DEATH AND DEGREE

Establishing a Relationship of Death and Heat in Scorched Delhi

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Establishing a Relationship of Death and Heat in Scorched Delhi - 2025

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Dr. Manoranjan Ghosh (SSLA, SIU, Pune) and Selomi Garnaik (Greenpeace India)

1.0 INTRODUCTION

India suffered a death toll of 138,377 in fifty years (1970-2021) due to various climate-related disasters (Heatwatch, 2023). More specifically, from 2012 to 2022, a total of 11,868 people died due to heat strokes in India (National Crime Records Bureau, 2022). Since 2015, the National Centre for Disease Control (NCDC) has been giving morbidity and mortality data on heat-related illness and reported a total of 3,775 deaths during 2015-2019. According to a simulated study, heatwaves were responsible for approximately 1116 deaths per year in ten Indian cities during 2008 to 2019 (De Bont, 2024). A comparative analysis shows a discrepancy between the simulated annual mortality rates (1116 human deaths) and the NCDC figures. This indicates that the NCDC might have underestimated and miscalculated a potential underestimation and anomalies in numbers regarding heat-related deaths, particularly at the reporting office level. In India, in recent years, people are dying due to natural forces, such as lightning, heat waves, and cold waves; around 9.1% deaths are happening due to 'heat/sun stroke'. Notably, the majority of these victims—about 55.8%—are individuals between the ages of 30 and 60 (National Crime Records Bureau, 2022). Heat-related deaths of people over the age of 65 increased by 85% in 2018-2022 compared to 2000-2004 (Lancet Countdown, 2023), which is more than twice the increase expected if temperatures had not changed. If the temperature rises by 2°C by mid-century, it has been projected that heat-related deaths will increase by 370% (Lancet Countdown, 2023). In India, the frequency of heat wave days has increased from 40 days (2011) to 203 days (2022), particularly in the peak summer months of April, May, and June. India experienced extreme weather events on 93% of the days in the first nine months of 2024. This alarming trend is part of the broader pattern of intensifying climate extremes (CSE, 2024). It did not spare a single state or union territory, as all regions reported instances of extreme weather. Reports from 37 cities with temperatures above 45 degrees Celsius underscored the severity of the heat. This relentless rise in heat has serious implications for urban life, especially in cities like Delhi. Delhi inhabitants prepare for the familiar each summer as the temperature soars, and the city's poor infrastructure, especially the water supply systems, power outages, and uninhabitable housing, make life and livelihoods unbearable. Weather apps show temperatures spiking, but what they miss is the lived reality of the city streets. For millions of informal workers like street vendors, waste pickers,

gig workers, construction labourers, rickshaw pullers and homeless people, the lived reality of Delhi's heat is much more than physical discomfort. Prolonged exposure to the heat can lead to potentially fatal consequences.

Yet how we understand and respond to this danger remains narrow and reductionist. We rely heavily on daytime maximum temperature forecasts to define extreme heat, but these numbers don't reflect how heat is experienced on the ground, particularly by those who live or work outdoors for most of the day. To grasp the scale of Delhi's heat crisis, we need to look at the indicators that determine how the body feels in outdoor conditions, in addition to the thermometer reading. To fill this knowledge gap, the Universal Thermal Climate Index (UTCI) serves as a crucial metric to establish a link between comfort and rising temperatures. The comprehensive development of human thermo-physiological data made it possible to develop the UTCI (www.utci.org). In this paper, we have examined the relationship between the perception of heat and its impact on vulnerable communities using UTCI and the number of unaccounted deaths in the NCR (National Capital Region) over the last decade. Observing the correlation, we have highlighted the need for a policy focus on the homeless population in and around Delhi, extending to the rest of the country.

2.0
HEAT-RELATED ILLNESS AND DEATH IN INDIA: A BIGGER PICTURE

NCDC has vividly mentioned that “there is no diagnostic test for heatstroke". This is because, clinically, it is still challenging to certify human death related to heat stroke during a heatwave. However, the guidelines provided by the Govt. of India for investigation of suspected heat-related illness and death advised some to check the clinical manifestations of heat strokes such as Muscle Function Tests, Renal Function Test, Liver Function Test, Serum Electrolytes Test and other six specific diagnostic tests (a total of eleven clinical tests based on the condition of the patient) along with body core temperature increasing by ≥ 40°C or ≥104°F (The normal core human body temperature ranges from 36.5–37.5°C or 97.7–99.5°F) and a questionnaire survey based bio-social-meteorological informations (NPCCHH, 2021, 2024 and Hutchison et al., 2008). The National Heat-Related Illness and Death Surveillance (NHRIDS) was established in 2015 for surveillance purposes to collect daily near-real-time data at different reporting offices. In 2024, NHRIDS reported that Gujarat, Odisha, and Telangana remained high-performing states in terms of reporting. Nonetheless, it has been observed that NHRIDS classifies heat-related illness and death into various categories. Figure 1 shows different categories and year-wise (2022-24) patterns of heat stroke-related emergency reporting, suspected cases and deaths along with confirmed Cardiovascular Disease (CVD) in India. Although 48,156 Suspected Heatstroke Cases (SHC) were reported in 2024, only 269 Suspected Heatstroke Deaths (SHD) and 161 Confirmed Heatstroke Deaths (CHD) have been certified (figure 1). In 2024, SHC has increased while SHD and CHD have reduced compared to the previous 2 years (Figure 1). It has been astonishing that emergency attendance related to heat stress during summer months was ~30.9 million in 2024, which is nine times higher than the previous year (~3.6 million in 2022 and 15.3 million in 2023). This significant rise indicates a growing risk of heat-related illnesses, as well as ambiguity among CHD and SHD and related cardiac stress. The rapid rise in cardiovascular deaths, almost fifty times higher in 2024 than in 2022, is a major concern, resulting in ambiguity in heatstroke-related death certification. However, it has been

noted that cardiovascular vulnerability worsens during heat waves, especially among senior citizens or those with chronic illnesses. Figure 2 shows the daily Suspected Heatstroke Deaths (SHD) and cardiovascular deaths (CVD), and finally total deaths during the summer months (from 1st March to 31 July 2024) in India. Figure 2 indicates that SHD cases increased by more than ten times from 2022 to 2024. There is more ambiguity in the seasonal trends of SHD, CVD, and total mortality, which do not appear to reflect a collinear tendency visually. The SHD and total death (including SHD, CHD, and CVD) may coincide and be linked to heat wave events (Figure 2). The daily death toll surpassed 500 on almost every day between mid-May to June 2024.

Figure 1: Year-wise emergency reporting, suspected cases, and heat stroke deaths along with confirmed CVD in India, 2022-24.

Source: National Programme on Climate Change and Human Health (NPCCHH), 2024.

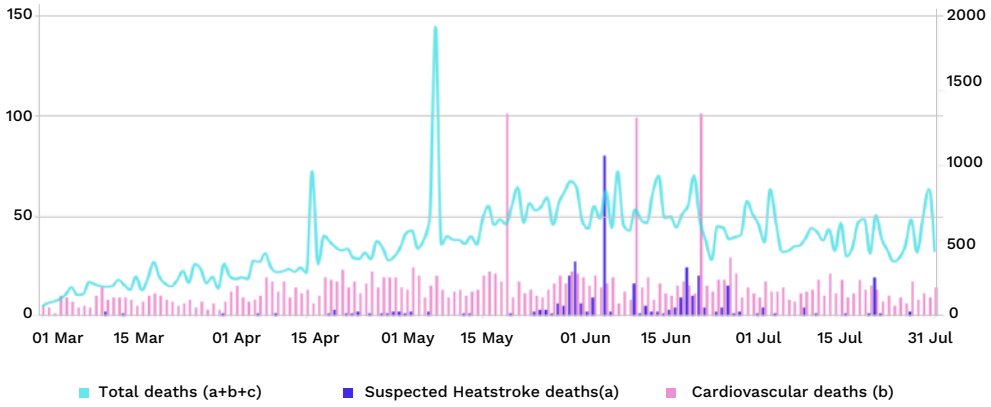

Figure 2: Daily suspected heatstroke, cardiovascular and all-cause deaths trends reported at health facilities, 2024

Source: National Programme on Climate Change and Human Health (NPCCHH), 2024.

3.0 WHAT IS UTCI AND WHY IS IT IMPORTANT?

The Universal Thermal Climate Index (UTCI) is a scientific tool that determines how the human body perceives heat in outdoor conditions. Unlike traditional temperature readings, which only reflect air temperature, UTCI accounts for multiple environmental factors, including humidity, water vapour pressure, wind speed and solar radiation. By combining these variables, UTCI provides a more accurate indication of heat stress than temperature alone. This makes it especially important in cities like Delhi, where many people live and work outdoors, exposed to extreme conditions with little to no protection. Several studies have used UTCI to assess heat stress in India; Shukla (2022) reported a rising trend from 1980 for the country as a whole and Delhi in particular. Exploring future UTCI scenarios from 2050 to 2080, Thapa (2024) reported a statistically significant increase in average UTCI, with western and central India resulting in higher stress.

- For construction workers, street vendors, sanitation workers, and delivery riders, UTCI reflects not only the number on a weather report but also the actual physical stress they endure.

- For those living in informal settlements, pavement homes, or tin-roofed shelters, it captures the oppressive combination of direct sunlight, poor ventilation, and heat-trapping environments.

- For the homeless, who spend both day and night outdoors, it shows how dangerous "ambient" temperatures can become without access to cooling.

Hence, UTCI is more than just a thermometric metric - it is a crucial tool for understanding thermal well-being at the individual, community, and spatial levels. It also supports efforts toward equitable climate response by

enabling governments, frontline health workers, urban planners, and decision-makers to identify who is most at risk and when timely intervention is needed, ensuring that vulnerable populations are not neglected in the face of rising climate extremes. Although UTCI captures the heat stress as a one-dimensional parameter, it is worth mentioning that the variability in thermodynamics due to local land use and land cover change within the NCR region is more nuanced and results in a more complex urban heat island effect. For example, the western part of Delhi received comparatively one mm of rainfall against 183 mm recorded in Northern Delhi in 2024, which is 12 km apart. At the same time, Pitampura and the Ridge area in the north have recorded a temperature 2°C higher than the Safdarjung area in the south (Agarwal, 2025; Sangomla, 2024).

4.0
DATA AND METHODS

a) **Unidentified (Mostly Homeless) Human Deaths in Delhi (2015–2024):** The study draws on the monthly number of unidentified human dead bodies recovered across the city, many of whom are homeless. The data has been collected and compiled by the Centre for Holistic Development (CHD), New Delhi. As discussed in the beginning, it is hard to find and collect certified heat-related human death data in Delhi; therefore, we used the "all-cause mortality" of unidentified human dead bodies in Delhi as a variable to check the impact of outdoor thermal discomfort or heat stress.

b) **Average Universal Thermal Climate Index (UTCI) Data (2015–2024):** Developed by International Society of Biometeorology in 2009 and derived from Copernicus Climate Data Store, this dataset uses advanced Bio-Thermo-Physological modelling to calculate the UTCI, an index that reflects how heat is felt by the human body in an outdoor environment. The analysis includes monthly UTCI averages from 2015 to 2024, covering Delhi's hottest and most uncomfortable time of the year for heat exposure: March to August. Table 1 demonstrates the UTCI scale of human physiological response to the outdoor environment. For UTCI analysis, we have considered the NCR, because the spatial resolution of the ERA-5 reanalysis UTCI is 0.25° x 0.25° (~31 km). The hourly average of UTCI of NCR provides us with a bird's-eye view of thermal comfort. Moreover, using the Month-on-Month Change (First Difference) method, we calculated the change in average UTCI from one month to the next.

Table 1: The UTCI and human physiological response scale

UTCI	Human physiological response
>46 °C	Extreme heat stress
38 to 46 °C	Very strong heat stress
32 to 38 °C	Strong heat stress
26 to 32 °C	Moderate heat stress
9 to 26 °C	No thermal stress
9 to 0 °C	Slight cold stress
0 - to -13 °C	Moderate cold stress
-13 to -27 °C	Strong cold stress
-27 to -40 °C	Very strong cold stress
<-40°C	Extreme cold stress

Source: https://www.utci.org

5.0

RESULTS AND DISCUSSION: WHAT DOES THE DEATH AND UTCI DATA TELL US?

After examining the UTCI trends from 2015 to 2024, especially for the months of March to August in the National Capital Region (NCR), we found that

- The traditional monsoon months (June to September) consistently record high UTCI values- 33.6°C in June, 32.4°C in July, and 31.9°C in August (average from 2015- 2024), even when air temperatures do not reach their peak (Fig:3). This is because of increasingly high humidity during the monsoon in Delhi, which amplifies the body's perceived heat load (Agarwal, 2025; Somvanshi & Kaur, 2023). Humidity slows down the body's natural cooling mechanism, namely sweating, leading to a higher felt temperature.

- Mean UTCI values for July and August across 2019 to 2024 consistently remain above 31.5°C, ranging from 32.77°C to 34.43°C in July and from 31.54°C to 32.26°C (Fig. 4) in August, despite these being traditionally seen as "rainy" months, indicating moderate to intense heat stress. The months of July and August now feel as oppressive as the peak summer months, signalling a dangerous shift where the duration of heat stress is extending well into the monsoon season. This change reinforces that not only the heat but also the humidity are now driving dangerous thermal conditions in the city.

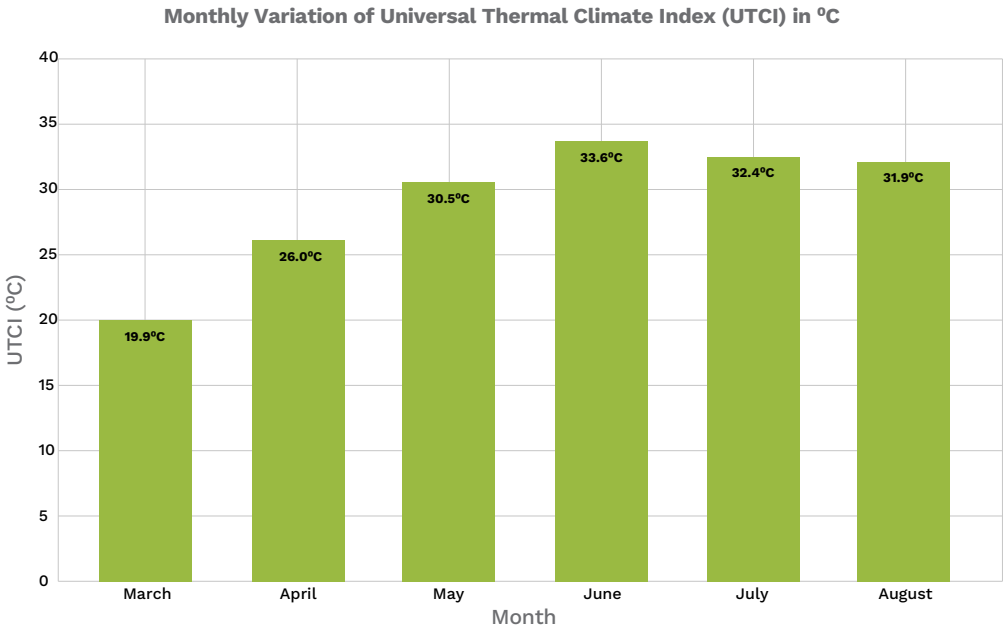

Figure 3: Mean Monthly Variation of Universal Thermal Climate Index (UTCI) in NCR (2015-2024).

Table: 2: Month-on-Month Change (First Difference) and Growth of UTCI in NCR (2015-2024)

Month	UTCI (°C)	Month-on-Month Change (First Difference)	ΔUTCI (°C)	Growth Rate (% change)	Nature of Change
March	19.91 °C	-	-	-	-
April	26.04 °C	March → April	+6.13	+30.78%	Sharp increase
May	30.50 °C	April → May	+4.46	+17.13%	Moderate increase
June	33.57 °C	May → June	+3.07	+10.07%	Mild increase
July	32.39 °C	June → July	-1.18	-3.52%	Slight decrease
August	31.91 °C	July → August	-0.48	-1.48%	Slight decrease

Furthermore, Table 2 shows the month-on-month change (First Difference) and growth of UTCI in NCR (2015-2024). The sharpest UTCI rise occurred between March and April (+ 6.13 °C in absolute value and + 30.78% change in growth), indicating the seasonal shift into summer, and the intensity of the strong heat build-up process began in the NCR region. Due to the constant accumulation of heat in April, May and June, with June showing the highest UTCI (33.57 °C), the NCR experienced intense heat stress throughout the summer. However, a slight cooling trend in July and August have been observed due to monsoon rainfall, and when the overall temperature shows a decreasing trend.

This upward trend aligns disturbingly with another dataset: unidentified deaths in the city, often representing the most marginalised (Fig. 5).

- In 2019, total deaths jumped to 5341, aligning with record UTCI levels in the months of June, July and August

- The 2022–2024 period, which recorded some of the highest UTCI values, also saw an alarming 11,819 unidentified deaths in just three years.

- A closer look at the monthly distribution reveals that June, a month that also shows some of the most extreme UTCI levels, consistently records the highest number of deaths each year. In June 2019, for instance, Delhi recorded 657 human deaths, the highest for any month, aligning with a peak UTCI of 34.24°C, indicating strong heat stress.

This clear statistical correlation between elevated UTCI levels in June and peak unrecognized death underscores a vivid pattern (Figs 6 & 7). The prolonged heat stress is becoming increasingly lethal, especially for those with no access to cooling, shelter, or care, specifically victims of homelessness. Therefore, the above relationship reveals that these are not isolated incidents- they reflect a systemic failure to protect the city's most at-risk residents during intensifying heat seasons. The empirical observations also suggest that homeless people lost their lives amid the scorching heat in Delhi. In 2024, a record number of homeless people (192) died due to heat strokes in Delhi from June 11 to June 19, 2024, which is the highest in two decades (CHD, 2024).

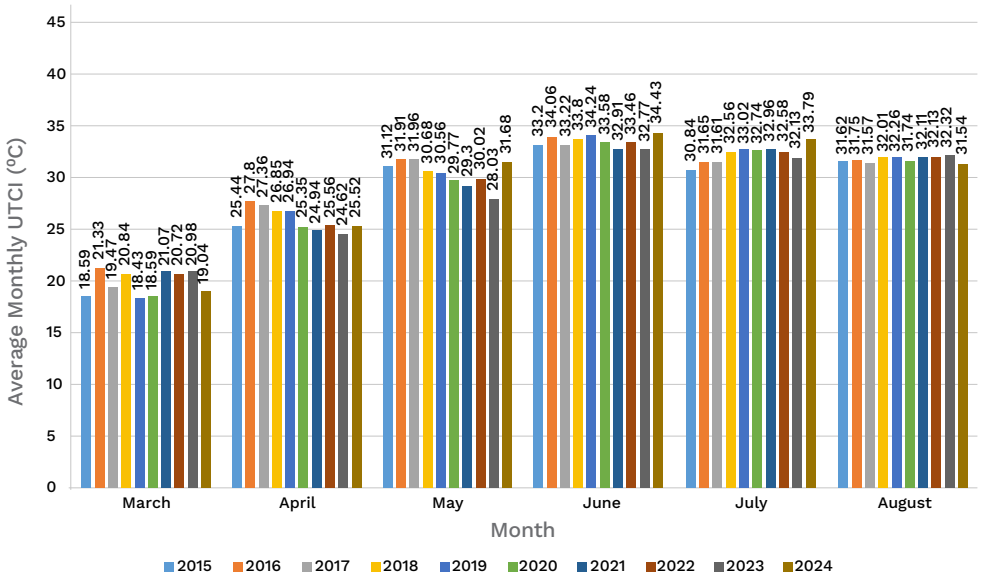

Figure 4: Monthly Variation of Universal Thermal Climate Index in NCR (2015-2024).

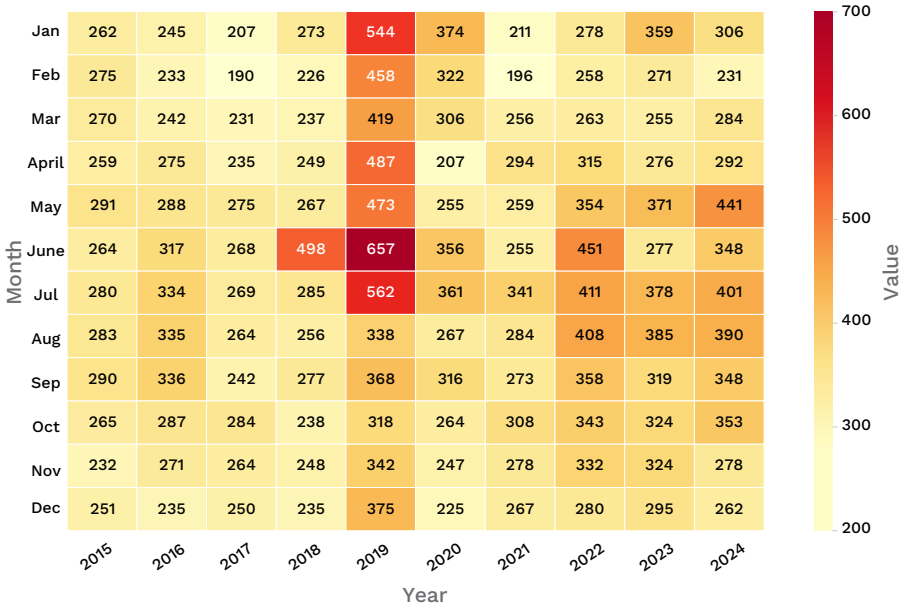

Figure 5: Monthly Variation of Unrecognised Human Death in Delhi (2015-2024). Source: CHD, New Delhi.

[1] It is noticeable that apart from the unidentified deaths due to COVID-19 in 2019 and 2020, there is an increasing trend of deaths in the months of June, July and August over the last 12 years in Delhi.

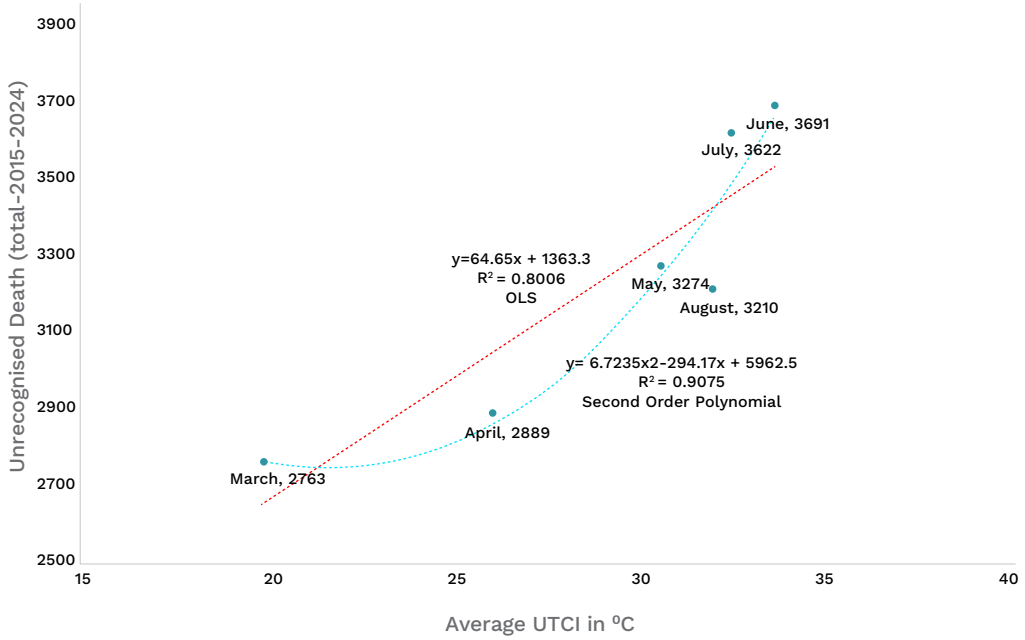

Figure 6: Statistical Correlation between average UTCI and total Unrecognised Deaths in Delhi (2015-2024)

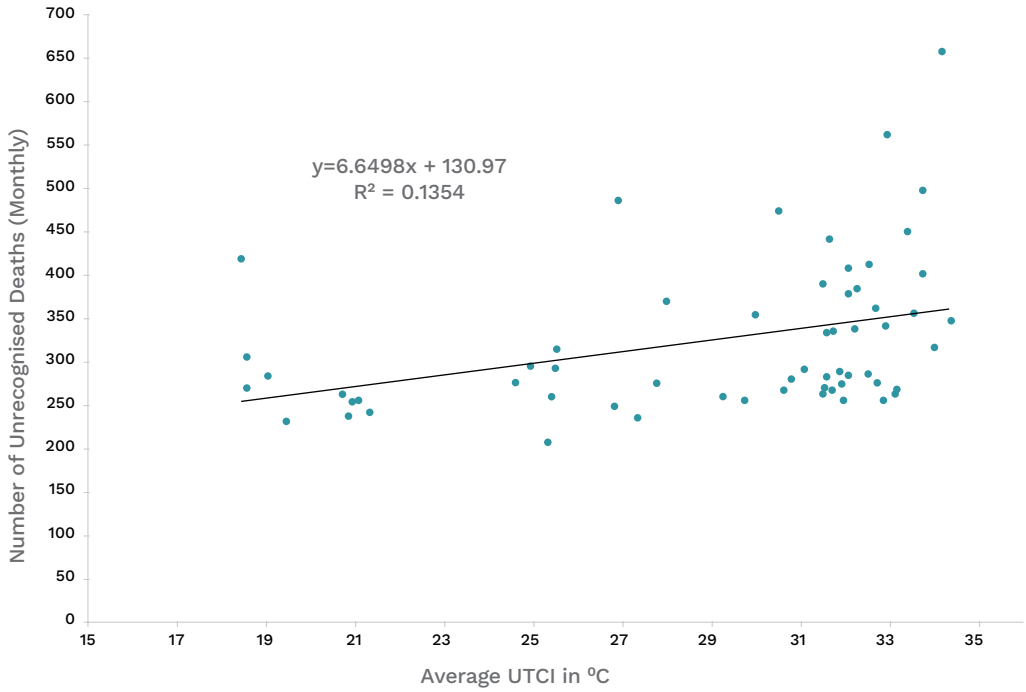

Figure 7: Statistical Correlation between Monthly Elevated UTCI and Unrecognised Human Deaths in Delhi (2015-2024)

6.0 POLICY RECOMMENDATIONS

1. Heat Action Plans must include the homeless population. Current heat action plans often overlook the unique vulnerabilities of homeless populations, who face continuous exposure to extreme temperatures with no access to shelter, water, or basic care. Key actions can include:

    A. Establishing 24x7 sustainable and medically equipped cooling shelters in high-risk urban zones during the hottest months, in close proximity to railway stations, underpasses, and crowded marketplaces, to serve the homeless people, outdoor labourers, the elderly, and other heat-vulnerable groups.

    B. Installing more Hydration Stations (potable water distribution facilities) at public transport hubs, hospitals and other high-risk locations frequented by vulnerable groups.

    C. Mobilising and training community workers or municipal teams to distribute ORS and first aid, while also identifying and educating individuals showing signs of heat stress or heatstroke.

2. Legally Recognise Heatwaves as Disasters - Notify heatwaves as disasters under the Disaster Management Act, 2005, to enable the timely allocation of relief funds, strengthen preparedness measures, and ensure legal accountability. Without this recognition, the vulnerable population, especially the outdoor labourers and the homeless, remains excluded from formal disaster response systems.

3. The urban local bodies need to collaborate with IMD to develop the city's geography-specific high-resolution outdoor heat stress map and implement Early Warning Systems for its residents.

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