[FIRST DRAFT ONLY]
Sub-theme VI: Weather, Climate, and Health

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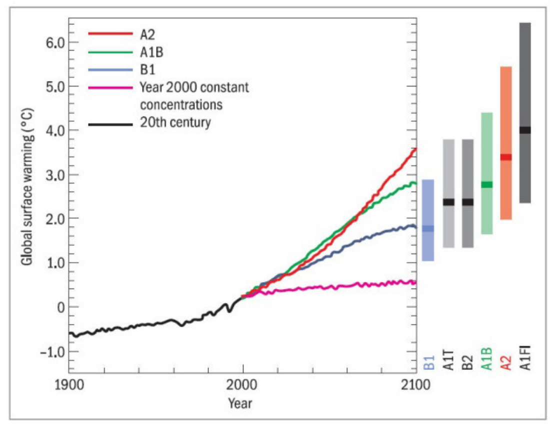
1. Background

Climate implies meteorological weather conditions including wind, temperature, precipitation, snow, and clouds that characteristically prevail in a particular region, calculated by averaging these weather conditions over an extended period, usually at least 30 years. Weather describes a phenomenon that can change quickly from hour to hour, day to day, season to season and year to year at a given location or region, even within an unchanging climate.

Weather and climate influences environmental and social determinants, and in addition, it affect health of the living beings. Health is a state of complete physical, mental, and social well being and not merely absence of disease. Public health depends on availability of enough food, safe drinking water, a decent home protection against disasters, a reasonable income and good social and community relations (WHO, 2003). Weather and climate, thus, have direct and indirect relationship on human and animal health.



Global average warming relative to 2000 and projected to 2100 for three IPCC scenarios

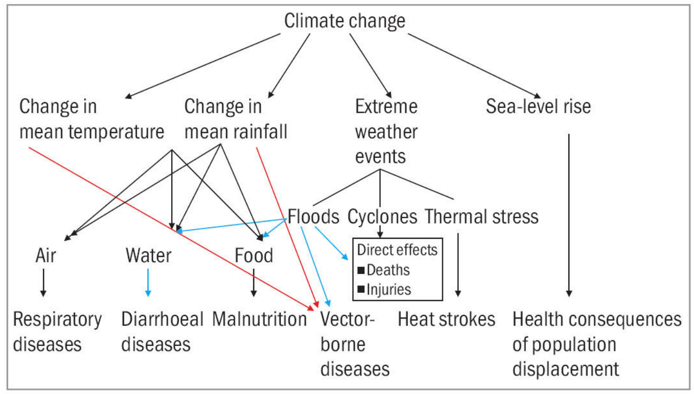
Note Vertical bars on the right show best estimates and ranges for six emission scenarios for 2100

Source *IPCC Fourth Assessment Report*

Climate change associated with global warming has already triggered weather changes (from flooding and storms to heat waves and droughts), which are taking a heavy toll on people's health around the world. Over the Indian region, the observed temperature during 1901 to 2008 indicated a rising trend at a rate of 0.52°C in 100 years. Over the Indian region, there have been significant rising trends in the frequency and magnitude of extreme rains during the monsoon season. Climate change leads to health consequences through pathways of direct exposures (e.g., extreme heat), indirect exposures (e.g., changes in water, air, and food quality), and social and economic disruptions. Thus, climate change produces a dynamic system where a change in one condition exerts influence in multiple pathways with associated health consequences (Michael *et al.*, 2012).

Climate change studies have shown that heat waves and higher temperatures can lead to an increase in serious air pollution that may cause respiratory, cardiovascular and cancerous diseases to people living in the urban and industrial zones. Heavy rainfall, floods, or droughts occurring frequently are threatening global safety, drinking water supply and food security leading to an increase in malnutrition, hunger, and famine.

The changes in environmental temperature, air humidity, and rainfall patterns are increasing the sensitive of vector-borne diseases such as malaria, dengue, chikungunya, Lyme disease, Japanese encephalitis, diarrhea, kala-azar, filariasis and cholera and the likes. In addition, natural disasters and abnormal weather phenomena can cause chronic stress disorders and many other psychological or mental health problems. Sea level rise resulting into the land loss, infrastructure damage, and a reduction in farming productivity may lead to increasing forced migration and several other socio-economic problems. Climate change also affects infrastructure of public health care systems (Bush *et al.*, 2011; Tuan, 2013).



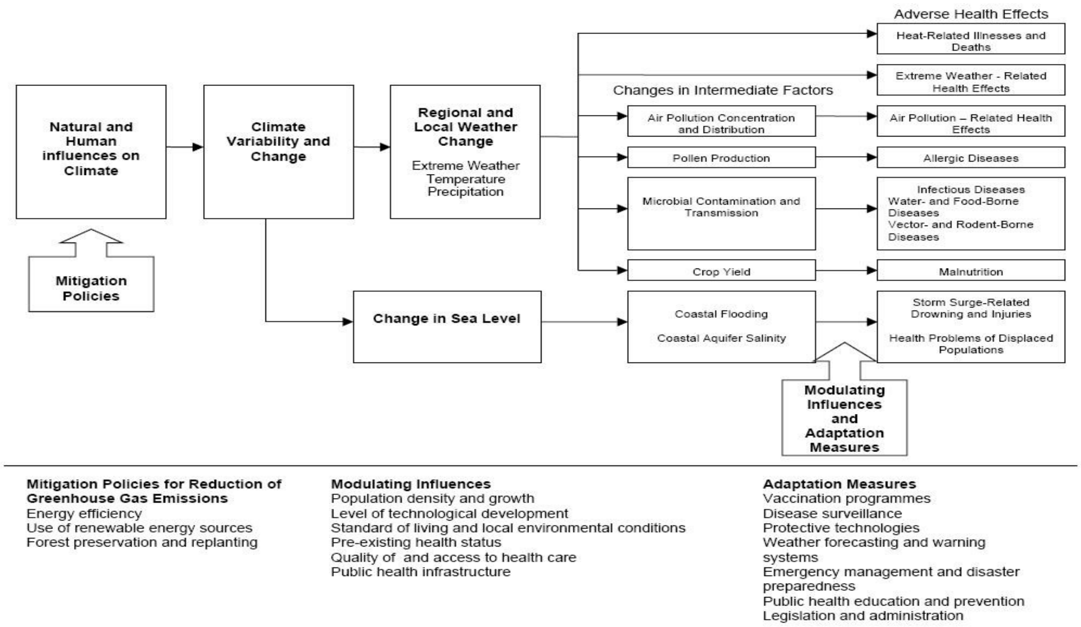
Dogra–Srivastava Framework for Climate Change and Health Outcomes

Relationships between year-to-year variations in climate and infectious diseases are most evident where climate variations are marked, and in vulnerable populations. Elder people, children, economically weaker, and especially women living in the undeveloped areas are the most vulnerable and sensitive to climate change. The El Niño phenomenon provides an analogue for understanding the future impacts of global climate change on infectious diseases.

Climate change will have a wide variety of health impacts, many are predictable, but some are not. Higher maximum temperatures will lead to increased heat-related deaths and illnesses and contribute to an extended range of some pest and disease vectors. In some areas, there will be increased severity and frequency of droughts leading to forest fires; in other areas, more intense rainfall will lead to slope instability, flooding and contaminated water supplies. More intense, large-scale cyclones will increase the risk of infectious disease epidemics (e.g., via damaging water supplies and sewerage systems) and cause the erosion of low-lying and coastal land through storm surges. Indirect effects of climate change will occur from economic instability, loss of livelihoods and forced migrations.

In light of the fact, that weather and climate have potential impact on the health of human beings and animals, child scientists are expected to understand the causative factors, the concerns arising and the corrective measures that can be adopted to lessen the adversity. Ailments like vector-borne diseases, infections and infestations, water and / air borne diseases, zoonosis, emergence and reemergence of certain diseases which are influenced by the variability of weather and climate are some of the areas to ponder upon and take up the study.

2. Framework



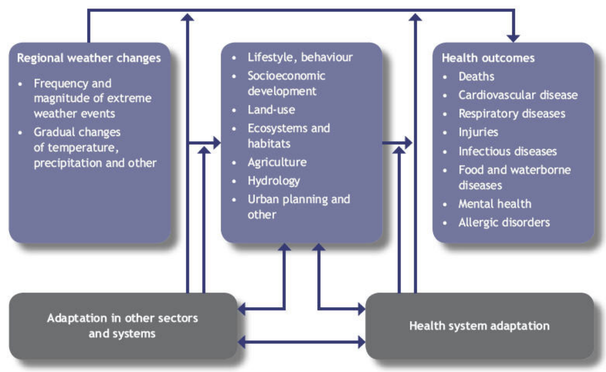
Potential health effects of climate variability and change from Haines and Patz[1] JAMA, 7 January 2004, Vol 291, Page 10. Copyright© (2004) American Medical Association.

a. What is to be understood?

Weather and Climate: India has a unique climatic regime with two monsoon seasons (south-west and north-east), two cyclone seasons (pre- and post-monsoon), hot weather season characterized by severe thunderstorms and heat waves, and cold weather season characterized by violent snowstorms in the Himalayan regions and cold waves. Heavy to very heavy rainfall during the monsoon season (June–September) often cause floods over many parts of India. Similarly, strong winds, heavy torrential rains, storm surges and astronomical tides associated with tropical cyclone are also prevalent over the coastal belt of India mainly during the pre-monsoon (April–May), early monsoon (June), and post-monsoon (September– November) periods. These disasters often results in epidemics.

Health: Weather and climate have both direct as well as indirect bearing on human and animal health. Climate disasters such as floods and droughts affect health and lead to social and economic disruption. They, more often than not, directly result in mortality and morbidity and may indirectly lead to an increase in the transmission of communicable diseases as well as damages to local infrastructure, displacement of population and ecological change. The majority of disasters occur in regions where infectious diseases such as malaria and dengue are either endemic or have a high endemic potential. Presumably, the impact of communicable diseases is often very high in the aftermath of disasters. However, the increase in endemic diseases and the risk of outbreaks are rather dependent on other different factors also, such as population movement and water as well as sanitation facilities that work synergistically to increase mortality resulting from communicable diseases.

Relationships: Extreme conditions such as heat wave and cold wave, drought and flood, storms and strong winds, have a greater impact on health of animals and human beings. The current burden of disease due to climate sensitive health outcomes, including but not limited to diarrhoea, vector-borne diseases, malnutrition, deaths due to floods and landslides, and cardiovascular diseases in cold waves and heat waves, is considerable.



(WHO, 2005)

During summer, most regions in India experience episodes of heat waves every year causing sunstroke, dehydration, and death. An analysis of daily climatological heat index (HI; combining temperature and humidity) over 41 districts well distributed over the country indicated that maximum HI exceeding 45°C characterizes many districts during March to May and June to September. On the other hand, the wind chill index (combining temperature and wind speed) is less than 10°C for a very few districts in northern India mainly in winter (January–February) and the post monsoon season (October–December). Different climatic conditions create favourable conditions for the transmission of vector-borne and enteric diseases.

b. Why is it important?

The potential health impacts of climate change are immense and managing the health impacts thereby is an enormous challenge. It is widely acknowledged that climate change is only one of many important factors influencing the incidence of infectious diseases and their effects are very unlikely to be independent of socio-demographic factors (e.g., human migrations, transportation, nutrition), or of environmental influences (e.g., deforestation, agricultural development, water projects, urbanization).

> Extreme high air temperatures contribute directly to deaths from cardiovascular and respiratory disease, particularly among elderly people. Urban air pollution causes millions of deaths every year. Pollen and other aeroallergen levels also increase triggering asthmatic bouts (WHO, 2014).
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> A report from the Ministry of Health and Family Welfare estimates that waterborne diseases affect nearly 40 million people, every year (Mandal, 2008).
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> The summer of 2010 was one of the hottest summers on record in India, with temperatures approaching 50°C (122°F); the effects were far-reaching, including hospitalization because of heatstroke, suffering of livestock, and severe drought in some regions that affected health as well as agriculture (Burke 2010).
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> India has approximately 2 million confirmed cases of malaria every year (Kumar et al. 2007). Like most infectious diseases, prevalence however varies by region. WHO concludes that approximately 15,000 individuals die from malaria each year in India (WHO 2008). A study by Dhingra et al. (2010) estimates approximately 200,000 malaria deaths per year in India before 70 years of age and 55,000 in early childhood.

1. Patterns of infections

Climatic conditions strongly affect water-borne diseases. Changes in climate are likely to lengthen the transmission seasons of important vector-borne diseases and alter their geographic range.

Malaria is a climate-sensitive disease transmitted by Anopheles mosquito. The distribution map of India reveals Odisha, northeastern states, Jharkhand and Chhattisgarh as endemic with stable malaria while Rajasthan, Uttar Pradesh, Himachal Pradesh, and Uttarakhand with unstable malaria. In stable malaria, transmission continues almost throughout the year as the temperature, rainfall and resultant relative humidity are suitable for round the year. The states having unstable malaria experience winters during which transmission does not take place. Areas with unstable malaria are epidemic prone depending on favorable conditions provided by unusual high rains at the threshold of the transmission season. Distribution of malaria and its endemicity is the reflection of suitable climatic conditions and availability of mosquito vectors in different parts of the country (INCCA, 2010).

Dengue, primarily transmitted by *Aedes aegypti* and secondarily by *Aedes albopictus*, is a major public health concern for over half of the world's population and is a leading cause of hospitalization and death, particularly for children in endemic countries. Rise in temperature is potentially associated with substantial increase in dengue outbreaks. Apart from climate factors other important issues that potentially contribute to global changes in dengue incidence and distribution include population growth, urbanization, lack of sanitation, increased human travel, ineffective mosquito control, and increased reporting capacity ((Naish *et al*., 2014) .

2. Loss of life

Water-borne infectious diseases: A report from the Ministry of Health and Family Welfare estimates that water-borne diseases affect nearly 40 million people every year burdening both the health and the economic sectors.

Vector-borne disease**:** India has approximately 2 million confirmed cases of malaria per year (Kumar et al. 2007). A study by Dhingra et al. (2010) estimates approximately 200,000 malaria deaths per year in India before 70 years of age and 55,000 in early childhood.

Heat stress**:** In recent past, the summer of 2010 was one of the hottest summers on record in India, with temperatures approaching 50°C (122°F); the effects were far-reaching, including hospitalization because of heat stroke, suffering of livestock, and severe drought in some regions that affected health as well as agriculture (Burke 2010).

Floods: Floods contaminate freshwater supplies, heighten the risk of water-borne diseases, and create breeding grounds for disease-carrying insects such as mosquitoes. Floods have been increasing in occurrence and intensity. Extreme weather events such as floods cause water logging and contamination, which in turn exacerbate diarrheal diseases such as cholera, vector-borne diseases, malnutrition, and deaths.

3. Adaptations and mitigations

Potential adaptation strategies in India could focus on controlling infectious diseases by removing vector-breeding sites, reducing vector–human contact via improved housing, and coordinating monitoring of mosquitoes, pathogens, and disease burden. In addition, improving sanitation and drinking water by supporting inexpensive and effective water treatment and increasing rainwater harvesting, safe storage, and gray-water reuse could be other means. In some areas, the focus may shift to flood, heat wave, and emergency preparedness, including strategies to address the additional risks placed on displaced populations from these and other climate-sensitive hazards. Developing an integrated early warning system, emergency response plans, and refugee management plans, along with increased capacity to provide shelter, drinking water, sanitation, and sustainable agricultural products to the most vulnerable populations could be the outcome (Bush *et al.*, 2011).

Environmental monitoring and surveillance: There is a great need to improve environmental monitoring and surveillance systems in countries such as India. New research initiatives should focus on collecting high quality, long-term data on climate-related health outcomes with the dual purpose of understanding current climate–health associations and predicting future scenarios. Health outcomes of interest, for which such data should be collected, include total morbidity and mortality and non-communicable diseases such as cardiovascular and respiratory diseases including asthma, as well as infectious diseases such as cholera, malaria, tuberculosis, typhoid, hepatitis, dysentery, tick-borne encephalitis, and other vector-borne and water-borne diseases. Such monitoring also requires the collection of appropriate climatic (e.g., temperature and precipitation) and non-climatic data (e.g., ozone). Surveillance of extreme weather conditions and risk indicators such as mosquito abundance or pathogen load is also necessary. Such data gathering should occur in conjunction with already existing public health programs and health centers. Where the necessary public health infrastructure does not exist, the anticipated risks associated with climate change should motivate international action to build such infrastructure. The collection of such diverse data necessitates the creation of linkable and documented repositories for meteorological, air pollution, and health data (Bush *et al.*, 2011).

c. How to go about?

i. Identify vulnerable areas and groups: All populations will be affected by climate change, but some are more vulnerable than others. People living in small islands, developing states and other coastal regions, megacities, mountainous regions are particularly vulnerable. Vulnerability of a population depends on factors such as population density, level of economic development, food availability, income level and distribution, local environmental conditions, pre-existing health status, and the quality and availability of public health care.

ii. Identify health risks: Climate-sensitive health risks include those occurring as a direct consequence of exposure to climatic stimuli (heat stroke, drowning during flood), those mediated via climate-sensitive ecological systems (water-borne and vector-borne diseases) and those resulting from the wider social implications of climate change (malnutrition). Children in particular are among the most vulnerable groups to the resulting health risks and will be exposed longer to the health consequences. The health effects are also expected to be more severe for elderly people and people with infirmities or pre-existing medical conditions. Appropriately managed resources and infrastructure could further help tackle the health risks of climate change as well as reduce greenhouse gas emissions. Similarly, a suitable lifestyle including appropriate dietary habits could not only further reduce the risks of non-communicable diseases but also contribute to protecting the climate.

> A Case Study of Malaria in India presents an assessment on health risks due to climate change in India, especially enhanced malarial incidences. All-India rainfall in October seems to be positively correlated with malaria incidences in the following year whereas the May rainfall is negatively correlated with malaria incidences. Also cold temperature anomalies over eastern Pacific south of equator March-April-May season seems to be favorable for malaria incidences over India as this is also favourable to subsequent good summer monsoon rainfall.

***iii. Control measures for food and water-borne, and vector-borne diseases*:** The main parameters affecting vector-borne diseases include temperature, rainfall, and absolute humidity. Malaria mitigation strategies require a combination of preventive and curative treatment methods and close collaboration between the health and climate sectors. The timely provision of climate information with several months lead-time can be combined with a well-developed national and regional response strategy that allocates resources for public outreach and distribution of medication and insecticides well in advance.

Warmer temperatures and increased rainfall variability are likely to increase food-borne and water-borne diseases. Infectious agents, such as protozoa, bacteria and viruses, and vector organisms, such as mosquitoes, ticks and sand flies, have no thermostatic mechanisms, so reproduction and survival rates are strongly affected by temperature levels and fluctuations.

The combination of warmer temperatures and increased rainfall variability is likely to increase the intensity and frequency of food-borne and water-borne diseases. Several studies have found relationships between temperature and food poisoning, as well as between temperature and specific enteric diseases (Bentham & Langford 2001, Kovats et al. 2005, Hashizume et al. 2007).

iv. Infrastructure facilities to face natural disasters: Natural disasters have a variety of health impacts. These range from immediate effects of physical injury and morbidity and mortality through to potentially long lasting effects on mental health status. Most flood-related deaths can be attributed to rapid rise of water level, resulting in increased risk of drowning. Following floods increase in diarrheal and respiratory diseases are reported. Disease transmission is increased where there is crowding of displaced populations.

v. Sea level rise: In light of climate change, extreme coastal events and accelerated sea level rise can threaten human safety and shoreline development. The coastal system is extremely dynamic owing to the changing nature of interactions between its components—the natural and human systems. Nearly a quarter of India's population living along its 7500 km coastline is at high risk due to sea level rise and its associated impacts. In India, model simulation studies indicate that SLR related to thermal expansion is expected to be between 15 cm and 38 cm by the middle of this century and between 46 cm and 59 cm by the end of the century. To counter the impacts of SLR, regional adaptation strategies will be needed because the extent of damage caused would vary from region to region depending on the slope of land, extent and nature of coastal development, population density, and local rate of SLR, existing coastal management policies, and local practices, among others (Dogra and Srivastava, 2012)

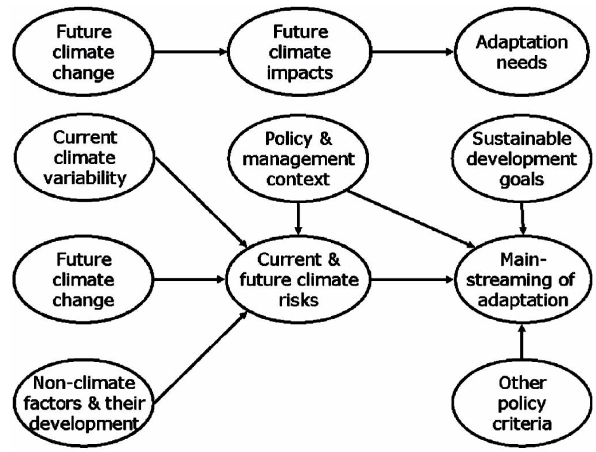
Effects Sea level rise on Health (Dogra and Srivastava, 2012)

	Effect
1	Morbidity and mortality associated with extreme coastal events such as flooding, cyclones, and storm surges
2	Effects on nutrition due to loss of agricultural land or de-cline in fish catch
3	Reduced freshwater availability by saltwater intrusion into groundwater aquifers
4	Changes in distribution of disease agents
5	Psychological trauma and stress
6	Population displacement associated with loss of land or other socio-economic and health impacts
7	Impacts on "sensitive" coastal ecosystems and loss of coastal livelihoods

Health Specific adaptations

- Adaptation includes strategies, policies, and actions undertaken to lessen the impact of climate sensitive health determinants and outcomes. In terms of the public health concepts of primary, secondary, and tertiary prevention, illustrative measures are as follows:
- Primary prevention includes adaptation responses (like bed nets for preventing malaria) in anticipation of disease or injury induced by climate-sensitive factors.
- Secondary prevention involves interventions (like strengthening rapid response to a disease outbreak) put in place after the effect of climate related hazards has been felt or observed.
- Tertiary prevention measures (like better treatment of heat strokes) seek to ameliorate the adverse effects of a disease or injury caused by climate-related extreme or adverse events.

Many adaptive measures have benefits beyond those associated with climate change. The rebuilding and maintaining of public health infrastructure is often viewed as the "most important, cost-effective and urgently needed" adaptation strategy. This includes public health training, more effective surveillance and emergency response systems, and sustainable prevention and control programs.



Aproaches for determining adaptation needs (Fussel, 2007)

Adaptation measures recommended for India include, among other aspects, the following: awareness; capacity building of individuals, communities, and institutions; disease and vector surveillance; preparedness for disaster management, development of early warning systems as well as strengthening of primary and secondary health-care facilities.

Suggested Projects

Project 1. ***Mapping of weather-related disease patterns in your locality***

Background

Weather and climate affect the social and environmental determinants of health particularly food sufficiency, safe drinking water, clean air and secure shelter. Weather variations heavily impact the health of people and climate change has an amplifying effect. Climate change affects disease dynamics directly (heat waves on stress induced strokes) and indirectly (increased activity of disease transmitting vectors). It is expected that, due to weather patterns, diseases alter their range, intensity, and timing.

It is imperative to develop measurable indicators of health impacts. Such assessments would not only augment our understanding of the relationship between climate and health but also help in designing better adaptation strategies. Mapping is a important tool to gather information in its spatial dimensions and to help understanding spatial interrelationship among various map-able parameters leading to planning process. Detailed maps of such climate change-induced hot spots for all the sectors need to be developed, as health risks are linked with food, water, environment, and socio-economic conditions (Dogra and Srivastava, 2012).

Many national level disease maps were prepared by different agencies in our country. Dengue and chikungunya epidemics in addition to malarial outbreaks with changing types and forms have been major problems for the public healthcare system in India that killed thousands of people in the past few years. Environmental determinants and man-made factors have favourable to the breeding of *Aedes spp*, the mosquito responsible for the spread of these dreaded diseases. In 2012, chikungunya hit 18 Indian states with 14, 277 clinically conformed cases while dengue was reported from as many as 24 states with 37,070 confirmed cases (Palaniyandi, 2012). Based on the data, disease maps are prepared which provide clear idea of disease intensity.

Objectives

- To identify diseases occurrence in your locality from secondary sources
- To collect the daily, weekly and monthly weather data (temperature, rainfall, humidity, etc.) of minimum five years period for your locality.
- To draw disease mapping based on the weather patterns in your locality

Methodology:

1. The periodic collection of the secondary data on various diseases prevalent in the study area collected from different levels such as primary health centers or Government hospitals, Private medical centers and also from the local pharmacies for last five years.
2. Develop the questionnaire and collect data in relation to disease conditions in the last five years from minimum 200 households at random in your locality. From the individual data, a common data sheet to be prepared for analysis.
3. Collect the weather data of study area from local weather station or other authenticated data sources for last five years
4. Collect the base map of your locality from any authenticated sources. Prepare the disease maps based on the different seasons of your locality with gradations.

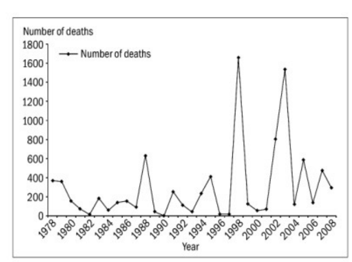
Interpretation

1. Correlate the season-wise weather parameters with disease occurrence and find out significant association between weather changes and cluster of diseases.
2. Study the changes in the weather conditions of the study area and impact on diseases condition in your locality.
3. Based on the results, prevention, preparedness, medications and warming systems may be recommended.

Project 2. *Incidences of sunstroke in your locality*

Background

During summer, most areas of India also experience episodes of heat waves every year causing sunstroke, dehydration and death. In the national context, a number of studies in India show that the country has been experiencing extreme weather events for the past few decades, particularly after the 1990s. An analysis of daily



Heat wave deaths in India (1978 - 2008) *(Dogra and Srivastava, 2012)* climatological heat index (HI: combining temperature and humidity) over 41 districts well distributed over the country indicated that maximum HI exceeding 45°C characterizes many districts during March to May and also during June to September. On the other hand, the wind chill index (combining temperature and wind speed) is less than 10°C for a very few districts of northern India mainly in winter (January - February) and the post-monsoon period (October–December). In 1998, major parts of north India and the northern parts of peninsular India experienced severe heat wave. During the second half of May, the heat wave was one of the severest ones seen in the last 50 years and led to the deaths of more than 2600 people. It is interesting to note that mortalities due to both heat waves and cold waves were highest in India in 2003 as compared to other years (Dogra and Srivastava, 2012).

Recently many cases of sunstroke were reported in the media. Such cases were never reported in the past as revealed from published literature, old hospitals records and senior citizen of the locality. So we consider it as problem to be investigated, in order to take precautions in the future to avoid such incidences.

Objectives

- To understand sunstroke and it consequences
- To identify area from secondary sources and published data where incidences of sunstroke has been reported
- To collect the daily weather data of summer months for last five years for that area
- To draw relationships between weather and sunstroke and recommend precautions

Methodology

1. Collect of the secondary data on incidence of sunstroke in the study area from different levels such as primary health centers or Government hospitals, private medical centers and also from the local doctors and pharmacies of last five years
2. Develop the questionnaire and collect data in relation to sunstroke in the last five years from household survey at random in the study area. From the individual data, a common data sheet to be prepared for analysis
3. Collect the weather data of study area from local weather station or other authentic data sources of last five years
4. Compare and analyze the weather and sunstroke data

Interpretation

1. To understand the indicators of sunstroke
2. Interpret the weather parameters on annual basis in relation to the occurrence of sunstroke

3. Investigate whether there is any direct relationship between nature of work, life styles, habits or place and sunstroke
4. Identify the precautions that can be taken to avoid sunstroke
5. Based on the results, recommendations may be drawn which include prevention, preparedness, first-aid and warming system

Project 3. ***Prevalence of dengue fever in your locality. Is it weather related?***

Background

Dengue fever is a mosquito-borne viral disease estimated to infect about 50-100 million worldwide every year, of which 25,000 are fatal. Global incidence has risen rapidly in recent decades with some 2.5 billion people, over half of the world's population, now at risk, mainly in urban centers of the tropics and subtropics. Demographic, societal and weather changes, in particular urbanization, globalization, and increased international travel, are major contributors to the rise in incidence and geographic expansion of dengue infections. Major research gaps continue to hamper the control of dengue (Wilder-Smith *et al*., 2012).

The spatial distribution of the main dengue vector, *Aedes aegypti*, has also increased over the last 25 years. Increase in both, dengue incidence and *A. aegypti* distribution have also been associated to variations in the climate system, including climate change. The evidence of the effects of climate drivers on dengue incidence is still under debate (Colo´n-Gonza´lez et al., 2013). Therefore, the present work is undertaken at local level to find out the relation between weather conditions and dengue infection.

Objectives

- To collect information on the occurrence of dengue in a locality from various published or authentic secondary sources available from different levels of last five years.
- To collect the daily, weekly and monthly weather data (temperature, rainfall, humidity, etc.) of five years for the study area.
- To study weather indicators that may influence dengue transmission dynamics in a locality.
- To compare and analyze the weather data with infection pattern in the study area.
- To develop a comprehensive, early warning based on the results of data analysis.
- To determine the most useful and cost-effective predictive factors for dengue.

Methodology

1. The periodic collection of the secondary data on dengue prevalent in the study area collected from different levels such as primary health centers or Government hospitals, private medical centers and also from the local pharmacies of last five years.
2. Design and develop the questionnaire and collect data in relation to occurrence of dengue in the last five years from a minimum of 200 households at random from the study area. From the individual data sheet, a common data sheet to be prepared for analysis.
3. Collect the weather data of study area from local weather station or other authentic data sources of last five years.
4. Compare and analyze the survey data with weather conditions data. Conclude and infer on the basis of analysis.

Interpretation

1. Compare weather parameters with dengue occurrence and find out significant association between weather changes and dengue.
2. Study the changes in the weather conditions of the study area and find out impact of dengue in the same.
3. Based on the results, recommendations may be drawn which include prevention, preparedness, medications and warming systems.

List of Projects

1. Mapping of weather related diseases in your locality
2. Studies on prevalence of vector-borne diseases (malaria / dengue)
3. Occurrence of communicable diseases due to extreme weather conditions
4. Effect of temperature and humidity changes on incidences of skin diseases
5. Impact of weather on production and/or health of animals
6. Effect of extreme weather on the health of women and children
7. Effect of summer, winter and monsoon on incidence of respiratory diseases
8. Effect of heat on the health of farmers / industrial workers in your area
9. Studies on weather patterns and income loss of workers with daily wages
10. Studies on air-borne infections during variable weather conditions

Glossary of technical words

Adaptation is adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, public and private adaptation, and autonomous and planned adaptation.

Adaptive capacity describes the general ability of institutions, systems and individuals to adjust to potential damages, to take advantage of opportunities or to cope with the consequences of climate change in the future.

Climate: Climate in a narrow sense is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. The classical period of time is 30 years, as defined by the World Meteorological Organization (WMO). In short, climate is the average state of the atmosphere and the underlying land or water in a specific region over a specific time scale.

Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity. Climate change is also defined as a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer).

Climate model is a numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. Climate models are applied, as a research tool, to study and simulate the climate, and also for operational purposes, including monthly, seasonal, and inter-annual climate predictions.

Climate prediction or climate forecast is the result of an attempt to produce an estimate of the actual evolution of the climate in the future, e.g., at seasonal, inter-annual or long-term time scales.

Climate projection is the calculated response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based on simulations by climate models. Climate projections are distinguished from climate predictions, in that the former critically depend on the emissions/concentration/radiative forcing scenario used, and therefore on highly uncertain assumptions of future socio-economic and technological development.

Climate-sensitive disease is a disease that is sensitive to weather or climate factors, with the current spatial distribution and seasonal transmission being affected.

Communicable disease is an infectious disease caused by transmission of an infective biological agent (virus, bacterium, protozoan, or multi-cellular macro-parasite).

Comparative risk assessment, as defined by WHO is the systematic evaluation of the changes in population health that result from modifying the population's exposure to a risk factor or a group of risk factors.

Coping capacity is the means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human induced hazards.

Drought is the phenomenon that exists when precipitation is significantly below normal recorded levels, causing serious hydrological imbalances that often adversely affect land resources and production systems.

Endemic (of a disease or condition) is the one that is regularly found among particular people or in a certain area.

Environmental burden of disease is the burden of disease caused by environmental factors estimated using methods described by WHO.

Epidemic is widespread occurrence of an infectious disease in a community at a particular time.

Extreme weather event is an event that is rare within its statistical reference distribution at a particular place. By definition, the characteristics of what is called "extreme weather" may vary from place to place. An "extreme climate event" is an average of a number of weather events over a certain period of time, an average which is itself extreme (e.g., rainfall over a season).

Health is a state of complete physical, mental and social well being and not merely the absence of disease or infirmity (WHO, 1946).

Health impact assessment is a systematic process to assess the actual or potential, and direct or indirect, effects on the health of individuals, groups or communities arising from policies, objectives, programs, plans or activities.

Health risk assessment is the process of estimating the potential impact of a chemical, biological, physical or social agent on a specified human population system under a specific set of conditions and for a certain time-frame.

HVI heat vulnerability index

IPCC Intergovernmental Panel on Climate Change

Malaria is an endemic or epidemic parasitic disease caused by species of the genus Plasmodium (Protozoa) and transmitted by mosquitoes of the genus Anopheles; produces bouts of high fever and systemic disorders, affects about 300 million and kills approximately 2 million people worldwide every year.

Morbidity is the rate of occurrence of disease or other health disorders within a population, taking account of the age-specific morbidity rates. Morbidity indicators include chronic disease incidence/prevalence, rates of hospitalization, primary care consultations, disability-days (days of absence from work), and prevalence of symptoms.

Mortality is the rate of occurrence of death within a population. Calculation of mortality takes account of age-specific death rates, and can thus yield measures of life expectancy and the extent of premature death.

Outbreak is a sudden occurrence of something unwelcome, such as disease.

Pandemic (of a disease) is the one that is prevalent over a whole country or the world.

Vector is a blood-sucking organism, such as an insect, that transmits a pathogen from one host to another.

Vector-borne diseases are the diseases transmitted to the hosts by a vector organism (such as a mosquito or tick); e.g., malaria, dengue and leishmaniasis.

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Weather describes the day-to-day changes in atmospheric conditions in a specific place at a specific time. More simply, climate is what you expect and weather is what you get.

Zoonosis or **Zoonotic diseases** refer to diseases that can be passed from animals, whether wild or domesticated, to human beings.

Health Tips for summer season-

Prickly heat

- **Intake of fluid with salt and lesser sugar**
- **Bathing twice or thrice**
- **Loose fitting light coloured cotton clothes**
- **Avoid applying prickly heat powder**
- **Application of sandal paste**
- **Drink butter milk and coconut water**
- **Avoid soft drinks**

Activity: Collect more information on existing traditional health tips and practices and validate

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