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# Pattern of Unnatural Deaths Among Medicolegal Autopsy Cases at The Department of Forensic Medicine, Dhaka Medical College: A Retrospective Study

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## ABSTRACT

**Background:** Unnatural deaths reflect the social and mental health of a population, but recent autopsy-based data from Dhaka are scarce. **Objectives:** To describe the pattern of unnatural deaths among medicolegal autopsy cases at the Department of Forensic Medicine, Dhaka Medical College, in 2020. **Methods & Materials:** This retrospective cross-sectional study included 116 autopsy cases examined from January to July 2020. Socio-demographic characteristics, manner and cause of death and post-mortem findings were analysed using descriptive statistics and chi-square tests. **Results:** Males accounted for 64.7% of victims (male-to-female ratio 1.8:1); the mean age was 33.5 ± 15.8 years and 61.7% were aged 18–44 years. The manner of death was accidental in 32.8%, suicidal in 24.1% and homicidal in 10.3%, and was not stated in 32.8%. Hanging (24.1%), road traffic accidents (19.0%), poisoning (13.8%) and burns (11.2%) were the commonest causes; organophosphorus compounds caused 62.5% of poisonings. Cause ($p = 0.016$) and manner ($p = 0.025$) of death differed by sex, with females predominating in poisoning (62.5%). Manner of death ($p < 0.001$) and cause of death ($p = 0.042$; exact $p = 0.054$) were associated with age group. **Conclusion:** Unnatural deaths mainly affected young adults, and hanging, road traffic accidents and poisoning caused most deaths. Standardised manner-of-death certification, suicide prevention among young people, pesticide control and road safety measures are needed.

***Keywords:*** *Unnatural death; Autopsy; Hanging; Poisoning; Dhaka*

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## INTRODUCTION

Injuries, which result from road traffic crashes, falls, drowning, burns, poisoning and acts of violence against oneself or others, take the lives of an estimated 4.4 million people worldwide each year and account for nearly 8% of all deaths [1]. Road traffic crashes alone cause about 1.19 million deaths annually, with 28% occurring in the WHO South-East Asia Region [2], and more than 700 000 people died by suicide in 2019, about one in every 100 deaths [3]. The frequency and pattern of such unnatural deaths are therefore widely regarded as indicators of the social and mental health of a population and of the safety of its living environment. In Bangladesh, a national survey estimated that more than 108 000 people die from injuries each year, with suicide, road traffic crashes, drowning and falls the leading causes [4], and the most recent national survey reported 98 422 injury deaths annually, equivalent to 268 deaths per day and nearly 11% of all deaths [5]. Pesticide self-poisoning, which is readily accessible in agricultural settings, has been estimated to account for about 30% of suicides worldwide [6]. Every unnatural death in Bangladesh is subject to medicolegal investigation, and autopsy findings recorded in the mortuary are the principal source of information on how, and in whom, such deaths occur. The Department of Forensic Medicine at Dhaka Medical College is one of the busiest medicolegal centres in the country and receives bodies referred by police stations across the capital. National household surveys describe the community burden of injury, but they cannot supply the forensic details, such as the manner and cause of death, the circumstances of the victim and whether the body was identified, that only autopsy-based series provide. Autopsy-based data from Dhaka are limited and dated, and the city has since changed considerably in population, traffic, urban living conditions and access to hazardous substances. The year 2020 was exceptional in addition, because the COVID-19 pandemic and the national lockdown altered movement, economic activity and psychological stress. Whether and how these changes were reflected in the pattern of unnatural deaths reaching the mortuary has not been documented in autopsy-based series. Up-to-date information on the age and sex distribution, the manner and cause of death, and the circumstances of the victims is essential for planning injury prevention, suicide prevention, road safety and the strengthening of death investigation. Therefore, this study aimed to describe the pattern of unnatural deaths among medicolegal autopsy cases at the Department of Forensic Medicine, Dhaka Medical College, from January to July 2020, in terms of age, sex, manner and cause of death, and to examine the association of these characteristics.

## METHODS & MATERIALS

This retrospective cross-sectional study was conducted at the Department of Forensic Medicine, Dhaka Medical College, Dhaka, Bangladesh, and included all medicolegal autopsy cases of unnatural death with post-mortem examinations performed from January to July 2020 (first case examined on 21 January and last on 30 July 2020); a total of 116 cases were studied. Data were extracted from the post-mortem records and the accompanying police inquest/requisition forms using a structured data sheet. The variables collected were post-mortem number and date, referring police station, age, sex, religion, whether the identity of the deceased was known, rigor mortis, cyanosis, decomposition, time from arrival at the morgue to post-mortem (hours), manner of death as written on the form (suicidal, homicidal, accidental or not stated), cause of death, and type of poison in poisoning cases. Age was recorded in years (months converted to years) and grouped as 0–12, 13–17, 18–29, 30–44, 45–59 and ≥60 years. The cause of death was classified from the opinion of the autopsy doctor into eleven groups: road traffic accident, railway accident, fall from height, hanging, strangulation, poisoning, burn, electrocution, other homicidal trauma, chest

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compression and other unspecified injury. Blank entries were treated as missing or not recorded, and no imputation was performed. Data were coded and entered in Microsoft Excel and analysed using IBM SPSS. Categorical variables were summarised as frequencies and percentages, and continuous variables as mean with standard deviation or median with interquartile range. Associations between categorical variables (age group, sex, manner of death and cause of death) were tested using the Pearson chi-square test, with the likelihood ratio and linear-by-linear association reported where appropriate; the mean age of males and females was compared using Welch's t-test. Because many cross-tabulations contained cells with expected counts below 5, a Monte Carlo exact test was used to check the robustness of the chi-square results. A p value of less than 0.05 was considered statistically significant.

## RESULTS

A total of 116 medicolegal autopsy cases of unnatural death, examined between 21 January and 30 July 2020 and referred by 30 police stations, were analysed. Age group was missing for one case and religion for three; all other variables used in the analyses were complete. Males accounted for 64.7% of victims (male-to-female ratio 1.8:1). Mean age was 33.5 years (SD 15.8; median 30, interquartile range 22.0–42.5; range 1.5–80 years). The 30–44 and 18–29 year groups together comprised 61.7% of cases, whereas children and adolescents up to 17 years made up 13.9% and persons aged 60 years or above 9.6%. Age was approximate or unclear on the form in 12 cases (10.4%). Most of the deceased were Muslim (94.7%), and 15 bodies (12.9%) were unidentified at autopsy (*Table I*).

**Table I**
Socio-demographic characteristics of the deceased (*n* = 116).

| Characteristic | Category | n | % |
|---|---|---|---|
| Age group (years) | 0–12 | 5 | 4.3 |
| | 13–17 | 11 | 9.6 |
| | 18–29 | 34 | 29.6 |
| | 30–44 | 37 | 32.2 |
| | 45–59 | 17 | 14.8 |
| | ≥60 | 11 | 9.6 |
| Sex | Male | 75 | 64.7 |
| | Female | 41 | 35.3 |
| Religion | Muslim | 107 | 94.7 |
| | Hindu | 5 | 4.4 |
| | Christian | 1 | 0.9 |
| Identity of the deceased | Known | 101 | 87.1 |
| | Unknown | 15 | 12.9 |

*Percentages for age group are based on 115 valid cases (1 missing) and for religion on 113 valid cases (3 missing).*

February recorded the highest number of cases (25; 21.6%) and May the lowest (7; 6.0%); January represents a partial month because data collection began on 21 January. Shahbag police station referred nearly one-third of all cases (29.3%), and the five leading stations together accounted for 62.9% (*Table II*).

**Table II**
Monthly distribution of cases and leading referring police stations (*n* = 116).

| Variable | n | % |
|---|---|---|
| Month of autopsy (2020) | | |
| January (from 21 January) | 9 | 7.8 |
| February | 25 | 21.6 |
| March | 18 | 15.5 |
| April | 20 | 17.2 |
| May | 7 | 6.0 |
| June | 18 | 15.5 |
| July | 19 | 16.4 |
| Referring police station | | |
| Shahbag | 34 | 29.3 |
| Badda | 16 | 13.8 |
| Dhaka Railway | 11 | 9.5 |
| Khilkhet | 7 | 6.0 |
| Hatirjheel | 5 | 4.3 |
| Other (25 stations) | 43 | 37.1 |

Accidental deaths and deaths with no stated manner were equally common (32.8% each), followed by suicidal (24.1%) and homicidal deaths (10.3%). Hanging was the single most frequent cause (24.1%), followed by road traffic accidents (19.0%), poisoning (13.8%) and burns (11.2%), which together accounted for 68.1% of all deaths; electrocution accounted for 8 deaths overall (6.9%). Among the 16 poisoning deaths, organophosphorus compounds were responsible for 10 (62.5%), aluminium phosphide for 3 (18.8%), zinc phosphide for 2 (12.5%) and calcium arsenate for 1 (6.3%). Of the 15 unidentified bodies, 8 were road traffic and 6 railway accident victims (36.4% and 66.7% of those causes, respectively) and 1 was an unspecified injury (*Table III*).

**Table III**
Manner of death as recorded on the form and cause of death ($n$ = 116).

| Manner of death / cause | n | % |
|---|---|---|
| Accidental | 38 | 32.8 |
| Road traffic accident | 22 | 19.0 |
| Railway accident | 9 | 7.8 |
| Fall from height | 6 | 5.2 |
| Electrocution | 1 | 0.9 |
| Suicidal | 28 | 24.1 |
| Hanging | 28 | 24.1 |
| Homicidal | 12 | 10.3 |
| Other homicidal trauma | 10 | 8.6 |
| Strangulation | 2 | 1.7 |
| Not stated on form | 38 | 32.8 |
| Poisoning | 16 | 13.8 |
| Burn | 13 | 11.2 |
| Electrocution | 7 | 6.0 |
| Chest compression | 1 | 0.9 |
| Other injury (not specified) | 1 | 0.9 |
| Total | 116 | 100.0 |

Rigor mortis was present in 98.2% of cases in which it was recorded, and only 2.6% of bodies were decomposed. The median interval from arrival at the morgue to autopsy was 0.5 hours, with 16.8% examined after one hour or more. Cyanosis was documented in only 45 cases (61.2% unrecorded) and was therefore not interpreted (*Table IV*).

**Table IV**
Selected post-mortem findings and time to autopsy.

| Finding | Value |
|---|---|
| Rigor mortis present, n/N (%) | 110/112 (98.2) |
| Cyanosis present, n/N (%) | 44/45 (97.8) |
| Body decomposed, n/N (%) | 3/116 (2.6) |
| Delay from arrival at morgue to autopsy (hours), n = 113 | Median 0.5 (IQR 0.25–0.75); mean 0.67 (SD 0.68); range 0–5.5 |
| Autopsy ≥1 hour after arrival, n/N (%) | 19/113 (16.8) |

*Rigor mortis was not recorded in 4 cases, cyanosis in 71 cases and time to autopsy in 3 cases.*

Sex was not significantly associated with age group (p = 0.577); males predominated in every group except 13–17 years, where females accounted for 54.5% of cases. Mean age was 35.2 years (SD 16.3) in males and 30.3 years (SD 14.6) in females (Welch t-test, p = 0.101). Sex was significantly associated with manner of death (p = 0.025): males predominated among homicidal (83.3%) and accidental (78.9%) deaths, whereas suicidal deaths were equally divided between the sexes (*Table V*).

**Table V**
Distribution of sex by age group and by manner of death.

| Variable | Male n (%) | Female n (%) | Total n |
|---|---|---|---|
| Age group (years) | | | |
| 0–12 | 4 (80.0) | 1 (20.0) | 5 |
| 13–17 | 5 (45.5) | 6 (54.5) | 11 |
| 18–29 | 21 (61.8) | 13 (38.2) | 34 |
| 30–44 | 24 (64.9) | 13 (35.1) | 37 |
| 45–59 | 11 (64.7) | 6 (35.3) | 17 |
| ≥60 | 9 (81.8) | 2 (18.2) | 11 |
| Subtotal | 74 (64.3) | 41 (35.7) | 115 |
| Manner of death | | | |
| Suicidal | 14 (50.0) | 14 (50.0) | 28 |
| Homicidal | 10 (83.3) | 2 (16.7) | 12 |
| Accidental | 30 (78.9) | 8 (21.1) | 38 |
| Not stated on form | 21 (55.3) | 17 (44.7) | 38 |
| Total | 75 (64.7) | 41 (35.3) | 116 |

*Row percentages. Age group × sex: $\chi^2 = 3.813$, $df = 5$, $p = 0.577$ (4 cells [33.3%] with expected count < 5; minimum 1.78); linear-by-linear association $p = 0.300$. Manner × sex: $\chi^2 = 9.327$, $df = 3$, $p = 0.025$ (1 cell [12.5%] with expected count < 5; minimum 4.24).*

Cause of death differed significantly by sex (p = 0.016). Males accounted for all deaths from falls and for most deaths from other homicidal trauma (90.0%), railway accidents (88.9%), electrocution (87.5%) and road traffic accidents (72.7%). In contrast, females formed the majority of poisoning deaths (62.5%) and slightly over half of burn deaths (53.8%). Hanging was equally distributed between the sexes. Because more than half of the cells had small expected counts, interpret this result with caution (*Table VI*).

**Table VI**
Cause of death by sex (*n* = 116).

| Cause of death | Male n (%) | Female n (%) | Total n |
|---|---|---|---|
| Road traffic accident | 16 (72.7) | 6 (27.3) | 22 |
| Railway accident | 8 (88.9) | 1 (11.1) | 9 |
| Fall from height | 6 (100.0) | 0 (0.0) | 6 |
| Hanging | 14 (50.0) | 14 (50.0) | 28 |
| Strangulation | 1 (50.0) | 1 (50.0) | 2 |
| Poisoning | 6 (37.5) | 10 (62.5) | 16 |
| Burn | 6 (46.2) | 7 (53.8) | 13 |
| Electrocution | 7 (87.5) | 1 (12.5) | 8 |
| Other homicidal trauma | 9 (90.0) | 1 (10.0) | 10 |
| Chest compression | 1 (100.0) | 0 (0.0) | 1 |
| Other injury (not specified) | 1 (100.0) | 0 (0.0) | 1 |
| Total | 75 (64.7) | 41 (35.3) | 116 |

*Row percentages. $\chi^2 = 21.881$, df = 10, p = 0.016; 12 cells (54.5%) with expected count < 5 (minimum 0.35).*

Manner of death was significantly associated with age group (p < 0.001). Suicidal deaths were concentrated in younger persons, with 67.9% occurring before 30 years of age, whereas 51.4% of accidental deaths occurred at 45 years or above. Homicidal deaths were most frequent at 30–44 years (41.7%), as were deaths with no stated manner (42.1%). As two-thirds of the cells had small expected counts, the result should be interpreted cautiously (*Table VII*).

**Table VII**
Manner of death by age group (*n* = 115).

| Manner of death | 0–12 | 13–17 | 18–29 | 30–44 | 45–59 | ≥60 | Total |
|---|---|---|---|---|---|---|---|
| Suicidal | 1 (3.6) | 6 (21.4) | 12 (42.9) | 7 (25.0) | 1 (3.6) | 1 (3.6) | 28 |
| Homicidal | 0 (0.0) | 0 (0.0) | 2 (16.7) | 5 (41.7) | 3 (25.0) | 2 (16.7) | 12 |
| Accidental | 0 (0.0) | 2 (5.4) | 7 (18.9) | 9 (24.3) | 11 (29.7) | 8 (21.6) | 37 |
| Not stated on form | 4 (10.5) | 3 (7.9) | 13 (34.2) | 16 (42.1) | 2 (5.3) | 0 (0.0) | 38 |
| Total | 5 (4.3) | 11 (9.6) | 34 (29.6) | 37 (32.2) | 17 (14.8) | 11 (9.6) | 115 |

*Values are n (row %). $\chi^2 = 40.347$, df = 15, p < 0.001; 16 cells (66.7%) with expected count < 5 (minimum 0.52).*

Cause of death was associated with age group (p = 0.042), but because 92.4% of cells had expected counts below 5, the chi-square approximation is unreliable; a Monte Carlo exact test gave p = 0.054, so this association should be regarded as borderline. Road traffic accidents occurred predominantly in older victims (13 of 22; 59.1% aged 45 years or above; none below 18 years). Hanging was the leading cause at 13–29 years (18 of 28 hangings; 64.3%), poisoning and burns were most frequent at 18–44 years (12 of 16 [75.0%] and 10 of 13 [76.9%], respectively), and 5 of 8 electrocution deaths (62.5%) occurred at 18–29 years (*Table VIII*).

**Table VIII**
Cause of death by age group (*n* = 115).

| Cause of death | 0–12 | 13–17 | 18–29 | 30–44 | 45–59 | ≥60 | Total |
|---|---|---|---|---|---|---|---|
| Road traffic accident | 0 | 0 | 5 | 4 | 7 | 6 | 22 |
| Railway accident | 0 | 1 | 1 | 2 | 3 | 2 | 9 |
| Fall from height | 0 | 1 | 1 | 2 | 1 | 0 | 5 |
| Hanging | 1 | 6 | 12 | 7 | 1 | 1 | 28 |
| Strangulation | 0 | 0 | 1 | 0 | 0 | 1 | 2 |
| Poisoning | 1 | 2 | 6 | 6 | 1 | 0 | 16 |
| Burn | 2 | 0 | 2 | 8 | 1 | 0 | 13 |
| Electrocution | 1 | 1 | 5 | 1 | 0 | 0 | 8 |
| Other homicidal trauma | 0 | 0 | 1 | 5 | 3 | 1 | 10 |
| Chest compression | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Other injury (not specified) | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Total | 5 | 11 | 34 | 37 | 17 | 11 | 115 |

*Values are n. $\chi^2 = 68.461$, df = 50, p = 0.042; 61 cells (92.4%) with expected count < 5 (minimum 0.04).*

## DISCUSSION

This retrospective study describes 116 medicolegal autopsy cases of unnatural death examined at the Department of Forensic Medicine, Dhaka Medical College, between January and July 2020. Hanging was the leading cause of death (24.1%), followed by road traffic accidents (19.0%), poisoning (13.8%) and burns (11.2%). Males predominated (64.7%), most victims were aged 18–44 years (61.7%), and both manner and cause of death differed significantly by sex and age group. Nearly one-third of forms (32.8%) did not state the manner of death.

The male predominance and young adult peak in our series agree with earlier Dhaka Medical College reports, although the male proportion here was lower. Earlier series reported males in 77.3% of unnatural deaths (1996) and 75.8% (1996–2000), with a male-to-female ratio of 3.4:1 in the first [7,8], compared with 1.8:1 in the present study. The narrower gap is largely explained by hanging and poisoning, which affected females as often as, or more often than, males in our data (50.0% and 62.5% female, respectively). An earlier Dhaka series likewise found suicidal deaths to be more common among females [8]. The 21–40 year peak described by Rahim and Das [7] corresponds to our 18–44 year concentration, and the proportion of Muslim victims (94.7%) closely matches their 95.5% [7], reflecting the religious

composition of the catchment population rather than any differential risk.

Accidental deaths (32.8%) were the commonest recorded manner, followed by suicidal (24.1%) and homicidal (10.3%) deaths. This ordering, with suicide second to accident and ahead of homicide, is consistent with a 2006 Dhaka Medical College analysis of 3012 autopsies [9]. However, the share attributed to accidents is far below the 77.2% reported for 1996–2000 [8], and the share attributed to suicide is substantially higher than the 8.0% and 10.8% reported previously [7,8]. Part of this difference may reflect a genuine change in the pattern of deaths, but it also reflects how forms are completed: in 38 cases (32.8%) the manner was not stated, and these comprised mainly poisoning, burn and electrocution deaths. Because poisoning deaths in Dhaka Medical College material have been reported to be overwhelmingly suicidal (91.3% in 2008–2009) [10], a substantial proportion of the unstated cases are probably suicidal or accidental, and the true proportions of each manner cannot be established from the forms alone. Earlier work from Sir Salimullah Medical College has similarly noted undecided cases arising from poor coordination between forensic doctors and legal authorities [11]. Manner of death differed significantly by sex and age group in our data, with homicidal and accidental deaths predominantly male, suicidal deaths concentrated before 30 years of age, and accidental deaths concentrated at 45 years or above. These associations should be read with caution because several tables had sparse cells.

Hanging was the single most frequent cause, with 18 of 28 cases occurring at 13–29 years. Earlier Dhaka data also placed the peak for hanging in a younger age bracket (11–20 years) than for other unnatural deaths [7]. A media-based analysis of suicides during the first seven months of the pandemic in Bangladesh found hanging to be the most common method (73%) [12], in keeping with our findings, although the equal sex distribution among hanging victims in our series differs from the male predominance in that report. Poisoning accounted for 13.8% of deaths and was more common in females, with organophosphorus compounds responsible for 62.5% of cases and phosphide compounds for 31.3%. The importance of pesticide poisoning as a means of self-harm in Bangladesh has been emphasised previously, and organophosphorus compounds were the commonest poison identified (78.6%) in an earlier Dhaka Medical College series [10]; the presence of aluminium and zinc phosphide, which are used as fumigants and rodenticides, underlines the need for stricter control of access to these agents. Burns, which were slightly more frequent in females and peaked at 30–44 years, were mostly recorded without a manner of death, so their circumstances (accidental, suicidal or homicidal) remain uncertain.

Road traffic accidents (19.0%) and railway accidents (7.8%) accounted for 26.7% of deaths, mainly in men and older adults, with 13 of 22 road traffic victims aged 45 years or above. This is far below the 68.9% road traffic share described for 1996 [7]. Although differences in classification and in the catchment area may contribute, the study period coincided with the national COVID-19 lockdown, during which public transport was suspended from late March to 30 May 2020 [13]. In our data, accidental deaths fell to two cases in each of April and May, compared with twelve in February, whereas suicidal deaths rose to eight in April and again in July. These are descriptive counts with no 2019 comparison and cannot be attributed to the lockdown. Nevertheless, they are compatible with reports of fewer road traffic fatalities in 2020 than in 2019 [13] and of increased suicide risk and economic hardship during the pandemic in Bangladesh [12]. A Pakistani study, by contrast, found that accidents remained the leading cause of unnatural death during lockdown [14], so the effect may be setting-specific.

Two-thirds of railway accident victims (6 of 9) and over one-third of road traffic victims (8 of 22) were unidentified, accounting for 14 of the 15 unidentified bodies. Unidentified bodies of this kind are commonly unaccompanied migrants or pedestrians without documents, and their frequency has implications for investigation, legal proceedings and the return of bodies to families.

The study draws on a high-volume mortuary and contains few missing data for the main variables, and results are reported with exact counts for every cross-tabulation. Its limitations should nevertheless be acknowledged. It is a single-centre study covering about six months, with January represented only from 21 January, so seasonal patterns cannot be assessed. Hospital autopsy cases are not a population sample and no denominators were available, so rates could not be calculated. Manner of death was taken from police and inquest forms, one-third of which did not state it; cause groups were derived from the doctor's opinion, and chemical and histopathological results were not systematically available. Cyanosis was recorded in only 45 cases and was not interpreted. Many chi-square tests had expected counts below 5, particularly cause of death by age group (92.4% of cells; exact $p = 0.054$), so these associations are exploratory. Finally, no pre-pandemic comparison period was included.

## CONCLUSION

Unnatural deaths in this series affected mainly young adult men, but hanging and poisoning affected women as much as, or more than, men. Hanging, road traffic accidents and poisoning accounted for most deaths. The high proportion of forms without a stated manner of death and the number of unidentified bodies limit interpretation and indicate the need for standardised manner-of-death certification and better coordination between forensic and investigating authorities. Prevention efforts should focus on suicide prevention among adolescents and young adults, restriction of access to pesticides and phosphide compounds, and road and railway safety for older and vulnerable users. Larger multi-year studies with population denominators and a pre-pandemic comparison are needed to confirm these findings.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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