating regional differences that may reflect varying patterns of firearm access and mental health issues.

Overall, these findings affirm that while Peshawar's firearm injury profile shares global patterns—male predominance, concentration in younger age groups, urban clustering, and high lethality—there are distinct regional nuances, particularly in the mechanisms of injury and the low suicide proportion. These insights underscore the importance of context-specific prevention strategies, integrating both public health and law enforcement interventions.

The patterns identified in this study have important implications for public health interventions. The high incidence of firearm injuries in young males and urban areas suggests a need for targeted prevention strategies focusing on violence reduction, improved trauma care, and addressing socio-economic factors that contribute to firearm violence. Additionally, the severe nature of the injuries observed highlights the importance of trauma preparedness and response systems in managing firearm-related emergencies effectively.

Some of the limitations of the study were its cross-sectional design, which cannot be generalized, and a single setup study, which includes referral cases as well.

Conclusion

This study provides valuable insights into the patterns and outcomes of firearm injuries in District Peshawar. The findings align with some global trends while highlighting unique regional differences. A low level of education is significantly associated with firearm deaths.

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2. Naheed Siddiqui – Methodology, Data Analysis, Supervision
3. Rabia Khan – Data Collection, Literature Review, Draft Writing
4. Anwar Ali – Statistical Analysis, Data Interpretation
5. Muhammad Ishaq – Data Collection, Materials Preparation
6. Ihsan Ullah – Critical Review, Final Approval of Manuscript