



Research Article

Unanticipated Demise: A Five-Year Retrospective Study of Sudden Natural Deaths

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Abstract

Sudden natural deaths (SNDs) are unexpected fatalities from natural causes, occurring without warning or preceding terminal illness. This five-year retrospective study examines the socio-demographic profile, seasonal trends, and aetiological factors contributing to SNDs autopsied at Hassan Institute of Medical Sciences (HIMS) Medical College. A total of 543 autopsy cases of SNDs from 2018 to 2023 were analyzed. Age, gender, marital status, socioeconomic status, location, and seasonality were collected. Deaths were classified into cardiovascular, respiratory, neurological, gastrointestinal, and other causes. Descriptive statistics highlighted demographic trends and causative factors. Most SNDs occurred in middle-aged individuals (41–60 years), with males accounting for 68% of cases. Cardiovascular diseases were the leading cause (42%), followed by respiratory disorders (23%) and neurological conditions (15%). Seasonal peaks were noted in winter (45%), with cardiovascular and respiratory deaths predominating. The majority of deaths occurred at home (56%), followed by workplaces or outdoors (25%). Married individuals (69%) and those from the middle class (50%) were most affected. Cardiovascular and respiratory conditions are major causes of sudden natural deaths, especially among middle-aged men, with seasonal peaks highlighting the need for targeted interventions. Reducing these risks requires addressing social and economic disparities while increasing public awareness of heart disease, strokes, and respiratory conditions in high-risk populations.

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1. INTRODUCTION

The definition of Sudden Natural Death (SND) can vary depending on different authorities and guidelines. The World Health Organization defines it as a death that occurs within 24 hours of the onset of symptoms. However, many medical and forensic experts have differing opinions on this definition. In this

study, we have used the widely accepted definition by Apurba Nandy, which describes sudden death as an unexpected fatality with no known cause related to trauma, poisoning, or violent asphyxia occurring either instantly or within 24 hours of the first terminal symptoms ^[1]. The study of SNDs is crucial for understanding the prevalence and causes of these untimely

deaths, which can have significant implications for public health, particularly in terms of prevention and intervention strategies. Sudden deaths may occur in older individuals under circumstances that typically do not raise suspicion. However, when such deaths happen in younger individuals, they are more likely to prompt concerns. In these situations, an autopsy is strongly recommended. A medical officer should not issue a death certificate for a sudden death without conducting an autopsy, if the death appears unexpected or unusual, the case should be reported to the appropriate legal authorities for further investigation [2].

The study also aims to classify SNDs based on key demographic factors such as age, gender, marital status, socioeconomic status, and place of occurrence, as well as the seasonality of these deaths. By analyzing the etiological factors, the study seeks to determine the most common causes of sudden death in this population and to identify any trends that may be useful for targeting preventive healthcare strategies.

Understanding the distribution and underlying causes of SNDs is essential not only for improving medical intervention but also for public health policy formulation aimed at reducing preventable deaths.

The data gathered in this study will contribute to the broader efforts of improving healthcare services, promoting awareness, and developing effective preventive measures, particularly for high-risk groups in both urban and rural settings.

In this context, the following sections provide a detailed analysis of the socio-demographic characteristics of the individuals whose deaths were investigated, the seasonal variations in mortality, the primary causes of death, and the implications of these findings for healthcare policy and public health interventions.

2. MATERIALS AND METHODS

After the approval of the Institutional Ethics Committee, this retrospective study examined sudden natural deaths (SNDs) over five years to understand their prevalence, demographic distribution, and underlying causes.

The study was conducted using data collected from medicolegal autopsies performed in the Department of Forensic Medicine, Hassan Institute of Medical Sciences, Hassan, from 01/08/2019 to 31/07/2024.

A total of 4453 autopsies were performed during the above-mentioned timeframe, with 543 established sudden natural deaths (SND) cases recorded.

Data Collection and Analysis

Data for each case, including age, gender, ethnicity, marital status, and identified cause of death, were collected from forensic autopsy records. The climate at the time of death was also noted to explore any potential environmental factors. The data was entered and analyzed in MS Excel and expressed in percentages and proportions.

Inclusion

- All cases where postmortem findings and pathology reports would suggest it to be a case of natural death.
- All age groups from both sexes.

Exclusion

- Cases categorized as unnatural, accidental, undetermined, or homicidal based on autopsy findings, pathology reports, and forensic science laboratory (FSL) reports were excluded.

Ethical Considerations

Confidentiality of the deceased individuals was maintained, with all data anonymized before analysis. The study followed institutional ethical guidelines for research involving deceased individuals, with additional oversight from the relevant ethics committee.

3. RESULTS

Table 1: Age-wise distribution of sudden natural death

Age Group(years)	Number of Cases (n = 543)	Percentage (%)
<20	50	9%
21-40	130	24%
41-60	300	56%
>61	63	11%

Middle-aged individuals (41–60 years) accounted for 56% of deaths, highlighting the vulnerability of this working-age group. The elderly (≥61 years) contributed 11%, often linked to winter and chronic illnesses, while younger individuals (≤20 years) had the lowest mortality (9%), mainly due to congenital and undiagnosed conditions (Table 1)

Table 2: Sex wise incidence of sudden natural deaths Sex

Sex	Number of cases (n = 543)	Percentage (%)
Male	368	68%
Female	175	32%

Males (68%) were more affected than females (32%), potentially due to higher exposure to risk factors such as smoking, stress, and sedentary lifestyles. This gender disparity was consistent across all age groups, emphasizing the need for male-focused health interventions (Table 2)

Table 3: Distribution of Sudden Natural Deaths by Religion

Religion	Number of Cases (n = 543)	Percentage (%)
Hindu	463	85%
Muslim	52	10%
Christian	18	3%
Others (e.g., Jain)	10	2%

Most SNDs occurred among Hindus (85%), mainly due to cardiovascular (50%) and respiratory (20%) diseases, with peaks in winter and monsoon. Similar patterns were seen among Muslims (10%), with cardiovascular and respiratory causes primarily affecting older adults. SNDs in Christians (3%) were mostly from cardiovascular affecting the elderly in winter. In

other religions (2%), respiratory and gastrointestinal disorders were common in smaller groups, with no notable seasonal trends (Table 3).

Table 4: Distribution of Sudden Natural Deaths by Residence

Residence	Number of Cases (n = 543)	Percentage (%)
Urban	326	60%
Rural	217	40%

Sudden natural deaths (SNDs) were more common in urban areas (60%) due to lifestyle-related factors like stress, sedentary habits, and pollution, with cardiovascular diseases being the leading cause. Rural areas (40%) had slightly lower cases, but limited healthcare access contributed to mortality, especially from cardiovascular and respiratory conditions. Seasonal peaks in winter highlight the need for better healthcare accessibility and preventive measures in both settings (Table 4).

Table 5: Seasonal Distribution of Sudden Natural Deaths

Season	Number of Cases (n = 543)	Percentage (%)
Winter	244	45%
Summer	136	25%
Monsoon	98	18%
Autumn	65	12%

The highest mortality (45%) was observed in winter, with cardiovascular and respiratory conditions being major contributors. Deaths in summer (25%) were linked to dehydration and heat-induced exacerbation of pre-existing conditions, particularly among the 41-60 age group. The monsoon season (18%) saw a rise in respiratory and gastrointestinal illnesses, likely due to infections and damp climatic conditions. Autumn months (12%) had the lowest mortality, possibly due to more stable weather conditions. (Table 5).

Table 6: Distribution of Sudden Natural Deaths by Marital Status

Marital Status	Number of Cases (n = 543)	Percentage (%)
Married	372	69%
Unmarried	136	25%
Widowed/Separated	35	6%

Married (69%): Most SNDs occurred in middle-aged individuals (41–60 years), with cardiovascular diseases leading (45%). Unmarried (25%): Younger groups (≤ 40 years) were affected, mainly by congenital conditions, infections, and sudden cardiac arrest. Widowed/Separated (6%): Elderly cases (≥ 61 years) saw respiratory and neurological deaths, especially in winter. (Table 6).

Table 7: Distribution of Sudden Natural Deaths by Socioeconomic Class

Socioeconomic Class	Number of Cases (n = 543)	Percentage (%)
Upper Class	54	10%
Middle Class	271	50%
Lower Class	218	40%

Middle Class (50%): Most deaths were linked to work stress, lifestyle diseases, and limited healthcare, with cardiovascular (50%) and respiratory (20%) conditions leading. Lower Class (40%): Higher mortality was driven by poverty, poor healthcare access, and infections, with respiratory and infectious diseases prominent during monsoons. Upper Class (10%): Fewer deaths occurred due to better healthcare, with neurological conditions (25%) and sudden cardiac deaths (30%) as primary causes. (Table 7)

Table 8: Distribution of Sudden Natural Deaths by Place of Occurrence

Place	Number of Cases (n = 543)	Percentage (%)
At Home	304	56%
Workplace/Outdoor	136	25%
Hospital	103	19%

At Home (56%): Most deaths occurred unexpectedly during routine activities, with cardiovascular diseases (60%) and respiratory disorders (20%) affecting middle-aged and elderly individuals. Workplace/Outdoor (25%): Common among individuals aged 21–60, deaths were often due to sudden cardiac arrest (45%) or stress-related incidents, peaking in summer due to exertion and dehydration. Hospital (19%): These involved acute worsening of pre-existing conditions like stroke or respiratory distress, primarily affecting elderly patients. (Table 8)

Table 9: Causes of Death in Sudden Natural Deaths

Cause of Death	Number of Cases (n = 543)	Percentage (%)
Cardiovascular Diseases	228	42%
Respiratory Disorders	125	23%
Neurological Conditions	82	15%
Gastrointestinal Disorders	54	10%
Others	54	10%

Cardiovascular diseases (42%) were the most common cause of death, with a notable spike in winter months, particularly among males aged 41-60 years. Respiratory disorders (23%) were the second leading cause, often associated with seasonal changes and exacerbated during colder months. Neurological conditions (15%), including strokes and brain hemorrhages, disproportionately affected elderly individuals. Gastrointestinal disorders and miscellaneous causes together contributed to 20% of deaths, with no significant seasonal variation observed. (Table 9).

4. DISCUSSION

This study provides valuable insights into the demographic and clinical characteristics of sudden natural deaths, highlighting a predominance of males, middle-aged individuals, and cardiovascular diseases as the leading cause. The majority of deaths occurred at home, underscoring the challenges in managing such events outside healthcare settings. Additionally, the significant seasonal variation observed, with increased mortality during winter, aligns with global trends and

emphasizes the importance of targeted public health interventions to mitigate these deaths.

In our study, the majority of sudden natural deaths (56%) occurred in individuals aged 41–60 years, with males comprising 68% of cases, highlighting a significant middle-aged and male predominance. Kumar *et al.* [5] and Narsireddy *et al.* [6] reported the highest incidence of sudden natural deaths in the 41-50 age group. In contrast, Derya AA *et al.* [9] found that most common in the 50 – 59 age group, while Escoffery CT *et al.* [7] reported the highest occurrence in the 61 – 70 age group, which differs from the findings of the present study. Male persons, in general, are at higher risk for sudden natural deaths (M: F ratio = 6.75:1).10–12. Narsireddy *et al.* [6] reported that out of 60 total sudden deaths, 49 cases (81.7%) were male, and 11 cases (18.3%) were female. Similarly, Sarkioja *et al.* [10] found that 63 out of 77 cases (82%) involved males, while Thomas A.C *et al.* [11] observed that 238 out of 322 cases (73.9%) were male. Nordrum *et al.* [12] also reported a male predominance, with 341 out of 428 cases (79.67%) affecting men. These findings align with studies by Ashwinkumar S *et al.* [1], Mukhopadhyay S *et al.* [2], and Chaudari VA *et al.* [3], which also highlight a higher occurrence of sudden natural deaths among males. Whereas this finding is not consistent with the studies of Escoffery CT *et al.* [7], this might be due to differences in the geographic distribution of disease patterns, lifestyle, and dietary habits.

In our study, the majority of sudden natural deaths occurred among Hindus (85%), similarly in Mukhopadhyay *et al.* [2], Chaudari VA *et al.* [3], Narsireddy *et al.* [5], among the study population 66.7%, 80.9%, 86.6% were Hindu by religion respectively and in Mukhopadhyay *et al.* [2] also showed 33.3% were Muslims reflecting the predominant religious demographic in the region. These figures are generally in line with the religious demographics of the general population, indicating that religion does not influence the occurrence of sudden natural deaths.

In our study, 60% of sudden natural deaths occurred among urban residents, and 50% were from the middle socioeconomic class, highlighting the impact of urban stressors and lifestyle factors. Similarly, there was 83.3% of urban residents' sudden death in Narsireddy *et al.* [5], and 62.5% in Mukhopadhyay S *et al.* [2]. In contrast, Narsireddy *et al.* [5] found that 90% of sudden natural deaths in individuals from lower socioeconomic backgrounds, including laborers, industrial workers, farmers, and drivers. This higher prevalence in economically disadvantaged groups may be due to factors such as financial constraints, lack of access to healthcare, neglect of early symptoms, and increased physical and mental stress.

In our study, 69% of sudden natural deaths occurred among married individuals, suggesting that while marriage often provides social and emotional support, it does not fully mitigate health risks. Similarly, Mukhopadhyay S *et al.* [2], Chaudari VA *et al.* [3], Narsireddy R *et al.* [6] observed a high proportion of medicolegal cases among married individuals, reflecting their significant representation in the adult population.

Cardiovascular diseases were the leading cause of sudden natural deaths, accounting for 42% of cases, with a significant number

of deaths (56%) occurring at home. This trend is consistent with findings from a study by Narsireddy R *et al.* [6] and Kuller *et al.* [14], which highlighted the high prevalence of cardiovascular events as a cause of death and the challenges of managing such events outside healthcare settings, particularly at home. Similar rates of cardiovascular diseases have been reported as 56.4% by Di Maio *et al.* [13]

45% of sudden natural deaths occurred during the winter months, indicating a potential seasonal effect on mortality, particularly related to cold weather's impact on cardiovascular health similar to Mukhopdhyay S *et al.* [2], and it does not coincide with the study of Azmak *et al.* [8] because, the difference in the demography. The maximum cases were seen in September and the least in January.

Overall, our study reinforces the well-established patterns of sudden natural deaths, emphasizing the strong association with middle age, male gender, urbanization, cardiovascular diseases, and seasonal variations. These findings highlight the need for targeted public health interventions, including lifestyle modifications, regular cardiovascular screenings, improved access to emergency medical services, and seasonal awareness campaigns to mitigate the risks associated with sudden natural deaths. Addressing these factors could significantly reduce the burden of sudden deaths and improve overall population health outcomes.

5. CONCLUSION

The study provides valuable insights into the patterns and causes of sudden natural deaths (SNDs), emphasizing the critical need for targeted preventive health care measures. Cardiovascular diseases emerged as the predominant cause, accounting for 42% of cases, particularly among middle-aged men. This highlights the significant role of underlying medical conditions, lifestyle factors, and limited awareness of early warning signs. Respiratory disorders (23%) and neurological conditions (15%) were also major contributions, further reinforcing the importance of proactive healthcare interventions. A key observation is the seasonal influence on SNDs, with the highest mortality occurring in winter. The increased prevalence during cold months suggests a link between temperature-related stress on cardiovascular and respiratory systems, necessitating season-specific health care strategies. Additionally, urban populations were disproportionately affected, likely due to environmental and lifestyle factors such as air pollution, stress, and sedentary habits. These findings underscore the need for improved urban healthcare accessibility and awareness initiatives. Socioeconomic status also played a crucial role, with middle-class individuals being the most affected, possibly due to work-related stress and delayed medical interventions. The fact that over half of these deaths occurred at home (56%) highlights the urgent need to strengthen emergency medical response systems and promote awareness of critical symptoms requiring medical attention. To mitigate the burden of SNDs, comprehensive strategies, including widespread cardiovascular screenings, public health education, and improved access to preventive care, must be implemented. Further research leveraging advanced

diagnostic techniques, such as molecular autopsies, could enhance our understanding of the underlying mechanisms, enabling more effective preventive strategies. Addressing these factors historically will contribute to reducing the incidence of sudden natural deaths and improving overall public health.

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