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Impact of Climate Change in Human Health in Solapur, Maharashtra

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Abstract

The present paper studies the impact of climate change on human health in Solapur. The Solapur district is one of the five districts of Pune division. Solapur district ranks 6th in area and 8th in population amongst 36 districts in the state. The Solapur district comprises of an area of 1489 sq, which is 4.88% of the total area of the states as per 2011 census. It lies between 17^0 10'N to 18^0 32' N latitudes and 74^0 15' E longitudes.

The climate of district is agreeable and free from extreme of heat or cold. There are very little variations in the climate in different parts of the district. Maximum temperature of the city reaches 45^0 c. in summer and minimum temperature during winter season falls down 13.50 Temperature rise to 45.3$^{0\,c}$. The temperature is generally mild in March, April and May is the hottest months when temperature rise to 45.3$^{0\,c}$. Due to these changes environmental condition is also changing which affect the human health adversely. Health is an important aspect of human life. Good health or ill health is related in several ways to different environment situations. Physiographic, drainage and climate are the important factors influencing the human health. The paper aims to find out the relation between monthly rainfall, temperature and number of deaths in cities of Solapur district.

The present study is based on secondary sources of data like census records, govt. publications, Gazetteer and socio-economic abstract of Solapur district. The result shows that the maximum deaths occur in rainy season that is in the month of august and September and in early winter season when the temperature is less and precipitation is more. In Solapur district cholera, epidemic breaks in the rainy season. Major small pox deaths occur in the late winter and early summer season when the temperature is highest.

Key Words: Climate change, relation between Rainfall, Temperature, Human Health and Waterborne Diseases Drainage pattern and Causes of Deaths.

Introduction:

Climate in the district as a whole is agreeable and is characterized by general dryness except during the monsoon season. The cold season from December to about the middle of February is followed by the hot season which lasts up to the end of May, June to September is the south- west monsoon season while October and November constitute the post monsoon or retreating monsoon season.

The average annual rainfall of the district is 584.3. The south eastern part of district gets slightly more rainfall then the rest of the district. Most of the rainfall is received during the south-west monsoon in the menthe from June to September. This account far about 74% of the normal annual rainfall. About 17% of the rainfall in the district is received in the post monsoon or recreating monsoon season. The variation annual rainfall from year to year I large.

May is the hottest month of the year. The heat during the summer is intense and the maximum temperature may sometimes go up 44^0 or 45^0 c. After the withdrawal of the south-west monsoon, early in the October day temperature increase slightly but night temperature steadily decrease. After mid November both days an night temperature begins to drop rapidly and December is the4 coldest menthe. Except during the south-west monsoon seasons, the daily range of temperature is quite large.

Except during the monsoon season, the air is generally dry. Winds are light to moderate in force with some strengthening during May to August. Thunder storms occur during the period from March to October, the highest incident being in June and September Dust storms occur occasionally in the hot season.

Study Area:

Solapur district lies entirely in the Bhima basin: a major tributary of River Krishna. It lies between 17^{0} 10'N to 18^{0} 32' N latitudes and 74^{0} 42' E to 76^{0} 15' E longitudes. The district is surrounded by Ahmadnager district to the north, Dharashiv district to the north-east, Sangli district to the south-west, Sangli district to the south-west Satara district to the west Pune districts to the North West. It is a part of the Deccan Plateau.

Solapur district has an area of 14895 km^{2} and total population of 38, 49,543 as per 2001 census. It ranks 6^{th} in area and 8^{th} in population amongst the 35 district in the state. The river Bhima is the main river of the district. On an average the climate of the disgrace is dry and comparatively extreme. The summers are hot and the winter is warm. In summer mean maximum temperature rises up to 40.7^{0} c, while in winter it decreases up to 17.1^{0} c. The rainfall throughout the4 district is scanty and uneven. The annual average rainfall of the district is 677 mm (fig.1).

Present study includes the ten cities of Solapur district namely Solapur, Barshi, Karmala, Kurduwadi, Mangalvedha, Pandharpur, Sangola, Maindargi, Dudhani and Akkalkot. These are located at different parts of the district. They represent different Physiographic units also. Three tahasils of the District namely. Malshiras, South Solapur and Mohol do not have any urban center.

Objectives:

The present paper aims at

- To study the distribution of diseases in relation to monthly rainfall, temperature and number of deaths existed in the different cities of the Solapur district.
- To prepare map of relation between month rainfall, temperature and nimbler of deaths in cities.
- To study of Waterborne Diseases in Solapur district.

Database and Methodology:

The study is based on secondary sources of data. The data relating to various aspects of climatic like temperature, monthly and annual rainfall has been obtained from the socio economic abstract of Solapur district for the year 1881, 1991 and 2001. The details of morality and wherever possible morbidity statistics is collected from the records of te municipal corporation and municipalities located in the ten cities of the district. The data used in the analysis of year 2000 to 2009 for 11 tahsils has been collected from the local weather report of Solapur. A map of relation between monthly rainfall temperature and number of deaths n cites of Solapur district is prepared. The tehsil wise number of rainy days and total rainfall is collected from the records of the District Agriculture office for the year 2009-2010.

Drainage:

Drainage plays a vital role in the distribution of the infectious waterborne disease in a region. Of all the environmental factors, water perhaps is the single most important factor that has always played a prominent tale in the spread of infectious diseases. The role of rivers in the spread if disease is important.

The Solapur district lies in the basins of River Bhima and her tributaries. Most of the Malshiras tahasil in the west drains northwards into the Nira River, which joins into Bhima at the western part of the district. The Bhima river which flows to the south east direction through the district has tahasils Karmala, Madha, Pandharpur, Mohal and South Solapur and at the left banks, while tahsilas Malshiras, sangola, Pandharpur and Mangalvedha are situated at the right banks' The river Sina, a major tributary of the Bhima river flows in south east direction, parallel to the Bhima in Karmala, Madha, Barshi, Mohal and Solapur North and Sokuth Solapur tahasils (fig.3). The Solapur district has average altitude 500 meters above the mean sea level. All of the rivers are non perennial. Most of the surface comprises of law relief, with shallow basis of tributary and small streams become dry just after the wet season, while the major rivers have water up to March.

Major River Basinas of the Study Region:

River	Length in Kilometer
Bhima	289
Nira	48
Man	80
Sina & Bhogavati	177

There are 40 tanks within the district, some of which are used for irrigating the farmlands. Most of tem of them lie in Barshi and Sangola tahasils in the foot- hill Zone of the Baalaghat range. Most of the tanks in the district serve as the natural severs. They contain suspended materials including silt and clay particles as well as algae in large number which invite number of diseases. Dysentery, Diarrhea and cholera are the major waterborne diseases found in this district and the mortality rates are comparatively higher in the low-lying floodplain areas of the Bhima basin.

Climate:

The climate factors also influence the health directly as well as indirectly. "It's chief elements are Solar radiation (temperature) air movement (wind is pressure etc.), moisture (humidity, fog, dew etc.) precipitation (rain, snowfall etc.) which have direct influence on activities" (Mira 1970).

The climate of Sholapur district as a whole is agreeable and is characterized by general dryness in the major period of the year. In summer maximum temperature rises above 40^0 c and in winter the minimum temperature is 14.8^0 c. The rainfall throughout the district is scanty and unevenly the annual average rainfall of the district is 677 mm with only 42 rainy days. However the frequency of drought as is high. The data of rainfall for 50 years shows that only 27 years had average rainfall. There is a high frequency of breaks during the monsoon period the data of last 50 years shows that at least 20 breaks with duration of 70 weeks in a decade are experienced.

The southwest monsoon begins in the month of June and more than 802% of annual rainfall occurs in 4 months via June, July, August and September, while in the early winter months amount of rainfall decreases sharply. It has been found that number of death starts increasing but the onset of monsoon and it decreases when amount of rainfall starts declining. The city shows more number of deaths during rainy season. The waterborne diseases like dissent and diarrhea start increasing by onset of monsoon. The graph shows the positive relationship between monthly death rate occurring throughout all months of the year, the percentage of deaths occurring during rainy season is comparatively more than in non-rainy season of the year. Amongst the chief elements of climate, rainfall alone can modify the health of man and society. The monthly distribution of rainfall may affect the seasonal distribution of waterborne diseases or for many related diseases.

The relation between temperature, rainfall and number of deaths in different cities of Solapur district have been studied and shown in Figs.3 and 4. These maps show the variations of climatic condition so that the deaths are also varying from place to place and from season to season.

The maximum deaths occur in rainy season i.e. in the months of August and September and in early winter season when the temperature is less and humidity is more. Fig.4 shows that maximum deaths occur in August and September months when the average monthly temperature ranges between 28^0 C to 29^0 C Whereas 34% to 38% of the annual rainfall ills observed in Solapur city. The Maximum deaths in Pandharpur, Akkalkkot and Kurdawadi cities also seem to the occurring in rainy season and in early winter season. The maximum deaths in these cities occur in August and September when the average monthly temperature is 26^0 c with 28^0 c with 22% to 34% of the annual rainfall. ln Solapur district cholera epidemics breaks n the rainy season.

Fig. 4 shows the correlation between temperature and number of deaths in Mangalvedha, Sangola, Maindargi and Dudhani cities. This map also shows the maximum occurrence of deaths in the months of August and September when temperature is less and amount of rainfall is more. The major infectious diseases are predominating in high rainfall, high humidity and unhealthy climate. The records of past two decades spew that the epidemic of cholera has been regular feature in this district. In the year 2022-23 major swine flu deaths occur in the lake winter and early summer season when the temperature is high. The maximum cholera and jaundice deaths occur in rainy season. The epidemic of cholera has been regular feature specially Sangola, Pandharpur, Akkalkot, South Solapur, Mohol and Madha which are situated on the river banks. Contaminated stagnant water is responsible for these waterborne diseases. (Table no. 1)

Table 1: Number of deaths due to different causes

Sr. No	Courses of death	2021	2022	2023	2024
1	Gastro enteritis	34	30	31	26
2	Typhoid	15	16	13	09
3	Respiratory diseases	629	518	641	332
4	Accidental deaths	575	860	481	371
5	Tuberculosis	--	538	556	463
6	Malaris	10	04	07	06

Solapur city experienced the epidemic of cholera in the year 2021 (from February to April) due to i) Alternate day water supply for last 140 years ii) Parallel drainage and Sewage lines iii) Leakage of contaminated sewage water iv) Low pressure of water supply. Therefore people dig pits near the houses to get more water. These pits are filled with sewage water especially in the slums. The contaminated water has created the spreading of disease even in posh localities of the city.

The distinct is situated in lower Bhima valley, 3 types of soils are present in the district: The irrigated soils of Bhima basin have a problem of water logging at places. This helps to provide breeding grounds of mosquitoes & others vector born diseases. These areas are prone to waterborne diseases and malaria.

The monthly average the number of deaths is shown in table 2. It is observed that the number of rainy days in the district caries between 33 and 61. The pattern of rainy days roughly follows the pattern of annual rainfall suggesting that occurrence of more rain is mainly because of large number of corresponding rainy days. In Barshi tehsil the annual rainfall recorded is 668 k mm which is mainly large number of rainy days that is 61. Table 2 shows the tehsil wise number of rainy

days a total rainfall recorded in mm in the year 2009-10. In Solapur district the annual rainfall recorded is 652 mm there are about 45 rainy days. In the year 2009-10 heavy rainfall areas of Barshi and Madha there are about 61 and 54 rainy days. In semi areas there are about 33 to 40 rainy days while in the average of moderate areas the number of rainy days varies between 44 and 50. The average annual rainfall of the district.

Table 2: Tehasil wise number of rainy days and total rainfall recorded in mm year 2021-2022

Taluka	No. of rainy days	Average rainfall	Rainy days	Rainfall recorded	Percentage of rainfall
Karmala	153	541	46	561.3	103.752
Makha	153	534.4	54	606.3	113.454
Barshi	153	596.5	61	667.9	111.97
N.Solapur	153	617.3	50	674.2	109.218
Mohol	153	573.9	38	521.4	89.2838
Pandharpur	153	573.7	44	726.2	126.582
Malshiras	153	463.4	38	788.7	170.199
Sangola	153	462.6	40	667.0	144.185
Mangalweda	153	519.8	33	723.9	139.265
S.Solapur	153	617.3	50	674.2	109.218
Akkalkot	153	676.3	39	567.2	83.8681
Didtrict	153	561.47	44.82	651.75	116.076

Source: District agriculture office

Is 652 mm which is less than the average rainfall of Maharashtra (1450 mm). The main problem of states rainfall is its spatio - temperature diversity. Added to this there is large variation in the total rainfall in each Geographical division from the year to another, causing floods or droughts. In Solapur district the average rainfall is 652mm most of which falls during southwest monsoon season.

Conclusion:

The present study can give a picture regarding climate and its effects in Solapur, many positive correlations have been established

- Low line areas gentle slope ultimately result in water stagnation due to which the spreader of diarrhea, dysentery and enteric fewer is more. Use of unsafe and contaminated water of public tap, improper disposal of sewage and lack of personal hygiene lead to spread the water borne diseases in city.
- Major cities are located near riversides
- Waterborne diseases are more common in the lowlands-river plains.
- More deaths are recorded during rainy season and early winter season. The low temperature, high humidity is responsible for unhealthy weather conditions. Maximum deaths occur in the month of August and September. However there is Declining death rate because of-
- Increased medical facility
- Awareness of people
- Eradication of tuberculosis- Solapur city has fewer death rates Compared to other cities in the district
- Lack of safe drinking water is major reason of waterborne diseases in the cities.
- Geological conditions also play important role in contamination of water.
- Due to dry climate and low humidity and more percentage of dust particles in air respiratory disease are more e.g. Bronchitis, Pneumonia may lead to death.
- In rainy season, cholera prevalence is more. Due to improved medical facilities, the disease is under control at present. As large number of people gather for Pandharpur fair, the cholera-break in the city is obvious.

Suggestions:

- Need of safe drinking water-uninterrupted water supply.
- Drainage lines and sewage lines should be away from each other.
- Small cities have open drainage system-leads to growth of mosquitoes throughout the year.
- Diarrhoea is water borne disease which is largely prevalence in Solapur city because the people of this city use the polluted water from the Bhima River.
- Shortage of water in dry season and contamination of public water sources in rainy season might be responsible for the spread of dysentery.
- Controlling this air pollution by industrial effluents at the low level and supplying the sufficient and filtered chlorinate safe water for drinking purpose may lower the intensity of the existing diseases of these cities.

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Conflicts of interest
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