Cause-Specific Mortality Pattern Variation of Unnatural Deaths; A Comparative Demographic Study in the settings of South Punjab

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ABSTRACT

Objective: To examine the demographic profile of unnatural deaths, in order to explore variation over time, in cause-specific mortality patterns of unnatural deaths, in South Punjab. **Study Design:** Cross sectional (descriptive) study. **Settings:** Department of Forensic Medicine & Toxicology, Sheikh Zayed Medical College, Rahim Yar Khan Pakistan. **Duration:** Six years, (1st January, 2015 to 31st December, 2017) and (1st January, 2021 to 31st December, 2023). **Methods:** Non-probability convenient sampling technique. Data from 2015 to 2017 taken as group A, while 2021 to 2023, as group B. Information collected from police papers, hospital record & autopsy reports entered on pre-designed performa. Statistical analysis is done by SPSS version 26. **Results:** Male victims were 79.71% in group A and, 72.57% in B as compared to 20.29% and 27.43% females respectively in group A and B. The age range of 21–30 year was common among victims in both groups. Accidents ratios decrease from 26.09% to 8.85% in recent times. The incidence of deaths due to sharp weapon risen to 12.39% as compared to 2.17% while the blunt weapon cases increased (17.70%) from (2.90%). **Conclusion:** Males are commonest victims of unnatural deaths across both groups but with a noticeable rise in ratio of females in B. Prevalent manner of death is homicidal. Common cause of death is firearm in group A, shifted to sharp edged weapons in B. A raise in sharp & blunt weapon cases needs coining preventive strategies.

Keywords: *Autopsy, Unnatural death, Manner of death, Cause of death, Sharp weapon, Blunt weapon, RTA, Mental health.*

INTRODUCTION

Every soul will taste death.[1] Death, being the event to mark the irreversible end of a person's life, serves an important function in public health surveillance.[2] Unnatural death is an intentional or unintentional death due to external causes such as accidents, suicides, homicides and other injuries. This can often be violent, mutilating or destructive.[3] In an instantaneous, suspicious or unnatural death, medicolegal autopsy of the deceased becomes indispensable. Medicolegal autopsies are performed worldwide in accordance with the laws of the land for the furthering of justice. In Pakistan, these autopsies are carried out on police inquest with chief aim to reveal the cause of death and to decide if the cause of death is in accordance with the hypothesized manner of death. Such deaths have a notable impact on any community due to their unanticipated and often preventable nature. Such deaths can lead to premature loss of life, emotional trauma for families and communities, and economic costs associated with medical care and lost productivity. Some unnatural deaths remain undetermined where the cause of death could not be ascertained even by complete autopsy, histological and toxicological examination. Unnatural death is one of the indicators of the level of social & mental health and the pattern of unnatural deaths reflects the prevailing social set up and mental health status of that region. Understanding the causes and patterns of unnatural deaths is crucial for public health officials and policy makers to develop effective preventive strategies.

Over the past few decades, there has been a noticeable rise in crime and a corresponding rise in cases of unnatural deaths. As per legal procedure of our country, all medico-legal deaths require investigation by the police/ magistrate and final resolution by the courts.[4] By studying unnatural deaths, public health authorities can work towards reducing the burden of preventable deaths, improving the overall health and mental well-being of communities, and promoting safer environment. Identifying factors associated with these deaths in a potentially vulnerable and underserved population may illustrate groups of individuals who are at risk or have a greater likelihood of death from unnatural causes.[5]

Understanding the specific causes of unnatural deaths can help in developing targeted prevention strategies. Knowledge of the demographic factors associated with unnatural deaths can help in allocating resources more effectively. Findings from studies on cause-mortality and demographic factors can inform the development of policies aimed at reducing unnatural deaths. Studying cause-mortality and demographic factors in unnatural deaths is important for public health surveillance. It helps in monitoring trends over time and identifying emerging issues that may require attention. It can help in ensuring that interventions are reaching all segments of the population, especially those that are most vulnerable.

In the context of South Punjab, Pakistan, studying cause mortality and demographic factors in unnatural deaths takes a particular significance due to the unique characteristics of the region. The higher incidence of unnatural deaths among males in South Punjab, as shown in previous studies in the same settings[6] could be attributed to social factors such as occupational hazards, involvement in risky behaviours, or cultural practices that place them at higher risk. The higher prevalence of unnatural deaths among younger individuals could be linked to factors such as lack of awareness about safety measures, engagement in risk-taking behaviours, or inadequate access to healthcare services. Road traffic accidents (RTAs) as a significant cause of death may reflect issues such as inadequate road infrastructure, lack of enforcement of traffic regulations, or insufficient emergency medical services. The high prevalence of homicide as a manner of unnatural death may indicate underlying issues related to crime, violence or social unrest in the region. It could also reflect challenges in law enforcement and access to justice.

Incorporating these specific aspects of the demographic profile and causes of unnatural deaths in South Punjab will provide valuable insights for developing targeted interventions and policies to address the unique challenges faced by the population in this region.

The rationale of this study is the analysis of cause-specific mortality in South Punjab, over stipulated time zones to identify trends over time, in different causes of death and assess any remarkable change for interventions and devising ways to reduce mortality rates from specific causes.

METHODS

This is a cross sectional (descriptive) study. After getting approval from the institution's ERC/ERB vide letter No: 55/IRB/SZMC/SZH, dated 29-03-2024, it was conducted in Department of Forensic Medicine &Toxicology ,Sheikh Zayed Medical College ,Rahim Yar Khan; a district of South Punjab, Pakistan.

The data of medicolegal autopsies conducted by department of Forensic Medicine & Toxicology SZMC/H, RYK is utilized. The dead bodies brought by police, for medicolegal autopsies after completing all legal prerequisites; were initially examined externally followed by dissection. Samples collected where necessary and dispatched to Punjab Forensic Science Agency (PFSA) and final inference was phrased on arrival of the reports from concerned corners. The final reports also included; number and nature of injuries, causative weapon, cause of death, duration between injury and death, as well as between death and autopsy.

Non-probability convenient sampling technique was used for collection of data. The sample size for this study was determined using epi info software (n= $p(1-p)z^2/e^2$). The primary outcome measure / frequency of the variables of interest i.e. gender is 20.1% with reference to the relevant published study.[6]Therefore, a minimum sample size of 251 subjects was required to detect a significant result with the confidence level of 95%and 5% margin of error. The sample size was further subdivided into two groups i.e. three year each. To account for statistical test application, we doubled the sample size, resulting in a final sample size of 502.Group A, 276 and group B, 226.

Autopsy cases included, were belonged to the police stations of Rahim Yar Khan, lied within the legal jurisdiction of Forensic Medicine Department, SZMC, RYK; reported between1st January, 2015 to 31st Dec, 2017 and 1st January, 2021 to 31st Dec, 2023 having complete autopsy data and police record.

The cases labelled as natural deaths on death certificates by the doctors, deaths during medical interventions (hospital deaths), death in police encounters and custodial deaths, and extremely putrefied / exhumed bodies were excluded.

The record of medicolegal autopsies conducted during the stipulated periods, was examined in detail. The

information collected from police papers, hospital record & autopsy reports were entered on pre-designed performa and subsequently analysed.

The data from 1st Jan, 2015 to 31st Dec, 2017 were labelled as group A; whereas the medico-legal autopsy conducted from 1st Jan, 2021 to 31st Dec, 2023 were labelled as group B. Age, gender, cause & manner of death were the variables of study.

RESULTS

The data entered and analysed by using Statistical Package for Social Science (SPSS) version 26.0 using data visualization methods like Histogram, Pie chart, Bar chart and Cluster Bar chart, Descriptive Statistics and Chi - Square test are applied. P≤0.05 is considered as statistically significant. The Normality of the data is checked by Shapiro - Wilk test.

The Quantitative variables are presented in terms of Mean & Standard deviation while the Qualitative variables presented in terms of Graphs, Charts, frequency distribution and percentage.

Table 1: Demographic profile of both groups (n1=276, n2=226)

Demographics Characteristics	Group (A)	Group (B)
No. of Cases	276	226
Gender	Male= 220 Female = 56	Male = 164 Female= 62
Mean Age	3.83±1.721 Year	3.84 ± 1.552 Year

Table 1 shows the summarized comparison of the demographic characteristics of both study groups, A and B. The demographic characteristics depict almost comparable mean in group A, but slightly more variation in demographic characteristics of group B.

Table 2: Tests of normality of both groups (n1=276, n2=226)

Variables of Study	Shapiro –Wilk Test	
	Group A	Group B
Age	0.92	0.93
Gender	0.49	0.55
Manner of Death	0.77	0.56
Cause of Death	0.894	0.92

Table 2 shows the P-value of Shapiro - Wilk test for both group A & B which is less than 0.05 (P < 0.05) and shows that the data was not normally distributed in both groups so that non- parametric tests on this data will be applied.
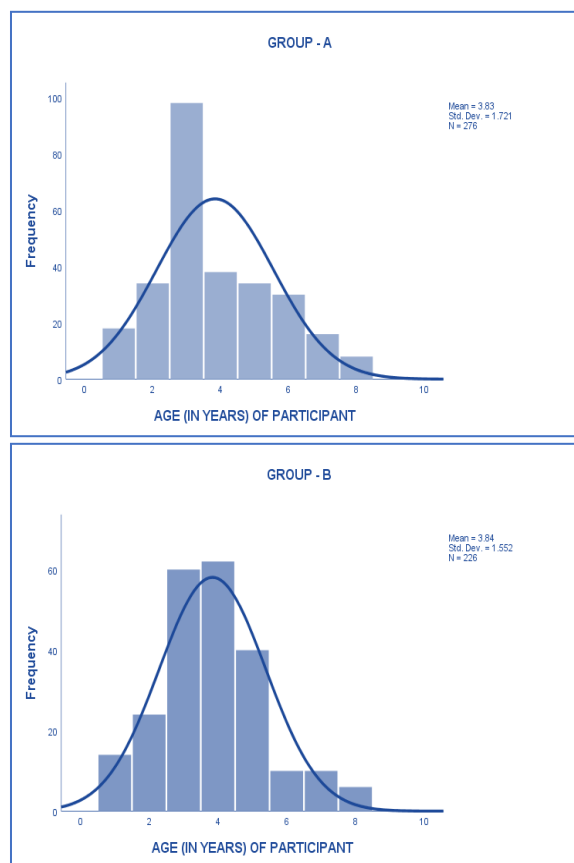
Figure 1: Histogram of both groups for age

Figure 1 displayed Histogram of both groups for age.276 cases in study group (A) (mean= 3.83 ± 1.721 years) and 226 cases in study group (B) (mean= 3.84 ± 1.552 years). It shows normal distribution bell shape curve in both groups, which can be used to provide an understanding of different statistical data pertaining to the given population.

Table 3: Frequency Distribution of Age (In Years) of both groups (n1=276, n2=226)

Age Range Years	Group A				Group B			
	2015	2016	2017	Total Group A	2021	2022	2023	Total Group B
0-10	02	08	08	18(6.5%)	10	02	04	16(7.07%)
11-20	12	10	12	34(12.3%)	10	02	14	26(11.50)
21-30	34	32	32	98(35.55)	20	14	28	62(27.43)
31-40	18	04	16	38(13.7%)	18	14	18	50(22.12)
41-50	10	10	14	34(12.35)	10	14	14	38(16.18)
51-60	12	08	10	30(10.8)	04	12	04	20(8.84%)
61-70	02	08	06	16(5.7%)	06	02	06	14(6.19%)
71& >	02	NIL	06	08(2.8%)	Nil	Nil	Nil	Nil (0%)
Total	92	80	104	276(100)	78	60	88	226(100)

The table; 3 shows the frequency of age distribution (in years) in both groups for the demographic characteristics. The age range in years (21-30) shows more responses as compare to other age ranges across both groups. Also, this table shows the average of age range in years (21-30)

in group – A is 35.5% which is more than the same age range in group – B i.e.27.43%.

Table 4: Manner of death among both groups (n1=276, n2=226)

| Manner of Death	Group	No. of Cases	Mean ± S.D
	A	276	2.21 ±0.831
	B	226	1.42 ±1.244

The analysis of manner of death, across the groups shows that the mean of group – A is slightly more as compared to group – B. The S.D of group – A is less than group – B which depicts less variation in manners of death in group – A. (Table 4)

Table 5: Manner & Causes of Death among Both Groups (n1=276, n2=226)

Group	Manner of Death				Causes of Death						
	Homicidal	Suicidal	Accidental	Undetermined	Sharp Weapon	Blunt Weapon	Traffic Accidents	Asphyxial Death	Firearm	Drowning	Undetermined
A	46%	11%	20%	46%	08%	06%	72%	38%	72%	24%	42%
B	78%	12%	09%	01%	28%	40%	20%	26%	62%	18%	10%

Table 5 displayed the relative contributions of manner and causes death in both groups. The group A shows homicidal death rate of 45.65%, as compared to the group - B i.e. 75.22%. Group - A shows that accidents death rate is 26.09% and the group – B shows 8.85%. It means group – B shows very remarkable decrease in accidental death rate. It also depicts that in group B there is a noticeable increase to the sharp weapon incidence that is 12.39% from 2.17% in group A likewise rise in incidence of blunt weapon in group-B is 17.70% as compared to group-A which is 2.90%.

Figure 2: Cluster bar chart between Gender & Manner of Death among the victims
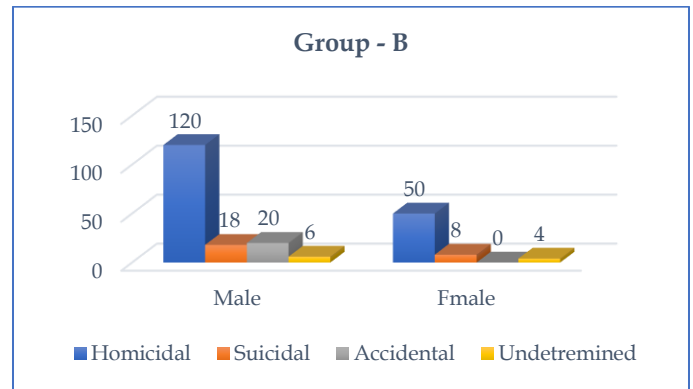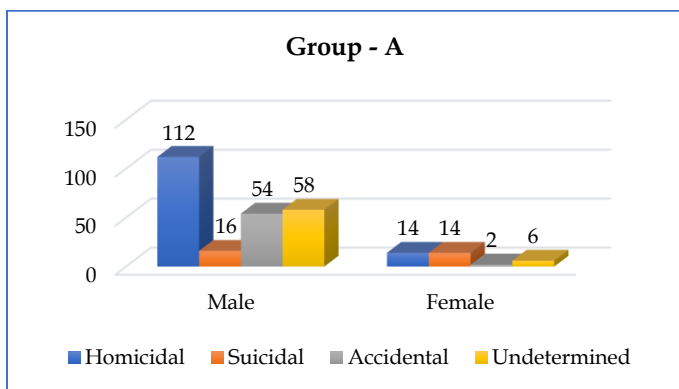
The figure 1.2 the cluster bar charts, displaying the relationship between gender & manner of death of both groups. Where it depicts the overall more ratio of male involvement in unnatural deaths as compared to female in both groups it also shows noticeable rise in the homicidal death ratio of female in group B to 23.15% from 10.38% as seen in group A.

Table6: Relation between Gender & Cause of Death (n1=276, n2=226)

Group	Cause of Death								Total	
	Traffic Accidents		Asphyxial deaths		Firearm cases		Un-determined			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
A	56%	16%	30%	08%	62%	10%	32%	10%	79.71%	20.29%
B	12%	08%	24%	02%	48%	14%	08%	02%	72.57%	27.43%

The Table 6 displayed the relative relationship between gender & cause of death of both groups and shows that there are 79.71 % male and 20.29% female cases in group A as compared to 72.57% male and 27.43% female cases are presented in group B. This shows the increase in the ratio of female gender involvement in unnatural deaths in group B.

Both groups show firearm as leading cause of death in male gender while in female there is a minor shift of highest cause from accidents in group A as 7.14% to the firearm in group B as 8.38% cases. It also shows that in female gender there is no very specific high incidence of any cause rather there is a mixed trend (heterogeneous) of all cases but in cases of male the firearm and sharp-edged weapons are leading cause.

DISCUSSION

Interpretation of the results is mainly dependant on the causes contributing to the overall mortality rate in South Punjab, requires consideration of this region's unique demographics and health infrastructure. Gender dynamics in a patriarchal culture, like Pakistan, intensify the socio-economic impact, given the reliance on male income earners. The powerful alliance between patriarchy and capitalism is widely known for concentrating wealth and power predominantly in the hands of men. South Punjab's demographic profile, especially the district under study includes a higher proportion of younger individuals and a male predominance, influences the pattern of causes contributing to mortality.

Table 1.1 shows the encapsulated comparison of the demographic characteristics of both study groups, A and B. The group B has slightly higher standard deviation values indicate B is more diverse as compared of group A

The prevalence of male victims is clearly shown in the results of group A in figure 1.2. This finding is similar to the finding of the study done in India[7] can be attributed to similar dynamics and socio-economic conditions of most of the population in both countries. This male prominence death pattern can be attributed to the fact that males exposed more to the external surroundings and lead more physically active life than the females. Male accepts more difficult tasks and may involve in violent acts as a part of their persona.

At the same time the result of group B also shows in Fig: 1.2, a leap up trend of female victims in recent years. This trend can be related to more involvement of female in outdoor activities in recent times. As per national report on the status of women in Pakistan, 2023 the overall labour force participation rate (LFPR) of women in Pakistan at 21% with inter provincial variations. The highest participation of women was recorded in Punjab i.e. 31% higher than other provinces, similar results were noted for young workers with large gender deviations. Recent media and academic reports also project rising levels of girls' violence and a narrowing gender gap but specifically, there is no systematic change in the gender gap for homicide, aggravated assault, nor have the violent crime index.[8]

The age distribution of both groups portrays in table 1.3. The age range of 21-30 years has more responses compared to other age ranges across both groups. The same pattern of age of victims of unnatural deaths is also noted in other studies conducted in different province of India[7] and Pakistan.[9] Additionally, that group A has a higher proportion of individuals aged 21-30 as compared to group B. Relatively younger individuals may be more

susceptible to violence and accidents. Injuries and violence account for a sizeable proportion of the global burden of disease in adolescents, especially among low-income & middle-income countries.[10]

The ubiquitous manner of death is homicidal across both groups A and B can be seen in figure 1.3 but the B group shows a clear decline in accidental manner of death which is quite a noticeable finding and can be the initiation point for new research for the factors leading to this data and numbers. Homicide, as a form of interpersonal violence, is considered one of the most severe crimes against individuals. It encompasses various forms of violent deaths and is increasingly becoming a significant threat to modern society. The group A shows homicidal death rate of 45.65% as compared to the group B i.e.75.22%. This jump up trend found in this study is alarming, found not only in Punjab, Pakistan but also noticed globally.[11]

The most widespread cause of death in group A (Figure 1.4) is firearm and transportation injuries, followed by asphyxia. Group B shows quite a different trend, with very less transportation accidents and sharp edged weapons shows up as the leading cause of death followed by blunt weapon and firearms .The decrease in accidental death rate from 26.09% in group A to 8.85% in group B is indeed a significant finding, indicating a positive change but, the increase in sharp weapon incidence from 2.17% in group A to 12.39% in group B, as well as the rise in blunt weapon incidence from 2.90% in group A to 17.70% in group B, are noteworthy changes that could suggest shifts in societal factors, aggression and violence patterns in the study population. Studies conducted in India also have turned up that sharp weapons are the second most frequent cause of homicidal deaths.[12]

The figure 1.5 the cluster bar chart, displaying the relationship between gender & manner of death of both groups. The homicidal cases as seen in both groups indicates that homicidal cases involving females are much less in number than males. This is like several other studies in Pakistan indicating that this may be significant.[13,14,15] The drift rises in female homicidal cases, in group B as compared to group A is also remarkable and can be the trigger for many new researches. Crimes against women are increasing at an alarming pace in India and the male-female ratio is also declining, the findings of our study are in line with study done in India.[16]

The relative relationship between gender & cause of death of both groups (Figure1.6) shows firearm as leading cause of death in males in accordance with other studies[17] where male dominance in firearm deaths in up to 80 percent while in group B there is a minor shift in leading cause of death in females, by accidents in group A to the firearms in group B. It also shows that in female gender,

there is heterogeneous pattern of cause of death in contrast to the study done by Mahadev.[7] The shift from accidents to firearm deaths in females between the two groups is notable. It's also interesting to see the contrast in the patterns of cause-specific mortality between males and females, especially when compared to other studies. Many studies have shown that low socioeconomic status/demographic factors are directly associated with road traffic accidents.[18]

Figure 1.7 shows the weighting up of cause of death between two groups and shows the swing of different causes of death between both groups. It is showing great rise in the deaths caused by blunt and sharp-edged weapons in group B. Poverty can lead to living in unsafe environments, inadequate access to healthcare services, and increased exposure to risk factors such as substance abuse and violence. The high level of mortality can largely be attributed to the effects of deprivation and poverty.[19] Education levels have also repercussion on mortality rates, as higher education is often associated with better health knowledge and behaviour. Studies noted that schooling years had a notable and congruous effect on all-cause mortality risks and the shielding effect of education persisted for both male and females, across all age groups.[20]

CONCLUSION

The study will contribute in the understanding of new emerging trends of cause-mortality of unnatural deaths in this district of south Punjab. Comprehending the contribution of different causes to overall mortality is essential for developing targeted interventions and policies to address the specific challenges posed by each cause. By addressing the underlying factors participating to each cause of mortality, public health officials and policymakers can work towards reducing the mortality rate and improving the health and well-being of the population in south Punjab.

LIMITATIONS

The study is subject specific and has potential impacts on the relevant fields. One limitation of this study is that it could not determine the causal relationship between variables and causes of death. The utilized data is from south Punjab only. Although SZMC/H, RYK is the largest autopsy centre of region, but has its legally defined jurisdiction and thus results may not be generalized to South Punjab. Some categorical variables had to be collapsed due to small number of cases, limiting the level of detail of results.

SUGGESTIONS / RECOMMENDATIONS

Addressing socioeconomic disparities through social welfare programs and improving educational

opportunities can positively impact mortality rates. Cultural norms and behaviours in South Punjab; such as, conflict resolution methods, violence prevention programs and healthcare-seeking behaviours, can also play effective role to reduce the mortality rates. Interventions should consider cultural sensitivities and preferences to be effective improving access to healthcare, especially emergency services, can help reduce mortality rates. There is also need to strengthen mental health services in South Punjab.

CONFLICT OF INTEREST / DISCLOSURE

None.

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