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Sudden death in the emergency department: A comprehensive 8-year study integrating clinical and autopsy data

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Abstract:

OBJECTIVES: This study aimed to examine the demographic and clinical characteristics of adult patients presenting with sudden, unexpected, and nontraumatic death to a high-volume tertiary emergency department in Türkiye, integrating clinical records with forensic autopsy findings.

METHODS: We conducted a single-center, retrospective, cross-sectional study including 1555 adult patients who presented with sudden death between January 2015 and January 2023. Data were obtained from electronic medical records and forensic autopsy reports. Descriptive and inferential statistics were used to evaluate cause-of-death distributions by age, sex, and employment status.

RESULTS: Cardiovascular diseases (CVDs) were the leading cause of sudden death (56.7%), followed by respiratory (12.8%) and infectious diseases (11.7%). Deaths due to central nervous system (CNS) pathologies, metabolic/endocrine disorders, and intoxications occurred at significantly younger ages ($P < 0.001$). Males accounted for 62.1% of deaths, with CNS- and respiratory-related deaths being more common in males. Unemployed individuals had higher rates of infectious and CVD-related deaths, while employed individuals showed a higher frequency of CNS, metabolic, and intoxication-related causes ($P < 0.05$).

CONCLUSION: Our findings confirm that CVDs remain the most frequent cause of sudden death. However, the significant presence of noncardiac causes, especially among younger and employed individuals, highlights the need for broader preventive strategies.

Keywords:

Autopsy, cardiovascular disease, emergency department, sudden death

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Introduction

Sudden death refers to an unexpected, natural fatal event that occurs within a brief period, typically within 24 h of a sudden clinical deterioration.[1,2] In developed countries, the American Heart Association reports that sudden death accounts for approximately 15%–20% of all natural deaths.[3] Despite significant advancements in emergency medicine and resuscitation techniques, the survival rate following out-of-hospital cardiac arrest (OHCA) remains below 10%. This underscores the urgent need for the early identification of at-risk individuals and the implementation of effective preventive strategies.

Emergency departments (EDs) serve as the first point of contact for critically ill patients and play a pivotal role in managing sudden collapse and cardiac arrest. However, the

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Box-ED Section

What is already known about the study topic?

- The American Heart Association reports that sudden death accounts for approximately 15%–20% of all natural deaths. Despite significant advancements in emergency medicine and resuscitation techniques, the survival rate following out-of-hospital cardiac arrest remains below 10%. This underscores the urgent need for the early identification of at-risk individuals and the implementation of effective preventive strategies. Emergency departments (EDs) serve as the first point of contact for critically ill patients and play a pivotal role in managing sudden collapse and cardiac arrest.

How is this study structured?

- This single-center, retrospective, observational, and cross-sectional study was conducted in the ED of our tertiary care hospital in Istanbul. The study population included adult patients (aged ≥18 years) who presented to the ED with sudden, unexpected, and nontraumatic death between January 2015 and January 2023. Sudden death was defined as a nontraumatic fatal event resulting from cardiac arrest, respiratory failure, or other acute medical conditions, occurring within 24 h of symptom onset or clinical deterioration, as identified through either clinical records or forensic autopsy findings.

What does this study tell us?

- This study seeks to generate new epidemiological insights by analyzing the demographic and clinical characteristics of individuals presenting with sudden, unexpected, and nontraumatic death to the ED. A major gap in the existing literature is the frequent exclusion of cases with undetermined causes of death, which may limit the generalizability of findings. To address this knowledge gap, our study integrates ED records with forensic autopsy reports, offering a comprehensive assessment that includes both diagnosed and undiagnosed cases.

What is the conflict on the issue? Is it important for readers?

- Previous studies often exclude undetermined or nonautopsied cases, potentially skewing cause-of-death distributions. Autopsy-based cohorts may overestimate certain noncardiac etiologies, while clinical registries may undercount them. This dual-source approach resolves that conflict by combining ED clinical data with forensic findings, yielding a more comprehensive and generalizable picture of sudden-death etiologies in an urban Turkish population. Readers gain a balanced understanding of both cardiac and noncardiac causes across demographic and socioeconomic strata – critical for tailoring public health.

evaluation of these patients poses significant challenges. Patients experiencing OHCA often arrive without prior medical records or accompanying family members, making it nearly impossible for healthcare providers to obtain a comprehensive clinical history.[4,5] The absence of eyewitnesses often hinders the reconstruction of the circumstances surrounding the collapse. Although autopsies are recommended in cases of unexplained or suspicious deaths, they are not always performed due to legal, cultural, or familial constraints.[2,3,5] These limitations highlight the necessity for further research investigating the characteristics and potential causes of sudden death in emergency settings.

Several previous studies have investigated the etiologies of sudden death. Ricceri *et al*. reported that 69.1% of OHCAs were due to arrhythmic causes, while 27.1% resulted from noncardiac origins.[6] Akinwusi *et al*. identified cardiovascular diseases (CVDs) as the leading cause (51.7%), followed by respiratory disorders (20.7%), central nervous system (CNS) pathologies (13.8%), intoxications (13.8%), and pulmonary thromboembolism (10.8%).[7] In Türkiye-based studies, similar patterns have been observed. An autopsy-based study by Gurger *et al*. found that 52.2% of deaths were of CVD origin, with males comprising 69.6% of cases.[8] More recently, Deveci and Demircin[9] conducted a large-scale forensic analysis of 735 sudden cardiac deaths and found that ischemic heart disease accounted for 68.8% of cases, followed by left ventricular hypertrophy and aortic dissection. Similarly, Yıldız *et al*.[10] retrospectively analyzed 128 autopsy-confirmed cases of sudden cardiac death and reported that 65.6% were due to coronary artery disease (CAD), while cardiac tamponade (10.9%), hypertrophic cardiomyopathy (7.8%). These findings confirm that CAD, hypertrophic cardiomyopathy, and vascular pathologies such as aortic rupture remain the most common fatal cardiac events.

However, the causes of sudden death can vary significantly by age, sex, and socioeconomic background. For instance, in younger individuals, congenital heart defects, myocarditis, and conduction abnormalities are more frequently observed, whereas in older adults, degenerative and ischemic etiologies dominate. Although numerous studies in Türkiye have provided valuable insights, most have relied either solely on autopsy data or exclusively on ED records, without integrating both sources. Moreover, national data from the Turkish out-of-hospital cardiac arrest[11] registry underscore the need for integrating ED data with autopsy results to improve the accuracy of sudden death classifications and inform targeted public health strategies.

To address this gap, the present study aims to generate novel epidemiological insights by examining the

demographic and clinical characteristics of adult patients presenting with sudden, unexpected, and nontraumatic death to a high-volume tertiary ED in Istanbul. By combining ED records with forensic autopsy findings, we provide a comprehensive and region-specific analysis that captures both diagnosed and undiagnosed cases across diverse subgroups.

Methods

Ethical approval statement

This study was conducted in accordance with the 2024 Declaration of Helsinki. The study protocol was approved by the Institutional Review Board of Haseki Training and Research Hospital, Istanbul, Türkiye (approval no. 35-2024). As the data did not include any personally identifiable information, the IRB waived the requirement for informed consent for the use of medical records.

Study design and setting

The single-center, retrospective, observational, and cross-sectional study was conducted in the ED of our tertiary care hospital in Istanbul. The hospital receives approximately 14,000 patient visits per day, of which around 3000 are ED admissions. The study population included adult patients (aged ≥18 years) who presented to the ED with sudden, unexpected, and nontraumatic death between January 2015 and January 2023. Sudden death was defined as a nontraumatic fatal event resulting from cardiac arrest, respiratory failure, or other acute medical conditions, occurring within 24 h of symptom onset or clinical deterioration, as identified through either clinical records or forensic autopsy findings.[1]

Data collection

The study covered 8 years from January 1, 2015, to January 1, 2023. Data were collected by searching for I46.x (cardiac arrest) and R96.x (other sudden death) International Classification of Diseases codes in the hospital's automation systems and archives. Eligible patients were identified through a comprehensive review of the hospital's electronic medical record system and archival databases. Only adult patients (≥18 years) presenting to the ED with nontraumatic, unexpected, and fatal clinical presentations within 24 h of symptom onset or deterioration were included. Following ethical approval, data extraction and case review were conducted over 6 months.

Data collected included demographics (age, sex, and occupation), comorbidities, diagnoses, cause of death, medication use, and the date and time of ED admission. For cases classified as suspicious deaths, where the cause of death was determined via forensic autopsy, official autopsy reports issued by the Istanbul Council of Forensic Medicine were reviewed. In cases where a forensic autopsy report was not available, the cause of death was determined based on the clinical diagnosis recorded in the electronic medical records, considering presenting symptoms, physical examination, laboratory tests, imaging results, and documentation by emergency physicians at the time of death.

Data were collected by two certified emergency medicine specialists with over 10 years of clinical experience. These physicians were responsible for identifying cases and extracting relevant data. Autopsy findings were subsequently reviewed and interpreted by a forensic medicine specialist with 8 years of professional experience. The statistical analyses were performed by an independent researcher who was blinded to the study hypothesis and had no role in data collection or patient selection.

Outcomes

The primary objective of the study was to identify the underlying causes and associated risk factors of sudden, unexpected, and nontraumatic deaths among adult patients, based on clinical records and forensic autopsy findings. Secondary objectives included analyzing demographic and epidemiological characteristics and examining age- and sex-related variations in the causes of death.

Study population and sampling

To minimize selection bias, all eligible patients during the study period were included. Adults (aged ≥18 years) who presented to the ED between January 2015 and January 2023 and met the criteria for sudden, unexpected, and nontraumatic death were enrolled in the study.

Exclusion criteria were as follows: Deaths due to traumatic causes (e.g., motor vehicle accidents, falls, firearm injuries), confirmed suicides, individuals under the age of 18, in-hospital deaths unrelated to emergency presentation, and cases with incomplete or insufficient documentation. In addition, cases of suspicious death without available forensic autopsy reports were also excluded.

A flowchart diagram summarizing the inclusion and exclusion process is presented in Figure 1.

Statistical analysis

Data were analyzed using SPSS software (version 27.0 for Windows; IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as means ± standard deviations for continuous variables and as frequencies (*n*) and percentages (%) for categorical variables. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test.

Figure 1: Flowchart diagram

Comparisons between categorical variables (e.g., sex) were performed using the Chi-square test. For comparisons of continuous variables (e.g., age) across more than two independent groups (e.g., cause of death categories), One-Way ANOVA was used when the data were normally distributed, and the Kruskal–Wallis test was applied otherwise. When ANOVA yielded statistically significant results, *post hoc* comparisons were performed using Tukey's honestly significant difference test to identify pairwise group differences. For other multiple comparisons, such as subgroup analyses involving categorical variables, the Bonferroni correction was applied to control for type I error. For two-group comparisons, the independent-samples *t*-test or Mann–Whitney *U*-test was used, depending on data distribution. $P < 0.05$ was considered statistically significant.

Results

Demographic and clinical characteristics

Table 1 presents the demographic and clinical characteristics of 1555 patients with sudden death who were included in the study, comprising 965 males (62.1%) and 590 females (37.9%). The mean age was 65.2 ± 16.3 years (range: 18–103; 95% confidence interval: 64.3–66.0). Among them, 812 individuals (52.2%) were in the 56–78 age group [Figure 2].

Overall, 553 patients (35.6%) were retired, 586 (37.7%) were workers, 170 (10.9%) were self-employed, and 96 (6.2%) were civil servants. At least one comorbidity was present in 810 patients (52.1%), with the most common being hypertension (n = 340, 21.9%), diabetes mellitus (n = 276, 17.7%), and CAD (n = 242, 15.6%).

The primary clinical diagnoses among the study population were acute myocardial infarction (n = 675, 43.4%), sepsis (n = 181, 11.6%), and ischemic stroke (n = 126, 8.1%). Overall, CVD accounted for 881 deaths (56.7%), followed by respiratory diseases (n = 199, 12.8%) and infectious diseases (n = 182, 11.7%) [Table 2].

Age differences in causes of death

A statistically significant difference was observed in mean age across different causes of death ($P < 0.001$). *Post hoc* Tukey analysis revealed that deaths due to CNS diseases ($P < 0.001$) and metabolic/endocrine disorders ($P = 0.003$) occurred at significantly younger ages compared to CVD, respiratory, and infectious causes. Intoxication-related deaths were predominantly observed in even younger individuals and were significantly different from all other causes ($P < 0.001$) [Table 3].

Sex differences in causes of death

CVDs were the most common cause of death in both sexes. However, male patients exhibited a significantly higher proportion of deaths due to CNS diseases and respiratory diseases compared to females ($P < 0.001$) [Table 3].

Employment status and causes of death

Deaths due to infectious diseases and CVDs were significantly more common among unemployed individuals ($P < 0.05$). In contrast, deaths related to CNS diseases, metabolic/endocrine disorders, and intoxications were more frequently observed among employed patients ($P < 0.05$). No statistically significant differences were found between the two groups in terms of gastrointestinal or respiratory diseases ($P > 0.05$) [Table 4].

Discussion

This retrospective study examined the demographic and clinical characteristics of 1555 adult patients who presented with sudden death to a high-volume, tertiary ED in Istanbul. A distinctive strength of our study lies in its integration of both ED records and autopsy findings, offering a more comprehensive and real-world perspective. This dual-source methodology enhances

Table 1: Demographic and clinical characteristics of patients with sudden death (*n*=1555)

Characteristics	Variable
Sex, ***n*** (%)	
Males	965 (62.1)
Females	590 (37.9)
Age (years), mean±SD (minimum–maximum)	65.2±16.3 (18–103)
95% CI	64.3–66.0
Employment status, *n* (%)	
Retired	553 (35.6)
Unemployed	84 (5.4)
Workers	586 (37.7)
Self-employed	170 (10.9)
Civil servants	96 (6.2)
Farmer	47 (3.0)
Student	19 (1.2)
Comorbidities, *n* (%)	
Hypertension	340 (21.9)
Diabetes mellitus	276 (17.7)
CAD	242 (15.6)
Stroke	162 (10.4)
Chronic heart failure	123 (7.9)
COPD	90 (5.8)
Chronic renal failure	88 (5.7)
Malignities	246 (15.8)

Data are expressed as numbers (*n*) and percentages (%). CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, CAD: Coronary artery disease, SD: Standard deviation

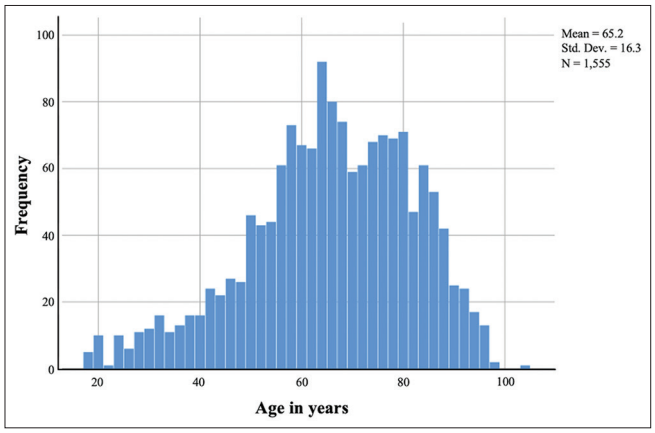

Figure 2: Histogram showing the age distribution of patients with sudden death (*n* = 1555)

the accuracy of cause-of-death classifications, especially in cases where clinical data alone may be limited or inconclusive.

Our study confirms the well-established predominance of CVDs as the leading cause of sudden death, consistent with previous national and international findings. Beyond this, our analysis offers novel insights into age-and employment-related disparities in sudden death etiology. Specifically, deaths due to CNS diseases, metabolic/endocrine disorders, and intoxications were more frequent among younger and employed

Table 2: Causes of death categorized by clinical diagnosis

Cause of deaths	*n* (%)
CVD	881 (56.7)
Myocardial infarction	675 (43.4)
Pulmonary embolism	68 (4.4)
Pulmonary edema	65 (4.2)
Heart failure	24 (1.5)
Dysrhythmia	24 (1.5)
Aortic dissection	23 (1.5)
Myocarditis	2 (0.1)
Respiratory diseases	199 (12.8)
Pneumonia	114 (7.3)
COPD exacerbation	85 (5.5)
Infectious diseases	182 (11.7)
Sepsis	181 (11.6)
Febrile neutropenia	1 (0.1)
CNS diseases	156 (10.0)
Ischemic stroke	126 (8.1)
Hemorrhagic stroke	22 (1.4)
Status epilepticus	7 (0.5)
Meningitis	1 (0.1)
Metabolic/endocrine disorders	70 (4.5)
Diabetic ketoacidosis	26 (1.7)
Hypoglycemia	16 (1.0)
Kidney failure	15 (1.0)
Electrolyte imbalance	9 (0.6)
Liver failure	4 (0.3)
Intoxications	34 (2.2)
GIS diseases	31 (2.0)
Gastrointestinal bleeding	26 (1.7)
Gastrointestinal perforation	4 (0.3)
Pancreatitis	1 (0.1)
Hematological diseases	2 (0.1)
Disseminated intravascular coagulation	2 (0.1)

Data are expressed as numbers (*n*) and percentages (%). COPD: Chronic obstructive pulmonary disease, CVD: Cardiovascular diseases, GIS: Gastrointestinal system, CNS: Central nervous system

individuals, suggesting the influence of occupational and psychosocial stressors. Conversely, infectious and cardiovascular deaths were significantly more common among unemployed individuals, highlighting potential barriers to healthcare access and preventive care. These patterns underscore the multifactorial nature of sudden death and the importance of integrating social determinants into risk stratification and public health interventions.

In our study, sudden deaths were more prevalent among males (62.1%) than females (37.9%), which is consistent with previous autopsy-based studies conducted in Türkiye as well as broader international literature.[8-14] This male predominance in sudden death may be attributed to biological differences in CVD risk, lifestyle factors, and health-seeking behaviors. The age distribution of the study population revealed that more than half of the deaths occurred among

Table 3: Distribution of causes of death by age and sex

	CAD	Respiratory diseases	Infectious diseases	CNS diseases	Metabolic/endocrine disorders	GIS diseases	Intoxications	*P**
Age (years), mean±SD	66.8±15.8	66.5±18.6	67.9±14.1	58.8±12.9	60.1±14.4†	65.0±17.8	39.9±12.3†	<0.001
95% CI	65.9–67.8	63.8–69.0	65.9–70.0	56.7–60.8	56.7–63.5	58.5–71.5	35.6–44.2	
Sex, *n* (%)								
Males	531 (55.0)	96 (9.9)	115 (11.9)	130 (13.5)	42 (4.4)	21 (2.2)	30 (3.1)	<0.001
Females	350 (59.3)	103 (17.5)	67 (11.4)	26 (4.4)	30 (5.1)	10 (1.7)	4 (0.7)	

†*Post hoc* Tukey HSD analysis showed that the mean age for CNS and metabolic/endocrine-related deaths was significantly lower than for CVD, respiratory, and infectious causes ($P<0.05$). Intoxication-related deaths occurred at significantly younger ages than all other groups ($P<0.001$). *Data are presented as numbers (*n*), percentages (%), and means±SD. Comparisons between groups were performed using the Chi-square test for categorical variables (sex) and One-Way ANOVA or Kruskal–Wallis test for continuous variables (age), depending on data distribution. CAD: Coronary artery disease, CNS: Central nervous system, GIS: Gastrointestinal system, CI: Confidence interval, SD: Standard deviation, CVD: Cardiovascular diseases, HSD: Honestly significant difference

Table 4: Association between employment status and causes of death

Cause of deaths	Unemployed, *n* (%)	Employed, *n* (%)	*P**
CVD	382 (60.0)	499 (54.4)	0.028
Respiratory diseases	82 (12.9)	117 (12.7)	0.941
Infectious diseases	102 (16.0)	80 (8.7)	<0.001
CNS diseases	34 (5.3)	122 (13.3)	<0.001
Metabolic/endocrine disorders	17 (2.7)	55 (6.0)	0.002
GIS diseases	82 (12.9)	117 (12.7)	0.396
Intoxications	5 (0.8)	29 (3.2)	0.002

*Intragroup comparisons (unemployed versus employed) were made using Chi-squared test. Data are expressed as numbers (*n*) and percentages (%). CVD: Cardiovascular diseases, CNS: Central nervous system, GIS: Gastrointestinal system

individuals aged 56–78 years, which aligns with reports from other countries indicating that sudden death is more common in middle-aged and older adults.[12-14] Additionally, we observed that deaths resulting from CNS diseases, metabolic/endocrine disorders, and intoxications occurred at significantly younger ages compared to those caused by CVD, respiratory, or infectious diseases. These findings are consistent with a recent study reporting that CNS-related sudden deaths disproportionately affect younger individuals, especially in the absence of preexisting medical conditions or with underlying neurological vulnerability.[15] Furthermore, metabolic/endocrine disorders have been shown to increase the risk of sudden cardiac death even in individuals without prior CAD.[16,17] A study by Tirandi *et al*.[16] found that the presence of metabolic syndrome increased the risk of sudden cardiac death by 70%. These findings underscore the necessity of incorporating age and underlying metabolic or neurological conditions into risk assessments for sudden death.

The present study demonstrated that CVDs were the most significant direct cause of sudden death, followed by respiratory and infectious diseases. These findings are consistent with those reported in previous studies.[6-8,13,17] A large-scale analysis of sudden deaths in Ireland between 1999 and 2008 reported that 63% of deaths were attributable to ischemic heart disease, underscoring the global predominance of cardiovascular causes.[18] Similarly, a study from Saudi Arabia found CVDs to be the most common cause, followed by respiratory and infectious diseases.[12] An autopsy-based study by Gurger *et al*.[8] in Türkiye also reported that CVDs were the primary cause, but found CNS pathologies and intoxications to be more prominent than in our study. This discrepancy may reflect a selection bias, as autopsies are more likely to be performed in forensic cases or in patients with altered consciousness, potentially overrepresenting causes such as intoxications or CNS cases. Our study combines clinical records and autopsy findings, providing a more comprehensive and balanced overview. This approach encompasses cases that may not undergo autopsy, such as those with well-documented clinical diagnoses. It offers a broader picture of sudden death causes, especially for respiratory and infectious diseases.

Our findings showed a clear association between employment status and the etiology of sudden death. While infectious and CVD-related deaths were more common among the unemployed individuals, deaths related to CNS diseases, metabolic/endocrine disorders, and intoxications were significantly more common among employed individuals. This distribution may reflect underlying socioeconomic disparities and behavioral health patterns. Unemployed individuals are more likely to experience delayed access to healthcare, increased burden of chronic diseases, and lower adherence to preventive measures, all of which contribute to a higher risk of fatal CVD and infectious conditions. Research has demonstrated a strong link between unemployment and increased cardiovascular morbidity and mortality, often mediated by psychosocial stress, unhealthy lifestyle habits, and reduced medical follow-up.[19,20] Conversely, the higher frequency of deaths due to CNS pathologies, metabolic disturbances, and intoxications among employed individuals may be associated with occupational stress, high-responsibility roles, irregular work schedules, or unrecognized psychiatric comorbidities. These factors can lead to substance misuse, poor disease management, and sudden decompensation, particularly in the absence

of timely intervention.[21,22] In sum, these findings underscore the importance of considering employment status as a significant social determinant of health in the context of sudden death.

Limitations

This study has several limitations that should be acknowledged. First, as a retrospective, single-center analysis, the findings may not be fully generalizable to other populations or healthcare systems. Although our sample size of 1555 cases is substantial, it may still be insufficient to detect subtle associations within smaller subgroups. Second, while the integration of both ED records and autopsy findings constitutes a significant strength of the study, it should be noted that not all cases underwent autopsy. In some cases, the determination of the underlying cause of death was based solely on clinical presentation and available medical history, which may introduce diagnostic uncertainty or classification bias. Third, detailed patient information regarding patients' symptoms prior to cardiac arrest, the time interval between the onset of complaints and arrest, and specific individual-level risk factors for sudden death could not be accurately obtained. In addition, patients who were under 18 years of age, had traumatic causes of death, confirmed suicides, or incomplete documentation were excluded based on predefined eligibility criteria. This exclusion may have led to the underrepresentation of certain etiological categories. Finally, while our data span 8 years (2015–2023), we did not perform a temporal trend analysis, including the potential effects of the COVID-19 pandemic, which may have influenced certain cause-of-death distributions, particularly those related to respiratory and infectious diseases.

Conclusion

While CVDs remain the most common cause of sudden death, our findings reveal important demographic and socioeconomic disparities. Noncardiac causes, such as CNS disorders, metabolic/endocrine conditions, and intoxications, were significantly more frequent among younger and employed individuals, indicating the possible influence of occupational stress, mental health issues, and risk behaviors. In contrast, infectious and cardiovascular deaths were more common among unemployed individuals, highlighting potential gaps in access to preventive care.

The elevated burden of noncardiac sudden deaths in younger and employed individuals suggests that prevention strategies should expand beyond cardiovascular risk to include occupational stress, mental health, and substance misuse. Meanwhile, the association between unemployment and increased infectious and cardiovascular mortality underscores the need for socioeconomic interventions alongside clinical care. These findings may guide future research on the development of targeted screening strategies and inform emergency care protocols by incorporating sociodemographic risk profiles into early risk assessment models.

Author contribution statement

Tarik Akdemir: Conceptualization, data curation, investigation, methodology, project administration, validation, visualization, roles/writing – original draft, writing – review and editing, revision. Adem Az: Conceptualization, formal analysis, investigation, methodology, project administration, validation, roles/ writing – original draft, writing – review and editing, revision. Yunus Doğan: Data curation, investigation, project administration, roles/writing – original draft, writing – review and editing, revision. Esma Akdemir: Conceptualization, formal analysis, supervision, roles/writing – original draft, writing – review and editing, revision.

Conflicts of interest

None Declared.

Ethical approval

The study protocol was approved by the Institutional Review Board of Haseki Training and Research Hospital, Istanbul, Turkey (approval no. 35-2024).

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