Short Original Article

A Study of Consistent Health Impact by Summer Heat on Morbidity and Mortality

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Abstract

Severe weather has always threatened human health. However, climate change is now recognized by the World Health Organization (WHO) as one of the leading global health threats of the 21st century (WHO 2009). In recent years, the many countries have experienced record-breaking summer heat. Climate change models forecast increasing India temperatures and more frequent heat waves in coming years. This scoping review summarizes research findings that characterize morbidity and mortality due to summer heat and identifies gaps in the existing research literature. Exposure to environmental heat is a significant, but overlooked, this small cross-sectional retrospective study found the incidence of illnesses due to summer heat and outcomes.

Keywords: Health morbidity, heat impact, summer heat

Introduction

Severe weather has always threatened human health. However, climate change is now recognized by the World Health Organization (WHO) as one of the leading global health threats of the 21st century (WHO 2009).[1] Recently, one study demonstrated the rise of 20% all-cause mortality at temperature ≥40°C. The study also concluded the spatial variation of all-cause mortality at zonal level with temperature.[2] Global Public Health scenario is changing because of remarkable burden of diseases and mortality due to climate change, especially extreme temperatures. Studies have shown that heat waves are most significant weather-related cause of mortality throughout the world. Evidence-based information from all over the globe revealed that climate change has augmented the threat of temperature-related morbidity and mortality, especially for urban areas.[3] Indian cities also experienced heat waves with a significant mortality rate.[2]

It is widely accepted that climate change is occurring and that it is caused mainly by increased emissions of anthropogenic greenhouse gasses, particularly over the last few decades. Not only has the average global surface temperature increased but also the frequency and intensity of temperature extremes have also changed.[4]

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High temperature has been associated with significant health impacts. The effect of ambient temperature on morbidity is a significant public health issue. Every year, a large number of hospitalizations are associated with exposure to extreme ambient temperatures, especially during the summer period in North and Central India. To estimate the impact of high temperatures and heat waves on morbidity and mortality in North Central India, we explored and documented the morbidity and mortality data at tertiary hospital during the April– July 2016. We used Poisson regression models to estimate the association between daily maximum temperature and rates of all-cause hospital visits and admissions and all-cause mortality. Total admissions were considered and not to be were identified as either a primary or secondary discharge diagnosis. The associations between heat and specific causes of death were not considered as there were insufficient deaths. Accordingly, the goals of this study were to: (a) quantify the association between maximum temperature and hospital visits

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and mortality in a tertiary hospital of a city in North Central India and (b) identify characteristics that may place individuals at greater risk of adverse health effects. We evaluated these goals using population-based data from the hospital covering population of 50 Lakhs of 12 districts in three states have a climate consisting of four seasons with an average temperature of 39.23°C ± 3.8°C during summer seasons of approximately 135 days.[5]

Materials and Methods

A retrospective analysis of the all-cause mortality data was analyzed during 135 days from April 15, 2016, to August 30, 2016, when mean temperature was found ≥39.23°C ± 3.8°C and 230 days from September 1, 2016, to April 15, 2017, when mean temperature <38°C ± 5.2°C was found. Climatic and all-cause mortality data were obtained through J. A Group of Hospitals, G. R. Medical College, Gwalior, Madhya Pradesh.

Results

Mean maximum temperature during summer was 39.23°C ± 3.8°C (range: 45.3°C–33.4°C) for the year 2016 of 135 summer days. Total outpatient department (OPD) patients were 522,683 in whole year and the mean number of OPD patients per day at daily maximum temperature of <38°C was 1365 which increased to 1546 during the daily maximum temperature of ≥39°C. Mean daily all-cause OPD patients shows a significant association with increase of 12.5% ($P < 0.001$).

Indoor patient department per day was increased with rate of 16.6% from 208 to 251 when temperature increased to ≥40°C ($P = 0.001$), and deaths per day at daily maximum temperature of <38°C were 9.8 which increased to 12.5 during the daily maximum temperature of ≥40°C. This shows that 33.3% deaths per day increased when the temperature reached ≥40°C. Mean daily all-cause mortality shows a significant association with daily maximum temperature ($P < 0.001$) [Table 1]. We found increasing morbidity and mortality with relation to rising temperature and conclude that temperature is an important factor affecting all-cause hospital visits for Gwalior city. The association with all-cause hospital admissions was strongest among male of all age groups of socially deprived, poor, and especially belong to urban areas. This also augments the previous findings and is consistent with results obtained in other areas. All-cause mortality is also correlated with the heat index consistent with various studies.[6,7] In addition, urban residents may be exposed to higher temperatures than residents of surrounding suburban and rural areas because of the "heat island effect" resulting from high thermal absorption by dark paved surfaces and buildings, heat emitted from vehicles and air conditioners, lack of vegetation and trees, and poor. Due to the urban heat island effect, people in urban areas are usually at an increased risk of morbidity from ambient heat exposure.[4,8]

Table 1: Comparison of outpatient department, indoor patient department, and mortality with temperature variation

Temperature variations (mean±SD) (total days)	OPD/day (n=522,683), n (%) (95% CI)	IPD/day (n=82,043)	Mortality/day (n=3941)
≥39.23°C±3.8°C (135)	1546.1	251.8	12.5
<38°C±5.2°C (230)	1365.0	208.9	9.8
Percentage difference	12.5	18.6	33.3
P	0.0001*	0.001*	0.001*

*Significant statistically. OPD: Outpatient department, IPD: Indoor patient department (hospital indoor admissions), SD: Standard deviation, CI: Confidence interval

Conclusions

Prolonged exposure to extreme heat can cause heat exhaustion, heat cramps, heat stroke, and death, as well as exacerbate preexisting chronic conditions, such as various respiratory, cerebral, and cardiovascular diseases. These serious health consequences usually affect more vulnerable populations such as the elderly, children, and those with existing cardiovascular and respiratory diseases. Socioeconomic factors, such as economically disadvantaged and socially isolated individuals, are at more risk from heat-related burdens. As global temperatures rise and extreme heat events increase in frequency due to climate change, we can expect to see more heat-related illnesses and mortality. All other factors held constant, and our findings suggest that the current population of North Central India would experience substantially higher morbidity and mortality if maximum daily temperatures increase from 38°C. National, state, and local public health and emergency management agencies need a clear understanding of the health risks posed by excess heat, now and under the warmer temperatures projected for the future.[8]

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Conflicts of interest

There are no conflicts of interest.

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