
UNIT 16 HUMAN HEALTH

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16.1 INTRODUCTION

Climate change is also expected to bring more natural disasters such as drought and flooding. Such changes will inevitably affect health, particularly in the developing world, leading to more deaths from heat stress, diarrhoeal diseases and malnutrition. The incidence of mosquito-borne diseases, in particular, is likely to change. In some tropical regions, both cyclones and floods create breeding grounds for the mosquitoes that carry malaria and dengue. Poor populations in coastal areas are particularly vulnerable to sea level rise and the associated threat of mosquito-borne disease.

Climate change can no longer be considered simply an environmental or developmental issue. More importantly, it puts at risk the protection and improvement of human health and well-being. A greater appreciation of the human health dimensions of climate change is necessary for both the development of effective policy and the mobilization of public engagement.

Strengthening of public health services needs to be a central component of adaptation to climate change. The international health community already has a wealth of experience in protecting people from climate-sensitive hazards, and proven, cost-effective health interventions are already available to counter the most urgent of these. Broadening the coverage of available interventions would greatly improve health. Coupled with forward planning, it would also reduce vulnerability to climate changes as they unfold in the future. To create the political will needed to address climate change and mosquito-borne disease, countries need information to identify potential sufferers and evaluate current state of preparedness. They should be assessing existing health system infrastructure, identifying the latest intervention tools available and providing the resources required to combat

the health consequences of climate change. Governments must establish local communities' capacity to cope so as to determine what additional inputs are needed. With the right research, tools and political will, regions like South and South-East Asia can prepare for any rise in mosquito-borne disease caused by climate change. But it will require concerted efforts to develop the research capacity needed for assessing the threat of climate change.

16.2 OBJECTIVES

After studying this unit, you should be able to:

- explain the impact of climate change on human health; and
- elucidate the climate change induced health care problems.

16.3 CLIMATE CHANGE IMPACTS ON NATURAL ECOSYSTEMS

Rising temperatures, shifting rainfall patterns and increasing humidity affect the transmission of diseases by vectors and through water and food. Vector-borne diseases currently kill approximately 1.1 million people a year. Climate change will affect, in profoundly adverse ways, some of the most fundamental pre-requisites for good health: clean air and water, sufficient food, adequate shelter and freedom from disease. The global climate is now changing faster than at any point in human civilization, and many of the effects on health will be acutely felt. The most severe risks are to developing countries, with negative implications for the achievement of the health-related goals and for health equity. Many of the major killer diseases transmitted by water and contaminated food, and by insect vectors are highly sensitive to climatic conditions and weather extremes. Climate change threatens to slow, halt or reverse current progress against many of these infections.

Likely health impacts that are currently not quantifiable include those due to:

- Changes in air pollution and aero-allergen levels.
- Altered transmission of other infectious diseases.
- Effects on food production via climatic influences on plant pests and diseases.
- Drought and famine.
- Population displacement due to natural disasters, crop failure, water shortages.
- Destruction of health infrastructure.
- Conflict over natural resources.
- Direct impacts of heat and cold (morbidity).

Surveys have shown that many populations, including those in Australia, China and Italy, place climate change high on lists of threats to their security and well-being.

16.3.1 Changes in Air and Water Quality

Extremely high temperature can cause immense negative impact on human health. The frequency of extreme heat events is rapidly increasing in the last two decades and it is reported that such events would be rather a norm in the second half of 21st century. Further, increasing surface air temperature and climate change would increase the levels of air pollutants such as tropospheric ozone levels. It is also reported that urban air pollution causes about more than 1.2 million deaths per annum due to respiratory and cardio-vascular diseases. The spread of water-borne diseases have been increased due to the factors such as “climate shifts”, “water-cooled air conditioning plants”; industrial agricultural practices; climate disaster, etc. Further, demographic changes, increasing vulnerable population combined with changes in human behaviour are also the driving factors causing human health burden.

16.3.2 Allergens/Air Pollutants

The phenomenon called “pollution” is an inescapable consequence of the presence of human being and his activities. Today, air pollution has become more subtle and recognize no geographical or political boundaries. Air pollution is one of the present-day health problems throughout the world. More than 100 substances which pollute air have been identified. The important ones are carbon monoxide, carbon dioxide, hydrogen sulphide, sulphur dioxide, sulphur trioxide, nitrogen oxides, fluorine compounds, organic compounds (e.g. hydrocarbons, aldehydes, ketones, organic acids), metallic contaminants (e.g. arsenic, zinc, iron resulting from smelting operation), radio-active compounds, photochemical oxidants (e.g. Ozone), and others include asbestos, beryllium, mercury, benzene, fluorides, vinyl chloride, lead and mercury, benzene, fluorides, vinyl chloride, lead and radiation. Indoor air pollutions contributes to acute respiratory infections in young children, chronic lung disease and cancer in adults, and adverse pregnancy outcomes (such as stillbirths) for women exposed during pregnancy. Acute respiratory infections, principally pneumonia, are the chief killers of young children, causing 10 per cent of the total burden of disease in developing countries. Air pollution can affect by two ways:

The health effects of air pollution include both immediate and delayed effects. The immediate effects are born by the respiratory system. The resulting state is acute bronchitis. If the air pollutions is intense, it may result even in immediate death by suffocation. Air pollution damages the human respiratory and cardio-respiratory system in various ways. As regards the socio-economic aspects, air pollution causes negative impacts on physical infrastructure, plant and animal life, etc.

The WHO has recommended the following procedures for the prevention and control of air pollution: (a) containment that is prevention of escape of toxic substances into the ambient air. By a variety of engineering methods such as enclosure, ventilation and air cleaning. (b) Replacement that is replacing a technological process causing air pollution by a new process that does not cause pollution. (c) Dilution: Dilution is valid so long as it is within the self-cleaning capacity of the environment. (d) Legislation: Air pollution is controlled in many countries by suitable environmental legislation. (e) International Action: To deal with air pollution on a world-wide

scale, the WHO has established an international network of laboratories for the monitoring and study of air pollution.

16.3.3 Spread of Disease Causing Organisms

The interactions between the pathogen or disease causing organisms and the host in a changing environment are indeed complex. Due to the changing environment, both the host and pathogen try to adapt itself and in the ensuing cycle of interactions, even the pathogen try to evolve itself. Further, climate variability and climate change greatly extend the geographical range of mosquitoes, increase the breeding season, increase the number of blood meal and eventually increase the spread and occurrence of mosquito borne diseases. Also, the climate change induced disasters such as floods increase the occurrence of vector-borne diseases.

Check Your Progress 1

- Note:** 1) Use the space given below for your answers.
 2) Check your answers with those given at the end of this unit.

1. What are the likely health impact of climate change?

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2. How climate change induce spread of disease causing organisms?

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16.4 HIGH INFANT AND MATERNAL MORTALITY RATES AND CLIMATE CHANGE

Climate sensitive diseases already place an enormous burden on child health. Perinatal conditions principally include low birth weight, prematurity, birth asphyxia (breathing difficulty) and birth trauma (injury). This definition is relatively narrow as it excludes stillbirths, malformations and other conditions affecting liveborn infants that may be affected by environmental factors. Higher rates of low-birth-weight infants were observed for mothers exposed to the environmental risks of air pollution, tobacco smoke or various chemicals. Children, particularly in poor countries, have made the least contribution to the greenhouse gases that are causing climate change, yet they are among the most vulnerable to the resulting health risks and will be exposed longer to the health consequences of a degraded natural environment.

The most important climate-sensitive diseases are those that affect poor children: 90% of the burden of malaria and diarrhoea, and almost all of the burden of diseases associated with under- nutrition, are borne by children

aged 5 years or less, mostly in developing countries. These major diseases of children are highly sensitive to variations in temperature and precipitation. The problems of under nutrition and associated diseases are most common among populations that are either directly dependent on rain-fed subsistence agriculture or who have low incomes and therefore high sensitivity to increases in food prices when harvests are diminished by floods and drought.

It is a fact that increased population growth causes immense pressure on quality of water, and access to water resources. Access to quality water is essential to health security. In fact, water-borne diseases are a cause of concern globally. Incidentally, the pathogens responsible for water-borne diseases like cholera, typhoid, etc. are influenced by the changing environmental conditions including climate change, sanitation, etc.

Malnutrition is also an important factor driving the population to be vulnerable to climate change. Land degradation and soil pollution, as well as climate change, can also contribute to malnutrition to a certain extent. It was estimated that climate change accounted for 2% of the health burden of malnutrition. Overall, 50% of the health burden of malnutrition was estimated to be attributable to the environment and in particular to poor water, sanitation and hygiene. Malnutrition causes vulnerability and increases the risk of adverse health outcomes, particularly in children.

Malnutrition probably plays a role in more than half of all child deaths; 50% of malnutrition's disease burden is attributable to the environment. Malnourished children tend to have more frequent episodes of severe diarrhoea and are more susceptible to infectious diseases such as respiratory infections and meningitis. Malnourished children have a poorer prognosis for almost all infectious diseases. Hence, malnutrition is one of the most important risk factors for children globally.

Check Your Progress 2

- Note:** 1) Use the space given below for your answers.
2) Check your answers with those given at the end of this unit.

1. What are the climate change induced diseases affecting children?

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2. What is malnutrition? What are the climatic factors responsible for conditions of malnutrition?

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16.5 CLIMATE CHANGE INDUCED HEALTH CARE PROBLEMS

Infections caused by pathogens that are transmitted by insect vectors are strongly affected by climatic conditions such as temperature, rainfall and humidity. These diseases include some of the most important current killers: malaria, dengue and other infections carried by insect vectors, and diarrhoea, transmitted mainly through contaminated water.

Protection from climate change is part of a basic, preventive approach to public health, not a separate or competing demand. The public health community has a wealth of experience in protecting people from climate sensitive hazards. Many of the most important actions are public health interventions of proven effectiveness, from controlling vector-borne disease, to providing clean water and sanitation, and reducing reliance on energy sources that pollute the environment and harm health. Widening the coverage of these measures will save lives now, and is a critical contribution to the global effort to adapt to climate change.

Improving the environmental and social determinates of health are critical to protecting pollution from climate change. Addressing known environmental risk factors could greatly improve health, while supporting sustainable development. Improving environmental conditions could prevent up to a quarter of the global burden of disease, rising to a third in the poorest countries. For example, scaling up water and sanitation services and household disinfection would immediately reduce diarrhoea and, at the same time, lessen the health impacts of decreasing and more variable water supplies. The benefits of such interventions are already several times greater than the costs, and the threat of climate change makes these preventive health measures an even wiser investment.

Increasing Tropical Diseases

Vectors, pathogens and hosts each survive and reproduce within a range of optimal climatic conditions: temperature and precipitation are the most important, while sea level elevation, wind, and daylight duration are also important. At increased temperatures, the rate of digestion of blood meal increases which in turn accelerates the ovarian development, egg laying, reduction in duration of the gonotrophic cycle and more frequency of feeding on hosts, thus, increasing the probability of transmission. Thus, climatic conditions play important role in the distribution, degree of endemicity and epidemicity of diseases in an area. Some areas, which have the most favourable conditions of temperature and rainfall, experience transmission of disease throughout the year, while in areas experiencing colder months, transmission is seasonal and does not take place throughout the year.

Early Warning of Malaria

As an adaptation measure to reduce the negative impacts of climate change, development of tools for early warning of malaria/diseases is warranted. Studies between climate variability and malaria with emphasis on different sites in India show that rainfall is an important indicator for early warning of malaria in Rajasthan and Gujarat. Work on relationship between El Nino Southern Oscillation (ENSO), vegetation index and malaria is being undertaken

to find out the indicators for early warning of malaria. The case studies undertaken in selected districts of Gujarat, Rajasthan and Karnataka reveal that rainfall, ENSO and satellite derived Normalized Difference in Vegetation Index (NDVI) may be used for early warning of malaria in some epidemic prone states. Efforts are being made to develop such a system in India by using meteorological and satellite derived parameters.

Water-borne Diseases

Globally, about 1.5 million deaths per year from diarrhoeal diseases are attributable to environmental factors, essentially water, sanitation and hygiene. A large proportion of diarrhoeal diseases are caused by faecal-oral pathogens. In the case of infectious diarrhoea, transmission routes are affected by interactions between physical infrastructure and human behaviour. If sanitation or related hygiene is poor, e.g. when hand washing facilities are inadequate, or when faeces are disposed of improperly, human excreta may contaminate hands, which can then contaminate food or other humans (person-to-person transmission).

Floods and Droughts induced Health Issues

Globally, climate change is likely to widen the area affected by drought, with particularly severe impacts in areas that are already water-stressed. These trends will impact on lives and on health. Floods cause drowning and physical injuries; heighten the risk of diseases transmitted through water, insect vectors and rodents; damage homes; and disrupt the supply of essential medical and health services. The number of floods reported globally is rising rapidly – much more rapidly than disasters unrelated to weather conditions. Droughts increase the risk of food shortages and malnutrition. They also increase the risk of diseases spread by contaminated food and water. Diarrhoea remains one of the biggest killer of children. Viruses and bacteria transmitted through water and contaminated food can cause severe diarrhoea in children, often locking them into a vicious cycle of undernourishment, susceptibility to other infectious diseases, and eventually death. Higher temperatures and too much or too little water can all facilitate transmission of this disease. Both flooding and unusually low levels of water can also lead to water contamination and bring higher rates of illness and death from cholera and other forms of diarrhoea. Warming and greater variability in precipitation threaten to increase the burden of this disease.

16.6 TOP TEN ACTIONS FOR NATIONAL AND LOCAL POLICY MAKERS

- **Advocate for strong and equitable climate change agreements:** Current and projected stresses on the Earth's life support systems (food, shelter, water and energy) require a fair, scientifically sound and globally binding commitment to reduce net greenhouse gas emissions and stabilize the global climate.
- **Promote the need for health-oriented agreements:** Protecting health and wellbeing is one of the three main objectives of the original climate convention, (alongside development and environment), and should be a priority within any new agreement; the strengthening of health systems

should be identified as a priority area for adaptation to climate change; and mitigation measures that bring health and other socio-economic benefits should be prioritized.

- **Establish multi-sectoral processes to oversee climate change and health policy development:** Utilize health impact assessments to evaluate social and economic costs of threats and prioritize action and investment areas.
- **Protect the most vulnerable:** Globally, people at the greatest risk of adverse health effects associated with climate change include the very young, the elderly, and the medically infirm and socio-economically disadvantaged groups should be protected.
- **Strengthen health system adaptive capacity:** Public education, disease surveillance, disaster preparedness, vector control, food hygiene and inspection, nutritional supplementation, vaccines, primary and mental health care, and training are to be strengthened to adapt to climate change
- **Take into account health co-benefits when considering different greenhouse gas mitigation options:** Reducing greenhouse gas emissions is also good for health. In countries where cars are the predominant means of transport, shifting to more walking and cycling and discouraging private car use in urban centres lowers carbon emissions, increases physical activity (which reduces obesity, heart disease and cancer), and results in less pollution and noise.
- **Increase funding for inter-disciplinary research on climate change mitigation technologies and strategies across a range of sectors:** Build capacity by supporting the career development and training of young researchers in relevant disciplines.
- **Measure public awareness and attitudes:** Develop communication and social marketing plans to address perceptual and behavioural obstacles.
- **Measure and address the ‘carbon footprint’ of public institutions:** Encourage public institutions to lead by example. As highly visible, high-energy-use centres, public institutions can serve as models by reducing their own carbon emissions, improving health and saving money.
- **Incentivize your workforce and all stakeholders:** This would to reduce their personal carbon footprint including through increased use of active transport.

Check Your Progress 3

Note: 1) Use the space given below for your answers.

2) Check your answers with those given at the end of this unit.

1. What are the vector-borne diseases that are influenced by climate change?

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2. What are the effects of heat stress? Name a health condition caused by heat?

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3. How do you attribute diarrhoeal disease as a product of environmental conditions?

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16.7 LET US SUM UP

Climate variability and climate change impact the human health through increases in near surface temperature, varying precipitation patterns and other indicators of climate change such as droughts and floods. Climate change is reported to increase the spread and occurrence of tropical diseases and many vector-borne and water-borne diseases. The skills, capacities and shared values of the public health community can make an important contribution to a fair and effective response to climate change. Climate change can no longer be considered simply as an environmental or a developmental issue. It will affect the health and well-being of all populations, with impacts escalating into the foreseeable future. A greater understanding of the health implications of climate change and related development choices can lead to improved policies and more active public engagement.

16.8 KEYWORDS

- Morbidity** : It is an incidence of ill health. It is measured in various ways, often by the probability that a randomly selected individual in a population at some date and location would become seriously ill in some period of time.
- Vector-borne Disease** : A disease that is transmitted to humans or other animals by an insect or other arthropod.
- Allergens** : An abnormally high sensitivity to certain substances such as pollens, foods or microorganisms.
- Pathogens** : Agents that causes infection or disease, especially a microorganism, such as a bacterium or protozoan, or a virus.
- Malnutrition** : It is the eventual result of an imbalanced diet. Consuming too much or too little of any one of the nutrients can cause malnutrition.

16.9 SUGGESTED FURTHER READING/ REFERENCES

McMichael AJ (2000). The urban environment and health in a world of increasing globalization: Issues for developing countries. *Bulletin of the World Health Organization*, 78: 1117–1126.

McNeill J (2000). *Something new under the sun: An environmental history of the twentieth century*. Penguin.

Taylor LH, Latham SM, Woolhouse MEJ (2001). Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society London – B*, 356: 983–989.

UN-HABITAT (2003a). *Cities in a globalizing world: Global report on human settlements*. Earthscan, London.

UN-HABITAT (2003b). *Water and sanitation in the world’s cities: Local action for global goals*. Earthscan, London.

Web Links

<http://www.ipcc.ch/report/ar5/wg1/>

<http://www.ipcc.ch/report/ar5/wg2/>

<http://www.ipcc.ch/report/ar5/wg3/>

<http://www.ipcc.ch/report/ar5/syr/>

<https://www.globalchange.gov/climate-change/glossary>

16.10 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1. Extremely high temperature can cause immense negative impacts on human health. The frequency of extreme heat events is rapidly increasing in the last two decades and it is reported that such events would be rather a norm in the second half of 21st century. Further, increasing surface air temperature and climate change would increase the levels of air pollutants such as tropospheric ozone levels. The spread of water-borne diseases have been increased due to the factors such as “climate shifts”, “water-cooled air conditioning plants”; industrial agricultural practices; climate disaster, etc. Further, demographic changes, increasing vulnerable population combined with changes in human behaviour are also the driving factors causing human health burden.
2. The interactions between the pathogen or disease causing organisms and the host in a changing environment are indeed complex. Due to the changing environment, both the host and pathogen try to adapt itself and in the ensuing cycle of interactions, even the pathogen try to evolve itself. Further, climate variability and climate change greatly extend the geographical range of mosquitoes, increase the breeding season, increase the number of blood meal and eventually increase the spread and occurrence of mosquito borne

diseases. Also, the climate change induced disasters such as floods increase the occurrence of vector-borne diseases.

Check Your Progress 2

1. The most important climate-sensitive diseases are those of poor children: 90% of the burden of malaria and diarrhoea, and almost all of the burden of diseases associated with under nutrition, are borne by children aged 5 years or less, mostly in developing countries. These major diseases of children are highly sensitive to variations in temperature and precipitation. The problems of under-nutrition and associated diseases are most common among populations that are either directly dependent on rainfed subsistence agriculture or who have low incomes and therefore high sensitivity to increases in food prices, when harvests are diminished by floods and drought. The distribution of malaria in time and location is influenced to a large extent by temperature, humidity and rainfall.
2. Malnutrition has been used to refer both to over-nutrition and under-nutrition. Individual nutritional status depends on the food that an individual eats, his or her general health, and the physical environment. In all three aspects, poor water and sanitation play an important role in malnutrition and several infectious diseases associated with malnutrition, including diarrhoea and other diseases caused by intestinal parasites, are related to poor water, sanitation, hygiene and food safety.

Check Your Progress 3

1. Infections caused by pathogens that are transmitted by insect vectors are strongly affected by climatic conditions such as temperature, rainfall and humidity. These diseases include some of the most important current killers: malaria, dengue and other infections carried by insect vectors, and diarrhoea, transmitted mainly through contaminated water.
2. As many as 14 disorders resulting from exposure to heat have been recognized and documented. Heat Stroke: This is attributed to failure of the heat regulating mechanism. It is characterized by high body temperature which may rise to 110 °F (43.3 °C) and produce disturbances including delirium, convulsions and partial or complete loss of consciousness.
3. Infections occurs by contact with contaminated drinking water, recreational water, or food. This may result from human actions such as improper disposal of sewage wastes, or due to weather events. Rainfall can influence the transport and dissemination of infectious agents, while temperature affects their growth and survival. Globally, about 1.5 million deaths per year from diarrhoeal diseases are attributable to environmental factors, essentially water, sanitation and hygiene. A large proportion of diarrhoeal diseases is caused by faecal-oral pathogens.