



### H43 Hypothermia-Related Deaths: A Ten-Year Retrospective Study of Two Major Metropolitan Cities in the United States

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**Learning Overview:** After attending this presentation, attendees will understand the epidemiology, risk factors, autopsy, and toxicological findings associated with hypothermia-related deaths during the past ten years in New York City, NY, and Houston, TX.

**Impact on the Forensic Science Community:** This presentation will impact the forensic and public health communities by identifying the risk factors for these fatalities in large metropolitan areas and will assist in reducing these deaths in susceptible populations.

Deaths due to hypothermia are preventable and affect vulnerable populations, including the homeless, elderly, and people with substance abuse and mental illness. Hypothermia is defined as a core body temperature of less than 95°F.<sup>1</sup> There are approximately 1,300 deaths due to hypothermia in the United States every year, most of which occur in the Midwest or West; however, Southern states may exhibit rapid temperature drops at night, in stark contrast to the daytime heat, leaving people unprepared.<sup>2-4</sup> The postmortem diagnosis of hypothermia can be challenging, as there are no pathognomonic signs.<sup>5</sup> This study reviewed the medical examiner case files on all deaths due to hypothermia over a ten-year period in two large populous cities in distinct geographic regions of the United States (New York City and Houston) to study the autopsy findings, toxicologic results, and the epidemiologic patterns of these fatalities.

The New York City Office of Chief Medical Examiner and Harris County Institute of Forensic Sciences electronic databases were searched for all fatalities where the cause of death included hypothermia, between January 2009 and July 2019. There were a total of 189 fatalities (139 in New York City, and 50 in Houston). The following data was collected: age, sex, ethnicity, survival interval, manner of death, place of death, place found, initial body temperature, outdoor temperature (high and low), precipitation, residence, autopsy findings, and toxicological results.

Of the 189 fatalities, there were 143 males and 46 females, and the average age was 60.1 years in New York and 64 years in Houston; age ranged from a neonate to 97 years old. The ethnicities were Black ( $n=76$ ), White ( $n=61$ ), Hispanic ( $n=39$ ), and Asian ( $n=13$ ). The known number of homeless fatalities ( $n=84$ ) versus those with a fixed residence ( $n=93$ ) was similar. A survival interval occurred in 91 cases, ranging from the time required to complete the rewarming protocol (hours) up to 33 days, of whom, the coldest recorded body temperature was 68.3°F, and the highest was 92°F. The average daytime high temperature in New York was 41.7°F and in Houston was 54.4°F; the average nighttime low in New York was 27.2°F and in Houston was 36.1°F. Precipitation (rain and snow) was noted in the weather report for 56 cases. The most cases by year for both cities was 2018, with a total of 23 in New York and 11 in Houston.

All causes of death were due to hypothermia and the manner of death was divided among accident ( $n=181$ ), undetermined ( $n=5$ ) and suicide ( $n=3$ ). The most common autopsy findings were Wischnewski spots in the stomach ( $n=107$ ) and pancreatic hemorrhage ( $n=29$ ). Toxicologic analysis detected ethanol ( $n=69$ ) with an average blood concentration of 0.20gm% in New York, and 0.27gm% in Houston; cocaine ( $n=9$ ); and others, including opioids, benzodiazepines, stimulants, and antipsychotics were more rarely detected. Other postmortem findings included cardiovascular disease ( $n=81$ ) and chronic obstructive pulmonary disease ( $n=16$ ). Pre-existing diagnoses of dementia ( $n=8$ ) or a mental illness, such as schizophrenia or bipolar disorder, ( $n=14$ ) were also noted.

Hypothermia is an important cause of preventable weather-related deaths in major metropolitan cities in the United States. Despite the different geographic locations and climates of New York City and Houston, many similarities were noted between the patient populations, including male sex, advancing age, and the number of deaths occurring equally between homeless people and those with a fixed residence, suggesting that even people who have access to shelter are at risk. Local agencies can use this data to target these higher-risk populations and offer appropriate intervention to try to prevent these deaths. The lack of pathognomonic autopsy findings emphasizes the importance of a thorough scene investigation; otherwise, these deaths may be underreported. The role of the medical examiner is crucial in the accurate classification of these deaths, to assist in improving public education, targeted interventions, and emergency response planning.

#### Reference(s):

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#### Hypothermia, Weather-Related Fatalities, Environmental Cold Exposure