

The urban heat island (UHI) effect a final common pathway for heat stroke

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Abstract

Aim: Heat wave may be the most essential but not the only deciding element for heat related disorders especially heat stroke.

Background: Urban heat island is a metropolitan area that is significantly warmer than its surrounding bucolic areas due to ecological manipulation by humans. It is very difficult to document and recognize the agony of peoples of Karachi city which they suffered in summer 2015 during the heat wave episode. The concept of Urban Heat Island (UHI) effect is presented and elaborated as an attempt to realize the sheer magnitude of the torment inhabitants of Karachi tolerated.

Material and Method: The city of Karachi faced an exhausting heat wave and its repercussions in June 2015 with huge terrible outcome. We took help for meteorological department and also our ward registry to collect patient data retrospectively.

Results: Between 21st - 23rd June, 2015 the temperature remained at 45°C during day time and 36°C during night time and humidity up to 59% and wind 11 km/h. During the period, 78 patients were admitted with heat stroke in Department of Medicine Unit II Jinnah Post-graduate Medical Karachi (A tertiary care center). Mortality rate was as high as 54%. These statistics give a grim picture of what the city faced during those three days (21 June – 23 June) in the summer 2015.

Conclusion: Urban Heat Island (UHI) effect is a real time phenomenon heat felt by city dwellers.

Keywords: climate, pollution, population, density, urban area, Urban Heat Island

Introduction:

It is estimated that approximately half of the world population lives in metropolitan areas and this is expected to increase 70% by 2030. This has its own ramifications on ecologic system like pollution, non-desirable alterations in physical and chemical properties of system and bad impact on raw soil.^{1,2} Urban heat island is defined as rise in temperature of manmade areas resulting in well-defined locally warm urban islands among the “cool sea” of lower temperature in surrounding areas that is the natural landscape.³ Urban heat island has deleterious influence on biomes.

Natural surfaces of raw soil which are often composed of vegetation and plants have a moisture

trapping function which promotes evaporation. In urban areas, most of this raw soil is replaced by human built surfaces, resulting in a large amount of radiant heat inhibiting all these functions.

There are multiple reasons why urban heat island effect is generally seen in a metropolitan area like Karachi. Heat in these areas is generally contributed by all the people living there, houses, shops, industries, cars, buses and trains with a lot of activity including heat generation, pollution, stress on water and power supply etc.⁶

These are the density populated areas with peoples close to each other. Houses and buildings are also densely constructed especially vertically where space is short (very true for Karachi).⁷

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Table 1: Breakup of Patients from various areas of Karachi (n = 78)

Places	Number of Patients
Korangi	10
Mahmoodabad	10
Malir Khokrapar	9
Landhi	7
Shah Faisal colony	7
Akhtar colony	3
New Karachi	3
Azam Basti	2
Baghdadi	2
Bismillah Colony Orangi	2
Muhajir camp	2
Orangi Town	2
Quaidabad	2
Guru Mandir	1
Hari pur Colony	1
Hub Chowki	1
Ibrhaim hyderi	1
Industrial area	1
JPMC Baldia Town	1
Kemari	1
Memon Goth	1
Millat Garden	1
Moosa Colony	1
Muzaffarabad	1
Natha Khan	1
Nazimabad	1

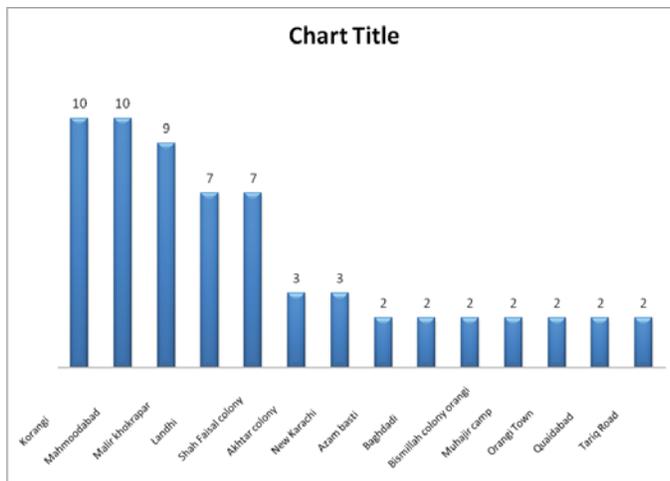


Figure No. 1 of Patients from Different Area of Karachi

This results in heat remaining trapped between the shielded buildings. Also buildings, houses and parking areas resist air flow which results in ineffective heat dissipation. All these phenomena result in raised day and night temperatures

and cause physical and mental stress to the people, resulting in a compromised environment overall.

Air conditioners are essential support for these metropolis dweller but they result in a 2°C raise in atmospheric temperature. The electrical supply is subject to rolling blackouts or power outages. Thus air-condition can betray people who are in high insulating buildings.⁹

There is need of green roofs plantation as a step to decrease major pollution. Other steps include light color buildings with lighter colour which will help to reflect rather than absorb the heat.¹⁰

Results:

Temperature and people status is shown in Figure 1 while and Table.1 shows that most of people were from centre of the city and none of the patients belonged to city suburbs. The results clearly demonstrates the catastrophic impact of urban heat island on centre of city whereas suburbs were spared. In our study, rural areas and surroundings of Karachi city were spared as no patient was reported from these areas. These areas also faced the same brunt of heat wave number of patients reflected while there is indiscriminate affection city dwellers. No. of patients from difference area of Karachi.

There were a total of 78 patients who were admitted to Medical Unit.II, JPMC, Karachi. All patients were from downtown Karachi. Among them 51 (65.3%) were male and 27 (34.6%) were female. No patient were reported from suburbs or rural areas. Out of 78 patients 42 (53.8%) died. Mortality rate was thus well over 50%.

Discussion:

The urban heat is largely related to excess amount of heat generated from rapidly heat acquiring urban surfaces. The construction of building, asphalt, bare soil and lack of plantation all continue to cause high day time temperatures. There is no significant fall in temperature during night time. Hence, there is no relief to the population even at night and no nocturnal relieve to the

people in such high temperature.

The concept of urban heat Island is now very well accepted phenomenon which is one of the most adulterated climatologically aspect of human modification in echo system. Massive urban migration greatly contributes to urban heat island and it is one of the undesirable consequences one faces when opting to live on a concrete jungle.

The purpose of this research paper is to document the urban heat island phenomenon and its repercussions on the city of Karachi which is struck by a heat wave in June 2015. It is comprehensive description of Urban heat island effect. urban heat island phenomenon happens regardless of seasonal variations throughout the year. It usually varies with time and space and mainly a result of meteorological conditions and degree of urbanization which is in turn related to the unique characters of each city, in our case Karachi.

It is linked to progressive change in natural surfaces such as loss of vegetations and moisture trap due to construction of roofs of buildings through urbanization which impair the natural process of evaporation which is involved in natural cooling.

Narrow and crowded arrangement of buildings along city streets result in an urban canyon's which hinders the escape of heat from surface to space. This capture heat results in urban heat island effect. Urban heat island effect runs parallel with meteorological factors asclond, humidity, sunlight precipitation and wind speed. Excessive heat trap resulting from ill ventilated outdoor or indoor spaces of residential and commercial buildings with poor thermal insulation, creates a dramatic increase in temperature. The net effect of this phenomenon is seen to increase the temperature about 0.5-3.5°C in areas of urban heat island compared to surrounding suburb an areas. These events especial take a toll on the ecosystem in wake of a heat wave which exploits the phenomenon. Urban heat island phenomenon

is an ideal situation for a heat wave. 0.5-3.5°C increase in only seen due to urban heat island which is not seen in surrounding suburb areas

Conclusion:

The study was done to investigate the urban heat island effect due to changes in land use/land cover of an ecosystem over time. Urban heat island increase the severity of heat waves in Karachi. Urban heat island is providing ideal conditions for heat waves to exert maximum effects the Karachi has a dense population, erratic construction of houses, roads, streets parking, industries, power and water features. Karachi city is on the edge of an ecological disaster. What we seen last summer is just tip of iceberg and situation can be more even worse in a coming days and years, with maximum mortality and morbidity. Urban heat island is the final common pathway for catastrophe which starts with heat wave. A number of personal, local and general factors all combined together to end up in a climate which is practically incompatible with life. This un-recognized, difficult, under-estimated condition is sufficient to alert decision makers and take urgent steps

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Role and contribution of authors:

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