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Editorial

Extreme Heat Events —A Community Calamity

There is a growing global concern that teeming millions might be at greater risk of death, disease and disability due to extreme heat events in the tropics and other regions. It has been estimated that about 48 million people were affected in Asia during the year 2008, due to climatological, geophysical, hydrological and meteorological events. Despite projection of changing climate and occurrence of increased frequency and intensity of extreme heat events in the coming years, the public recognition of the silent killer remains subdued. The heat-related mortalities that might be grave during a given year in a region do not leave a lasting reminder. For much of the tropical world, including the vast Indian subcontinent, the situation is potentially dire, as these regions continue to witness such community calamity at regular intervals over the centuries.

Besides naturally occurring hot climates, occupational situations, such as open field tropical farming, glass and ceramic production, molten metal operations, and many other hot industrial processes cause heat stress and strain[1]. Risks of heat induced human illnesses prevail, with relative vulnerability to children, elderly, pregnant mothers, and those with pre-existing medical conditions, such as obesity, cardiovascular and neurological diseases. Urban and rural poor dwelling in the slums and pavement, outdoor construction workers, street venders, rickshaw pullers and others, face adverse health effects, due to their low physiological adaptive capacity, lack of awareness of the risks, as well as non-feasibility of adopting any mitigation measures.

Climate change being real and fast happening, the current hot zones will continue to confront with extreme heat wave episodes, and also currently not affected geographic areas might be affected in the coming decades. The World Meteorology Organization defines heat wave when the average maximum temperature is greater than 5˚C above the normal range for five consecutive days. Alternatively, it has been defined as the average maximum temperature exceeding 97.5th percentile level for at least three days, and above 81st percentile level for the entire period. The average minimum temperature may exceed 97.5th percentile level for 3 days. According to Indian Meteorology Department, one category of heat wave includes places where the normal maximum temperature is more than 40˚C. In such regions, the day temperature exceeds by 3 to 4˚C above the normal. When the day temperature is 5˚C or more than the normal, the severe heat wave conditions persist. The other category considers the regions where the normal maximum temperature is ~40˚C, and if the day temperature is ~5˚C above the normal, then the place is said to be affected by moderate heat wave. A severe heat wave condition exists when the day temperature exceeds the normal maximum temperature by 6˚C. Severe heat wave generally does not last for more than a week, but some times it may go up to two weeks. In analyzing the meteorological data, it may be noted that the land surface temperature, a remote measure of the thermal inertia of surface characteristics, is not directly equivalent to the ambient air temperature that measures the thermal inertia of the surface atmospheric components. Undoubtedly, the areas of higher surface temperature contribute to higher levels of localized ambient air temperature[2], however, the relationship between surface temperature and the ambient air temperature is influenced by the wind velocity and condition, and also the land use and land cover characteristics[3].

The nominal ranking of the year 2008–2009 are among the top five warmest years, since the beginning of the instrumental climate records in 1850. The warming is taking place at varying magnitude; for example, some cities of the Asia-pacific regions has ambient temperature build-up at the rate of 0.21 (Ahmedabad and New Delhi), 0.45 (Bangkok), 0.48 (Osaka) and 0.71˚C (Shanghai) per decade, in comparison to the global average temperature increase of 1.8˚C in the past century and 3.0˚C by 2100 according to the report of the Intergovernmental Panel on Climate Change (2007)[4]. That said, the warming is unlikely to be linear for a whole century, since the geographic and meteorological conditions are influenced by urbanization, industrialization, power plants, burning of fossil fuels, and green gas emissions.

Reviewing heat wave events to the extent of elevated ambient conditions elucidate the heat related morbidity and mortality in a region. The strategic options to recognize the fundamental nature of extreme heat eventualities are the heat adaptability and biological monitoring, along with epidemiological cross correlation between chronic heat exposure and susceptibility of persons to heat disorders. This takes into account the modifying factors that (a) increase biologic sensitivity or reduce resilience to heat (e.g., age, gender, body composition, pre-existing disease, or genetics), (b) determine adaptive capacity, human behavioural pattern in built environment or outdoor locations, and (c) socio-economic factors that influence biological response and exposure. In essence, the population vulnerability assessment depends on multiple determinants, including biological, environmental, behavioural, social, and economic dimensions[5]. In heat wave episodes witnessed in Europe and northern America in the recent time, most of the victims were elderly who stayed isolated in indoor environment. In contrast, the vast labouring population in the tropical countries who have been engaged in rural farming and other informal occupations are subjected to extreme heat exposures outdoor. The context of climatic threat on human health and wellbeing, and economic and social costs as the indicative measures of vulnerability assessment may be differently viewed to different regions of the developed and the developing world. Also, under-nutrition and environmental heat are interrelated to affect human health, since the effective heat load on the body is relatively high in low calorie intake persons. Unpredictable heat waves may change geographic risk in certain regions; many remote rural settlements may be grossly devoid of artificial sources for cooling of living areas, thereby making the regions more vulnerable to heat extremes. Therefore, there is recognition of the role of the internal control authorities and the public health agencies to combat negative impacts of climatic events by implementing surveillance system, for tracking cases of heat-related emergencies.

Integration of geo-spatial and enviro-climatic information, socio-economic data, health outcome and wellbeing measures has been emphasized in planning response to heat wave[6]. The long-term goal is to evolve a practical tool to better prepare for heat related eventuality and tailor intervention measures for spatial examination of vulnerability[7, 8]. The US National Oceanic and Atmospheric Administration has provided data on geo-spatial mapping of seasonal and intra-daily climatic variations across countries[9]. The web-based spatial On-line Analytical Processing has the potential to apply in the surveillance of climate related health vulnerabilities, integrating with the epidemiological data[10, 11]. However, climate modelling with respect to physiological indicators is a research challenge. An example may be drawn that the environmental warmth depends on the environmental characteristics and anthropogenic activities, and the relationships between the environmental, physiological and biophysical descriptors yield dimensions of stress and disorders of the population involved.

The meteorological descriptors treated over the past decades might also elucidate interplay of the physiological and biophysical variables, in terms of environmental warmth indicators, e.g., WBGT index. Therefore, convergence of dimensions has obvious priority in arriving at robust relationships between spatial, demographic, biophysical, and environmental factors. In other words, if the physiological and biophysical descriptors are coincident to geo-spatial and enviro-climatic distribution, the approach may represent a step towards recognizing the risk potentials of the respective population. Prediction of sweating response of a vulnerable population group in a heat-prone region can be an indication to introduce, for example, fluid supplementation programme in a region, in order to avoid dehydration and heat exhaustion of the exposed population.

The extent to which the climatic change factors may prove determinants of health impairments, safety consequences and productivity impacts in the tropical low and middle income countries now or in the future remains speculative. The respective roles of the Government, regulatory and standards agencies, employer organizations have been delineated to take up measures of mitigation towards rural and urban area development, housing and shelters, industrial hotspots, transport systems, public health care services. The occupational and environmental health researchers and practitioners have obvious targets to generate experimental data from the heat exposed population from the community and work environment, with reference to morbidity of heat disorders and possible impacts on productivity. The endeavour may aim at the immediate needs to develop and apply feasible preventive interventions, such as research and planning on public and occupational health programmes, exposure optimization, clothing designs and preferences, and the like. To this, our own commitment to the challenge to accomplish the research agenda in bringing better adaptation and mitigation measures to protect all those at risk bears significance.

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