CURRICULUM

Certificate Course on
Climate Change and Public Health

Jointly Organized by
Department of Disaster Science and Climate Resilience (DSCR)
University of Dhaka

And

Climate Change and Health Promotion Unit (CCHPU)
Health Services Division
Ministry of Health and Family Welfare

With Technical and Financial Support of

Course Structure for Certificate Course on

Climate Change and Public Health

1. Introduction to the Department of Disaster Science and Climate Resilience

On the first day of July 1921 the University of Dhaka opened its doors to students with Sir P.J. Hartog as the first Vice-Chancellor of the University. The University was set up in a picturesque part of the city known as Ramna on 600 acres of land. At present, the University consists of 13 Faculties, 83 Departments, 13 Institutes, 20 residential halls, 3 hostels, and 56 Research Centers.

Among them is the Department of Disaster Science and Climate Resilience, which was renamed in January, 2022 from Department of Disaster Science and Management that in turn started its journey in 2012. The evolution of the department's name is a reflection of the importance given to climate change studies, along with hazard science and disaster management. The aim is to integrate earth science, social science and engineering in order to generate multidisciplinary and comprehensive knowledge and skills to understand and address complex risk and emergency scenarios and eventually create a resilient society. The Department runs with the vision to provide international standard and high-quality education, engage in collaboration and has particular focus on basic and applied research.

2. Introduction to the Climate Change and Health Promotion Unit

Bangladesh is one of the most vulnerable countries to climate change, with rising sea levels, increased frequency and intensity of cyclones, floods, and droughts, all of which have significant impacts on health outcomes. Climate Change and Health Promotion Unit (CCHPU) of the Ministry of Health and Family Welfare has been working dedicatedly on climate change and health issues under the leadership of the Additional Secretary (PH) since 2010. CCHPU has good track record of working closely with the Ministry of Environment, Forest and Climate Change and Bangladesh Climate Change Trust along with some reputed developmental international organizations (WHO, UNICEF, UNFPA etc.). Besides Dhaka University, this unit also has collaborations with different world class universities including Newcastle University, University of California San Francisco, etc. The unit’s work includes research on the relationship between climate change and health, developing public health campaigns to raise awareness of climate change impacts, and implementing interventions to prevent and mitigate the health impacts of climate change.

3. Certificate Course on Climate Change and Public Health

The Certificate Course on Climate Change and Public Health is an irregular academic program for graduates in any discipline relevant to Disaster Science and Climate Resilience as well as Public Health. The program will be jointly conducted by the Department of Disaster Science and Climate Resilience of the University of Dhaka (DU) and Climate Change and Health Promotion Unit (CCHPU) of the Ministry of Health and Family Welfare. The program is offered mainly to the graduates who are willing to work in the public health domain or the graduates whose current or future careers could be accelerated through advanced knowledge in the impact of climate change on public health. **The duration of the course is three months or thirteen weeks**.

3.1 Objective of the program

Broad Objective

The overall objective of this course is to enhance resilience and adaptive capacity to the effects of climate change on human health by providing a foundational understanding of the science of climate change, health vulnerabilities of population due to climate change, and practical skills of climate change modelling, surveillance, health impact assessment, and programmatic and policy interventions at various levels.

Specific Objectives

The proposed course curriculum will focus on the following specific objectives:

- To develop a solid foundation of the current evidence on climate change and public health from both national and international perspectives.
- To be equipped for leading climate and health related professionals at own institution or within own community (creation of skilled professional on Climate Change and Health).
- To strengthen institutional capacity and knowledge management on climate change and public health.
- To improve project planning, proposal writing, project development and implementation capacities.
- To revitalize analytical skills for data and interpretation.
- To gain better communication and advocacy skills.
- To contribute in building climate resilient health system.
- To gain a new professional network that will help to lead the way in addressing the adverse impacts of climate change on health and improve governance on climate change and health adaptation in Bangladesh.

3.2 Eligibility for admission

This course will provide clear, concise and up-to-date information for anybody interested in obtaining a general understanding of the health risks arising from climate change and strategies to mitigate and adapt with them. But it should be of particular interest to the following audiences:

- Health Professionals
- Health Educators
- Government Officials working in Climate and Health Sector
- Development Practitioners
- Policy Makers (both National and Local levels)
- Climate Leaders
- University Teachers (Faculty and Researchers)
- Post-graduates/Students (PhD/ Masters)

At least, 40% of the participants will be female candidates.

3.3 Target Audience

Students having Bachelor's degree in relevant discipline can apply for the course if they have a minimum CGPA of 2.5 or equivalent grades. Female candidates are highly encouraged to apply for the program.

4. Structure of the Curriculum:

This certificate course on "Climate Change and Public Health" will provide foundational, theoretical, and practical knowledge and skills in the field of climate change and public health. The course duration will be **3 months** or **13 weeks**. The completion time for this course is estimated at **126 hours in 37 days**. And the course will be divided in **3 parts**:

A. **Blended Learning Sessions:** **36 hours** didactic lecture sessions with expert resource persons and moderated QandA sessions. These sessions will be covered through **12 days' class lectures in 6 weeks** (**weekly 6 hours in 2 off-days (Friday and Saturday); per day 3 hours**). Two class lectures will be taken in each day. The duration of each class will be **1.5 hours**.

B. **Fieldwork for Project Development:** **2 weeks** fieldwork which will be covered in **10 days** (**5 days per week**). There will be 6 groups for participating in the activities with 6 expert team leaders (each group having 5 to 6 team members). The whole process will consist of **3 segments** and the completion time is estimated at **60 hours**:

- Project Appraisal and Project Development--- **18 hours** in 3 consecutive days (6 hrs/day)
- Data Collection and Data Analysis--- **24 hours** in 4 consecutive days (6 hrs/day)
- Preparation of Field Report and Project Proposal--- **18 hours** in 3 consecutive days (6 hrs/day)

C. **Project Presentation and Assessment:** After completion of the fieldwork, the program will be further expanded through group presentation and assessment based on quizzes, assignment, presentation and viva-voce. The participants will get **5 weeks**, **15 days** (**3 days per week**), and **30 hours** (**2 hours per day**) to complete this phase. The part will also consist of **3 segments**:

- **Groupwork**: Extensive group work/discussion will be performed by each group for developing combined, innovative proposal and project presentation. They will get **2 weeks**, **6 days** (**3 days per week**), and **12 hours** (**2 hours per day**) for performing this task.
- **Group Presentation**: Each of the 6 groups will present their innovative proposals on "Climate Change and Public Health" in front of the experts/judgement panel. The

completion time is estimated at **2 weeks**, **6 days** (**3 days per week**), and **12 hours** (**2 hours per day**) for this segment. One specific day will be allotted for one specific group.

- **Group/Individual Assessment**: Finally, the participants will go through a process of viva-voce in the last week. During the last 3 days of this week, two groups will be assessed in each day based on their group/individual performance.

Besides, the assessment process will focus on the following criteria:

- Assessment practices must give fair and equitable chance to each participant and also give them the opportunity to demonstrate what they have learned.
- Assessment must enable robust and fair judgements about each participant's performance.
- Assessment must maintain academic standards.

Segments	**Weeks**	**Days**	**Hours**
1.Blended Learning Sessions	6 weeks	12 days (2 days/wk)	36 hours (3 hrs/day)
2.Fieldwork for Project Development	2 weeks	10 days (5 days/wk)	60 hours (6 hrs/day)
3.Project Presentation and Assessment	5 weeks	15 days (3 days/wk)	30 hours (2 hrs/day)
Total	**13 weeks**	**37 days**	**126 hours**

5. Assessment

The participants' progress will be evaluated through class performance, presentations, assignment, pre and post assessment and other appropriate techniques determined by the resource persons.

6. Tuition Fees

Tuition fees will be decided by course convening committee. The 1st batch tuition fees will be covered by sponsors, such as FCDO, UNFPA, etc.

Summary of the Modules

Seven modules will be covered by 36 hours didactic lecture sessions. And each module will focus on the following particular areas:

Modules	Lectures	Summary of Lectures
Module 1: Introduction to Climate Change and Public Health (3 didactic lecture sessions)	**Lecture 1.1: Introduction to Climate and Climate Change**	This lecture will provide an overview of climate, weather, climate variability, and climate change. It will cover the basic concepts of global warming, greenhouse effects, major greenhouse gases, and heat island effects. This lecture will also cover the basics of future projections of climate change, trend analysis of climate over the year, and its effect on human lifespan.
	Lecture 1.2: Core Concepts and Components of Climate Change	This lecture will provide an overview of the core concepts and components of climate and climate change. It will cover the causes of rapid climate change, the consequences of climate change, and the evidence of abnormal climate change. This lecture will then discuss about the introduction of global and national climate change induced hazards and disasters and its impact on the public health including different case studies.
	Lecture 1.3: Association between Climate Change and Human Health	This lecture will provide an overview of the impact of climate change and climate variability on human health. It will cover the ways and mechanisms of affecting human health by climate change. This lecture will also briefly discuss on climate sensitive disease burdens in Bangladesh.
Module 2: Basics of Public Health	**Lecture 2.1: Concept and Areas of Public Health**	This lecture will give an overview of the public health system and different areas of public health. It will discuss the principles of health education and areas of public health including community and family

Modules	Lectures	Summary of Lectures
(3 didactic lecture sessions**)**		health, global health, environmental and occupational health, epidemics, and public health surveillance. This lecture will also focus on the core functions and services of public health.
	Lecture 2.2: Public Health and Its Role in Disaster Management: An Integrated Approach	This lecture will focus on public health and its role in disaster management. It will discuss public health emergencies and the role of primary health care in climate change related health issues.
	Lecture 2.3: Epidemiological Approach on Public Health and Climate Resilience	This lecture will discuss extreme weather events and public health management; phases of epidemiological approach, calculating rates of diseases. It will also discuss disease outbreak investigation in emergencies (major ten steps).
Module 3: The Impact of a Warming World-Climate Change and Human Health (3 didactic lecture sessions)	**Lecture 3.1: Climate Change Impacts and Human Health**	This lecture will provide an overview of the existing scenario of climate change impacts on human health from Bangladesh and world perspective. It will also discuss the vulnerable groups (regarding the health sector) for climate change. A brief idea will be given on the impact of climate change on food security and agriculture in Bangladesh as well through this session. This lecture will also discuss the diseases caused by climate extremes, extreme weather events and rapid unplanned urbanization.
	Lecture 3.2: Climate Sensitive Disease Burdens in Bangladesh	This lecture will talk about water-borne diseases; vector-borne diseases; food-borne diseases, air-borne diseases and their increase/intensity due to climate change.

Modules	Lectures	Summary of Lectures
	Lecture 3.3: Impact of Climate Change on Adolescent, Reproductive and Mental Health with Gender Issues	This lecture will mainly talk about the impacts on adolescent and reproductive health and fertility (SRHR) of climate change. It will also cover the trauma and mental health issues associated with climate change-induced disasters and migration in different gender perspective.
Module 4: Climate Change Prediction and Health Risk Management (4 didactic lecture sessions)	**Lecture 4.1: Climate Change Prediction: Prediction Models, Predictors and their Characteristics**	This lecture will contain the basics of climate change prediction modeling, most prevalent prediction models, the inputs and outputs of these models and their characteristics (how ground, earth and space observations are used to predict and model climate change) to provide a brief idea of the whole process.
	Lecture 4.2: Most Prevalent Prediction Models and their Mechanism	This lecture will highlight the discussion on the hierarchy of theoretical climate models; the underlying assumptions; importance, significance, and limitations of these climate change prediction models keeping a special focus on the public health sector.
	Lecture 4.3: Climate Change Prediction and Public Health	This lecture will discuss different processes of the assessment and prediction of health impacts of climate change (time series regression, episode analysis etc.)
	Lecture 4.4: Modelling the Future Health Impacts of Climate Change	This lecture will mainly discuss about 'risk assessment of future health burdens' by estimating/modelling the future health impacts of climate change. Besides, it will also talk about uncertainty in analysis and modelling.

Modules	Lectures	Summary of Lectures
Module 5: Climate Change Adaptation for Human Health (3 didactic lecture sessions)	**Lecture 5.1: Human Health and Climate Change Adaptation**	The lecture will highlight on the main adaptation strategies to reduce health impacts at global level: UNFCCC, the Paris Agreement, the Sendai Framework, Sustainable Development Goal (SDG), IPCC adaptation in health sector as well as strategies at the national level: National Adaptation Plan for Health Sector (NAP), National Adaptation Program of Action (NAPA), Bangladesh Climate Change Strategy and Action Plan (BCCSAP), Seventh Five-year Plan etc.
	Lecture 5.2: Assessment of Health Vulnerability	Through this lecture the best practices in assessment of health vulnerability will be discussed including community health assessment, H-NAP and Health Impact Assessment (HIA) approaches.
	Lecture 5.3: Development of Climate-Resilient Health System in Bangladesh	This lecture will focus on different aspects of developing a climate resilient health system in Bangladesh. It will discuss 10 key components for building climate resilience, women and child centered health adaptation for climate resilience etc.
Module 6: Resilience Building to the Health Impacts of Climate Change (Policy, programs) (4 didactic lecture sessions)	**Lecture 6.1: Climate Change Policies and Laws regarding Public Health**	In this lecture, the participants will know about the existing Climate Justice, Climate Policy, Law, related to Public Health. They will get to know about the policy considerations for mitigating and adapting to climate change related public health impacts. They will also evaluate the existing Climate Change Mitigation and Health policies.
	Lecture 6.2: Mainstreaming Climate	This lecture will demonstrate mitigation and adaptation practices at both national

Modules	Lectures	Summary of Lectures
	Change and Public Health: National and International Practices	and international levels to help the participants understand the mutual benefits of mainstreaming Climate Change Mitigation and Health policies. This will be done by presenting the best and common practices in relevance for public health. The lecture contents will also include Climate Change and Health Promotion Programs as well as their Planning, Implementation and Evaluation. Besides, this lecture will also discuss broadly about NAP and H-NAP activities in Bangladesh.
	Lecture 6.3: Interventions for Mitigating Climate Change Impacts on Public Health	The advanced concepts of Preparedness and Mitigation (short, medium and long-term) relevant for climate change impacts will be discussed in this lecture. The participants will achieve a working knowledge of existing different interventions and measures in Bangladesh after the completion of this lecture.
	Lecture 6.4: Climate Change and Public Health – Future Challenges and Interventions	This lecture will discuss about the existing and possible upcoming challenges for public health sector. The challenges resultant from the increased health hazards due to climate change will be covered in this lecture.
	Lecture 7.1: Research methods and techniques	This lecture will demonstrate a working understanding of strategies and methods of conducting research in the Earth and

Modules	Lectures	Summary of Lectures
Module 7: Research Methodology (4 didactic lecture sessions)	**for Climate Change and Public Health**	Environmental Science, and Public Sector as well as knowledge of general research tools and practices. The contents will include types of available data collection methods including library use, literature search and compilation of data from various sources (primary/secondary), their description and application, observation and monitoring techniques, relevant analysis and synthesis techniques, surveying and sampling techniques, mapping etc.
	Lecture 7.2: Research Design and Methodology Development	Through this lecture, the participants will learn to identify research problems, design studies by developing objectives and methodology. Besides, this lecture will discuss about different research frameworks, survey design, questionnaire development, sampling methods etc.
	Lecture 7.3: Data Collection Methods and Knowledge Management	In this lecture, the participants will be taught about different data collection methods (qualitative and quantitative), data analysis, Interpretation and result validation methods. This lecture will also discuss about data quality control and management; data presentation (table, maps, figures, graphs etc.); data screening and data processing etc.
	Lecture 7.4: Report Writing and Research Ethics	The participants will be taught how to write proposals and different types of reports (writing abstract; preparing contents; arranging the body of text; summarizing and conclusion; giving references and bibliography; adding appendices etc.). The ethics associated with their scientific discipline and how it

Modules	Lectures	Summary of Lectures
		relates to publishing scientific research papers will be discussed in this lecture. The relationship between the researcher and the scientific community will also be reflected here.

Detailed Content of the Courses

Module 1: Introduction to Climate Change and Public Health

Introduction to the Module:

Climate change is a significant global change that affects multiple facets of human life, including public health. The changing climate patterns have profound effects on air, water quality, food security, vector-borne diseases and mental health among other health outcomes. Addressing the complex changes posed by climate change requires a multidisciplinary approach, involving collaboration among scientists, policymakers, public health practitioners and communities. This module aims to provide an introduction to the key concepts of climate change, components of climate change and relationship between climate change and public health.

Specific Objectives:

- To understand the basic concepts of climate change, including its causes, impacts, and future projections.
- To gain a deeper understanding on global warming, its causes and effects, greenhouse gases and their effects.
- To explore the relationship between climate change and public health, including the direct and indirect impacts of climate change on human health and well-being.

Number of Lectures: 03

Lecture 1.1: Introduction to Climate and Climate Change

- Definitions of Terminology: Weather, Climate, Climate Variability, Climate Change and other related terms.
- Difference between ‘weather’ and ‘climate’; Difference between ‘climate variability’ and ‘climate change’.
- Why should we care about climate change?
- Overview of the climate system (atmospheric structure and composition)
- **Trends and Projections in climate**: Changes in climate that have occurred over human history.
    - ✓ Changing temperature and precipitation patterns.
    - ✓ Increases in ocean temperature and sea level rise.
    - ✓ Melting of glaciers and sea ice.
    - ✓ Changes in the frequency, intensity, and duration of extreme weather events.

- Basic concepts of global warming, greenhouse effects, major greenhouse gases, heat island effects.
- **Observed changes in Greenhouse gases**.

Lecture 1.2: Core Concepts and Components of Climate Change

- Overview of the core concepts and components of climate change.
- Causes of rapid climate change (**natural and anthropogenic**); the consequences of and the evidence of abnormal climate change (sea level rise, floods, cyclones, droughts, etc.).
- The most vulnerable regions of Bangladesh.
- Global and National Climate Change induced hazards and disasters and the effects on Human Health.
- **Different case studies** on Climate Sensitive Diseases/Health disorders (for instance: extreme precipitation and dengue fever; floods and malaria, cholera, diarrheal diseases; drought and health problems; heat wave related health disorders, etc.)

Lecture 1.3: Association between Climate Change and Human Health

- Overview of the health risks/impacts of climate variability and climate change.
- Ways and mechanism in which Climate Change affects human health (direct and indirect factors; natural and anthropogenic factors; environmental, biological and social factors).
- **Climate Sensitive Disease Burdens in Bangladesh** (dengue, malaria, chikungunya, cholera, malnutrition, diarrheal disease, asthma and respiratory allergies, heat-related cardiovascular disease/failure, mental health impacts, etc.)

References

- Dessler, A. (2021). *Introduction to Modern Climate Change (3rd ed.).* Cambridge University Press
- Dr. Philip J. Rasch, Philip J. Rasch, 2012. *Climate Change Modeling Methodology: Selected Entries from the Encyclopedia of Sustainability Science and Technology,* Springer-Verlag New York
- Neelin J.D., 2011. *Climate Change and Climate Modeling*, Cambridge University Press, London
- Sjideler, J. C., and Hatzel, J. (2016). *Introduction to Climate Change Management*. CRC Press

Module 2: Basics of Public Health

Introduction to the Module

Public health is the science of preventing and controlling diseases, promoting health, and improving the quality of life in community. It involves a broad range of activities, including disease surveillance, health education, health intervention. Public health professionals work to identify health problems and risk factors, and to develop and implement interventions to address them. Understanding the basics of public health is important for anyone who wants to make a positive impact on the health of their community. This module is, therefore, to cover the key concepts and principles of public health, including the history of public health, the determinants of health and its role in disaster management.

Specific Objectives:

- To introduce learners to the concept of public health and its importance in promoting population health and preventing disease.
- To provide an overview of the history and evaluation of public health as a field of study and practice.
- To familiarize learners with the key principles, theories that underpin public health interventions and strategies.
- To introduce learners to the tools and techniques used in public health research and evaluation including epidemiology, biostatistics.
- To introduce learners the importance of public health and its role in disaster management.

Number of Lectures: 03

Lecture 2.1: Concept and Areas of Public Health

- Overview of the public health system and different areas of public health.
- **Key public health terms**: Definitions of public health, clinical care, epidemic or outbreak, endemic, pandemic, difference between epidemic and pandemic, health outcome etc.
- **Areas of public health**: community and family health, global health, environmental and occupational health, mental health etc.
- **Public Health Problems**: Infectious diseases, chronic diseases, emergencies, injuries, as well as other health threats.
- **A Public Health Approach**: Four steps approach---
    - ✓ **Public health surveillance systems** (What is the problem)
    - ✓ **Risk Factor Identification** (What is the cause of the problem)
    - ✓ **Intervention evaluation** (What will work in addressing/solving the problem)
    - ✓ **Implementation** (How can we implement the intervention)
- **Core functions and essential services of public health**: Monitoring health; Diagnose and Investigate; Inform, Educate and Empower; Mobilize community partnership; **Develop**

policies; **Enforce laws**; Link to provide care; Assure a competent workforce; Evaluate; **Research**.

- Determinants of health and their effects on population health.

Lecture 2.2: Public Health and Its Role in Disaster Management: An Integrated Approach

- The **Role of primary health care** in climate change related health issues.
- Public health emergencies during extreme weather events and public health management.
- **5 key components of Emergency Management**: Prevention, Mitigation, Preparedness, Response and Recovery.
- **Prevention of Health Risks**: Reduce exposures (legislative policies, alterations in built environment, alterations in natural environment); Prevent onset of adverse outcomes (early warning systems, surveillance and monitoring, vector control programmes, **public education and outreach**); Response/Disease Treatment (**medical training and awareness**, emergency response).
- **Possible Areas for Public Health Response during Emergencies**: Food supplementation and health care; epidemic surveillance and early warning system; health services (immunization, child and maternal health, referrals); special services (outreach, mobile teams); emergency funding to support health action.
- **Principles of Public Health Emergency Management**: Concept of Risk Assessment and Risk Management; Emergency planning; National emergency management system and coordination within it.
- **Role of the Health Sector:**
    - ✓ Identify the health benefits (and potential health harms) associated with climate change. **(Assessment)**
    - ✓ Support health-promoting climate change policies. **(Policy Development)**
    - ✓ Ensure provision of services to those in need. **(Assurance)**
    - ✓ Enhance resilience and protect health from climate change.
- **Health Emergency and Disaster Risk Management Framework (EDRM):** Policies, strategies and legislation; Planning and Coordination; Human resources; Financial resources; Information and Knowledge Management; Risk Communications; Health Infrastructure and Logistics; Health and related services; Community capacities for health EDRM; Monitoring and Evaluation.

Lecture 2.3: Epidemiological Approach on Public Health and Climate Resilience

- Definition of Epidemiology; Determinants in Epidemiology (**causes, risk factors, frequency, patterns** etc. of health events during emergencies)
- **Phases of epidemiological approach; calculating rates of diseases.**
- **Methods used in Epidemiology:** observational study, cohort study, cross-sectional study, multi-level modelling
- **The role of Epidemiologist in Disaster Management**; **Core competencies** for public health professionals to work during emergencies.
- **Disease outbreak investigation in emergencies**: Major ten steps.
- **Public health Interventions in Emergency Management:** Disease outbreak investigation; health needs assessment; planning to keep primary and secondary care levels and referral services functioning; Rapid response teams; Mass casualty management; Mortality assessment; Medical supplies and logistics in emergencies etc.
- The components of essential public health package for climate resilience.
- Brief discussion on Psychosocial support in emergency.

References

- Aschengrau, A., and Seage, G. (2018). *Essentials of Epidemiology in Public Health.* Jones and Bartlett Learning.
- Fallon, L., Fleming, J. F., and Zgodzinski, E. (2012). *Essentials of Public Health Management.* Jones and Bartlett Learning.
- Filho, W. L., Azeiteiro, U., and Alves, F. (2016). *Climate Change and Health.* Springer International Publishing.
- Levy, B., and Patz, J. (2015). *Climate Change and Public Health.* Oxford University Press.
- Schneider, M. J. (2020). *Introduction to Public Health.* Jones and Bartlett Learning.
- Seabert, D., McKenzie, J., and Pinger, R. (2021). *McKenzie's An Introduction to Community and Public Health.* Jones and Bartlett Learning.

Module 3: The Impact of a Warming World – Climate Change and Human Health

Introduction to the Module

In the 21st century, the whole world is continuously experiencing the wider impacts of climate change on lives and livelihoods. Globally, warming temperatures and changing weather patterns have given rise to unprecedented conditions like extreme heat events, more intense storms, droughts, sea level rise, floods and wildfires etc. Warm condition of climate also poses a wide range of risks to human health which has become a topic of critical importance right now. Various diseases are caused by extreme weather events and the rate of their occurrence is very alarming in recent years. Hence, it is very important for the participants to familiarize with these diseases. Reproductive health and fertility status, trauma and mental health issues are also associated with climate change-induced disasters. The main objective of this module is to familiarize and develop the level of understanding of the participants with the effects of climate change towards human health.

Specific Objectives:

- To explain the basics about climate change impacts and human health with respect to the global and local perspective.
- To familiarize the participants with the climate-sensitive diseases burdens in local context.
- To describe the impacts of climate change on adolescent, reproductive health and mental health.

Number of Lectures: 03

Lecture 3.1: Climate Change Impacts and Human Health

- **Key terminologies of climate change**: Impacts, vulnerability, adaptation, mitigation, risk, hazards, shock, variability, trend, exposure, sensitivity, adaptive capacity etc.
- Overview of the existing scenario of climate change impacts on human health in Bangladesh: **Key observations and Projections based on WHO's estimation**.
- The **vulnerable groups** for Climate Change (**regarding the health sector**); **Factors** associated with **increased vulnerability**.
- Impact of Climate Change on Food Security and Agriculture in Bangladesh:
    - ✓ Discussion on how climate change is affecting agricultural production and food security. (Now)
    - ✓ Discussion on how climate change is likely to affect agricultural production and food security. (Future)
    - ✓ The burden of diseases from Malnutrition/Undernutrition; Malnutrition during pregnancy.
    - ✓ Steps to improve future food security.
- **Impact on health of climate extremes**: thermal extremes and extreme weather events; and rapid unplanned urbanization.

Lecture 3.2: Climate Sensitive Disease Burdens in Bangladesh

- **Climate Change and Vector-borne Diseases (VBD):**
  - ✓ Introduction to vector-borne diseases (dengue, malaria etc.)
  - ✓ Types of VBD Transmission (Human-vector-human/anthropogenic infections; Animal-vector-human/Zoonotic infections).
  - ✓ **Causes of Increased VBDs**: Rising global temperatures; Increased rainfall, flooding and humidity; Longer breeding season; Faster replication of pathogens; seasonality etc.
  - ✓ **Direct effects of climate change on VBDs**: Increase range or abundance of vector reservoirs; Prolong transmission cycle; Increase importation of vectors or pathogens; Increase animal disease risk and potential human risk.
  - ✓ Case studies on Climate Change and VBDs in Bangladesh (climate change and malaria scenario; climate variability and dengue incidence etc.)

- **Climate Change and Water- and Food-borne Diseases:**
  - ✓ The burden of water- and food-borne diseases in Bangladesh. (diarrhoea/dysentery, cholera, typhoid etc.)
  - ✓ Discussion on how climate and weather affects food- and water-borne diseases (in terms of season, temperature, extreme precipitation (flooding and drought) and sea level rise).
  - ✓ **Climate Resilience and Management of Water-borne and Vector-borne diseases**.

- **Climate Change and Air Quality related Health Issues:**
  - ✓ Introduction to Air Pollutants (CO, NO2, SO2, O3 etc.) and their characteristics.
  - ✓ **Exposure to Air Pollution**: Major sources of air pollutants; Who is most at the risk (people who work outdoors; truck drivers; young children and the elderly; people with chronic illnesses; people living next to highways etc.)
  - ✓ **Health impacts of Air Pollutants** (cardiovascular illness; heart disease; stroke; lung cancer; premature death; respiratory allergies/infections and asthma etc.)
  - ✓ Strong evidence between Air Pollution and Premature Death (time-series studies of acute effects; cohort or cross-sectional study of chronic effects)
  - ✓ **Benefits of air quality related policies**.

Lecture 3.3: Impact of Climate Change on Adolescent, Reproductive and Mental Health with Gender Issues

- **Climate change and psychosocial hazards**: post-traumatic stress disorder (PTSD)/Disaster trauma; depression; anxiety; suicidality; occupational stress; workplace violence etc.

- **Psychosocial needs and stress management in Mass Emergency and Disaster Management**: Identifying socio-psychological needs during emergencies; Assessment of needs and priorities; Area-specific requirements; Different psychological considerations in climate change induced natural and manmade disasters.
- Climate Change and Mental Health: Bangladesh Context.
- Climate change impacts on Reproductive Health and Fertility and Adolescent Health (gender-based violence; child marriage etc.)
- **Climate Change Action and Sexual and Reproductive Health (SRHR)**: Investments in SRHR; increasing girl's and women's resilience and adaptive capacity to climate change; and improving their engagement in climate action etc.
- Youth Initiatives for Sexual and Reproductive Health and Rights (SRHR).
- Gender Issues.

References

- Akhtar, R. (Ed.). (2020). *Extreme Weather Events and Human Health:International Case Studies* (1 ed.). Springer Cham.
- Lemery, M. J., and Auerbach, M. P. (2017). *Enviromedics: The Impact of Climate Change on Human Health.* Colorado: Rowman and Littlefield Publishers.
- Madeleine, C. T., and Simon, J. M. (Eds.). (2018). *Climate Information for Public Health Action* (1 ed.). Columbia, USA: Routledge.

Module 4: Climate Change Prediction and Health Risk Management

Introduction to the Module

Climate change modelling and risk management are both critical components in understanding the potential impacts of climate change and taking steps to mitigate those impacts. Having knowledge on climate change modelling and risk management is essential tools for addressing the health impacts of climate change, and for building a more sustainable future. Studying climate change modelling and risk management involves learning about the climate change prediction models, importance, significance and limitation of climate change prediction models, etc.

Specific Objectives:

This module will make participants understand different climate change prediction models, predictors and their characteristics, as well as the significance and the limitations of these climate change models. They will learn different process of assessment and prediction of health impacts of climate change.

Number of Lectures: 04

Lecture 4.1: Climate Change Prediction: Prediction Models, Predictors and their Characteristics

- Basics of climate change prediction modelling; most prevalent prediction models; and the inputs and outputs of these models.
- Climate change predictors and their characteristics (how ground, earth and space observations are used to predict and model climate change).
- Basic Statistical Analysis Methods for analyzing data of climate variables: trend analysis; establishing relationship between two or more different datasets/variables; time-series analysis; simple linear regression.
- Basics of **General Circulation Models** (GCMs) and **Atmosphere-Ocean GCM** to model the detailed patterns of climate variability and climate change (temperature, precipitation, wind patterns etc.)

Lecture 4.2: Most Prevalent Prediction Models and their Mechanism

- Discussion on the hierarchy of theoretical climate models, the underlying assumptions, and strengths and weaknesses/limitations of various climate modeling approaches.
- Discussion on the issue of how climate models have been 'validated'.
- Discussion on the concept of “equilibrium climate sensitivity”; Estimation of climate sensitivity.
- Zero-dimensional Energy Balance Model (EBM); One-layer EBM; One-dimensional EBM.

- Discussion on weather-health relationship analysis for predicting climate-related health effects and Importance of these prediction models for long-term solutions in public health sector.
- Lab based modelling (tools and techniques): GIS; RS; Satellite images etc.

Lecture 4.3: Climate Change Prediction and Public Health

- Discussion on Observational studies based on the Time- and Space-specific relationship/modelling between health effect and climate factor.
- **Types of analysis of climate-related health effects**:
    - ✓ **Conventional epidemiology/Observational analysis** (usually combining evidence on short-term weather-health relationships derived from epidemiological studies of recent past events with models of future climates derived from global circulation models).
    - ✓ **Model-based Analysis** (usually try to predict future health burdens by assuming current weather-health patterns applied to future worlds with altered climate, and decision-analysis).

- **Observational Analysis**:
    - ✓ **Episodes or event analysis**: heat wave, flood, drought, cyclone etc.
    - ✓ **Time-series analysis**: mortality/morbidity vs. temperature/precipitation.
    - ✓ **Seasonality**: diarrhoea, vector-borne diseases, aero-allergens etc.
    - ✓ **Changes in Geographical Distribution**: temperature/precipitation vs. vector-borne diseases (analyses of disease prevalence or vector abundance in relation to geographical factors).
- **Model-based Analysis**:
    - ✓ Risk Assessments of future Health Burdens.
    - ✓ Decision analysis of health impacts.
- Concept of time-series regression/regression analysis and Time Lags.

Lecture 4.4: Modelling the Future Health Impacts of Climate Change

- **Estimating future health impacts of Climate Change**:
    - ✓ Expert judgement
    - ✓ Simple extrapolation
    - ✓ Mathematical/Statistical Modelling
        - -Bivariate
        - -Multivariate
        - -Fully integrated

- **Risk Assessment of future Health Burdens:**
  - ✓ To demonstrate the potential nature and size of health burdens that may arise under climate change.
  - ✓ To provide evidence on the measures needed to protect human health.
  - ✓ To provide comparative evidence about the possible effect (on health) of alternative adaptation and/or mitigation policies.
- **Principles of Future Health Burdens Approach**:
  - ✓ Obtaining scenario-based evidence about the future distribution of climate patterns under assumptions of greenhouse gas emissions.
  - ✓ GCM/RCM model: Generating series of maps of predicted future distribution of these climate variables.
  - ✓ Health Impact model: Generating comparative estimates of the regional impact of each climate scenario on specific health outcomes.
  - ✓ Computing burdens of disease in terms of years of life lost (YLL), disability adjusted life years (DALYs) and premature mortality by combining these models.
- **Uncertainty in Analysis and Modelling**.

References

1. Dr. Philip J. Rasch, Philip J. Rasch, 2012. Climate Change Modeling Methodology: Selected Entries from the Encyclopedia of Sustainability Science and Technology, Springer-Verlag New York
2. Neelin, J. D. (2010). *Climate change and climate modeling*. Cambridge University Press.
3. Giorgi, F. (2005). Climate change prediction. Climatic Change, 73, 239-265.
4. López-Moreno, J. I., Goyette, S., and Beniston, M. (2008). Climate change prediction over complex areas: spatial variability of uncertainties and predictions over the Pyrenees from a set of regional climate models. *International Journal of Climatology: A Journal of the Royal Meteorological Society*, *28*(11), 1535-1550.
5. Patz, J., Campbell-Lendrum, D., Gibbs, H., and Woodruff, R. (2008). Health impact assessment of global climate change: expanding on comparative risk assessment approaches for policy making. Annu. Rev. Public Health, 29, 27-39.

Module 5: Climate Change Adaptation for Human Health

Introduction to the Module

Climate adaptation is crucial for human health because climate change has significant effects on health outcomes. Understanding climate adaptation is important for human health as it allows individuals, communities, and policymakers to take proactive steps to mitigate the adverse impacts of climate change on health outcomes. Knowledge of climate adaptation can help to be informed about public health policy and planning, which can lead to better preparedness and response to the health impacts of climate change. Studying climate adaptation for public health involves knowing about the national and global adaptation strategies to deal with climate change impacts on health, climate resilient health system and getting informed about different tools, techniques related to climate adaptation etc.

Specific Objectives:

- To explain the participants the basics about climate adaptation,
- To familiarize with global and national adaptation strategies to deal with the climate change impacts on health.
- To describe the community-based risk assessment and its practices, as well as the development of climate resilient health system in Bangladesh.

Number of Lectures: 03

Lecture 5.1: Human Health and Climate Change Adaptation

- Discussion on two key response measures to deal with climate change, i.e., Adaptation and Mitigation; What are the fundamental differences; Basics of Adaptation and Mitigation and their relevance to health.
- **Theory and Practice of Adaptation**:
    - ✓ Definition of Adaptation; Adaptation science.
    - ✓ Goal of adaptation (to prepare for, and effectively respond to the health risks of climate change)
    - ✓ Types of Adaptation (anticipatory/responsive)
    - ✓ Context specificity of adaptation etc.
- **Steps in an Adaptation Assessment**:
    - ✓ Determine the scope of the assessment.
    - ✓ Identify and convene stakeholders.
    - ✓ Identify and evaluate current strategies, policies and measures to reduce that burden.
    - ✓ Estimate future potential health impacts (using socioeconomic and climate change scenarios; both qualitative/quantitative).
    - ✓ Identify additional adaptation measures (to reduce potential negative health effects).

- **Framework for Adaptation Assessment**: 1. Identify problem and objectives; 2. Establish decision-making criteria; 3. assess risk; 4. Identify options; 5. Appropriate options; 6. Make decision; 7. Implement decision; 8. Monitor.
- **Key adaptation strategies /adaptation options** to reduce the health impacts of Climate Change: **legislative, technical, educational, or cultural and behavioral**; proper health education, early warning system, technology development, vector control, vaccination, sustainable surveillance and monitoring, prevention and control programmes, improved water treatment and sanitation, urban planning etc.
- **Global and National Adaptation Strategies and Institutions to deal with health impacts for Climate Change**: adaptation activities under the UNFCCC; the Paris Agreement; the Sendai Framework; Sustainable Development Goal (SDG); IPCC adaptation in health sector; National Adaptation Plan for Health Sector (H-NAP); National Adaptation Program of Action (NAPA); Bangladesh Climate Change Strategy and Action Plan (BCCSAP); Seventh five-year plan etc.

Lecture 5.2: Assessment of Health Vulnerability

- Discussion on the Community Health Assessment. (H-NAP and Health Impact Approaches)
- **Key terms around Health Vulnerability to Climate Change**: Definition; main causes of health vulnerability; vulnerability to natural, physical and social system etc.
- **H-NAP approach for assessing health vulnerability**: A systematic process to----
  - ✓ Engage in the overall NAP process at the national level.
  - ✓ Identify national strategic goals for building health resilience to climate change.
  - ✓ Develop a national plan with prioritized activities to achieve these goals.
- **Core Component of H-NAP approach**: A health vulnerability and adaptation Assessment.
- **Three major categories of activities in H-NAP approach (WHO guidance document)**:
  - ✓ Framing and scoping the assessment.
  - ✓ Conducting the assessment.
  - ✓ Managing and monitoring risks for the effectiveness of implemented adaptation options.
- **Health Impact Assessment (HIA):** combination of procedures, methods and tools by which a policy, project or hazard may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.
- **Elements in Health Impact Assessment (HIA)**:
  - ✓ Quantification of the expected health burden.
  - ✓ Integrated Assessment of Impacts. (a holistic view of health)
  - ✓ Relation to policies and projects and provides information for decision-makers.
  - ✓ Multidisciplinary process.

Lecture 5.3: Development of Climate-Resilient Health System in Bangladesh

- **10 key components for building Climate Resilience**: Emergency preparedness and management; health governance and policy; financing; capacity development; vulnerability, capacity and adaptation assessment; Integrated risk monitoring and early warning; Research; essential products and technologies; management of environmental determinants of health; climate-informed health programmes.
- **WHO framework for Health System Resilience**.
- Financial support through Global Environment Facility (GEF); Green Climate Fund; Adaptation Fund.
- Different aspects of developing a climate -resilient health system in Bangladesh. (sustainable and climate-resilient healthcare facilities; community health resilience etc.)
- Discussion on Women and child-centered health adaptation in Bangladesh.

References

- World Health Organization. (2014). *Gender, climate change and health*. World Health Organization.
- Paavola, J. (2017). Health impacts of climate change and health and social inequalities in the UK. *Environmental Health*, *16*(1), 61-68.
- Marselle, M. R., Stadler, J., Korn, H., Irvine, K. N., and Bonn, A. (2019). *Biodiversity and health in the face of climate change* (p. 481). Springer Nature.
- Leal Filho, W., Azeiteiro, U. M., and Alves, F. (2016). *Climate change and health*. Springer: Berlin/Heidelberg, Germany.
- McMichael, A. J., Campbell-Lendrum, D. H., Corvalán, C. F., Ebi, K. L., Githeko, A., Scheraga, J. D., and Woodward, A. (2003). *Climate change and human health: risks and responses*. World Health Organization.
- Marinucci, G. D., Luber, G., Uejio, C. K., Saha, S., and Hess, J. J. (2014). Building resilience against climate effects—a novel framework to facilitate climate readiness in public health agencies. *International journal of environmental research and public health*, *11*(6), 6433-6458.

Module 6: Resilience Building to the Health Impacts of Climate Change

Introduction to the Module

Climate change has significant health impacts, the direct effects and the indirect effects. To mitigate the health impacts of climate change, policy and programs should focus on reducing greenhouse gas emissions, building climate resilience, and enhancing public health systems. Understanding the policies and the programs about mitigating the health impact of climate change is very important to build the climate resilient health system. Studying the policies and the programs about mitigating the health impact of climate change involves being aware about the climate change policies and laws regarding public health, as well as national and international practices main-streaming climate change and public health.

Specific Objectives

- To enable participants, comprehend the climate change policies and laws regarding public health,
- To explain national and international practices for main-streaming climate change and public health issues.
- To comprehend the current and potential future challenges for the public health sector as a result of the increased health risks brought on by climate change
- To narrate about existing interventions and initiatives to tackle the challenges facing the public health sector both on Bangladesh and global perspectives

Number of Lectures: 04

Lecture 6.1: Climate Change Policies and Laws regarding Public Health

- **Climate justice, climate policy, law and Public Health**: Discussion on two key response measures to deal with climate change i.e., mitigation and adaptation; What are the fundamental differences; basics of Adaptation and Mitigation and their relevance to health; global injustice regarding carbon emission; equal rights on atmosphere and earth; equal rights to development; compensation regarding carbon emission and the injustice between survival and luxury.
- Key institutions to deal with climate change impacts and policies on health in Bangladesh: Ministry of Health and Family Welfare (MoHFW); DG Health Services; DG Health Education; Climate Change and Health Promotion Unit (CCHPU) etc.
- Discussion on existing policy considerations in climate change and health sector (Heat-Health Action Plan, effective Early Warning provision, Safe Drinking Water and Sanitation, Disaster Risk Reduction etc.)
- Discussion on evaluation of the existing climate change mitigation and health policies.
- Discussion on the mutual benefits of climate change mitigation and health policies.

Lecture 6.2: Mainstreaming Climate Change and Public Health: National and International Practices

- Climate Change and Public Health: Policy; planning and management (both at national and international level)
- Climate Change and Health Promotion Programs: Planning, implementation and evaluation (both at national and international level)
- **Broad discussion on Bangladesh NAP (National Adaptation Plan)**; their current operational activities; broad objectives etc.
- **Two specific projects of Bangladesh NAP regarding Climate Change**:
    - ✓ Mainstreaming adaptation and mitigation options to climate change through policies and programs in different sectors specially focusing on disaster management and public health.
    - ✓ Providing safe drinking water to coastal communities to combat enhanced salinity due to sea level rise and salinity intrusion.
- Broad discussion on **the concept of H-NAP (National Adaptation Plan for Health Sector)** to engage in the overall NAP process at the national level for building health resilience to climate change.

Lecture 6.3: Interventions for Climate Change impacts on Public Health

- Definition of Mitigation; What is climate change Mitigation; Why is mitigation necessary?
- Preparedness and Mitigation: Advanced concept; Mitigation in short, medium and long-term for climate change and health sector.
- Discussion on **different mitigation options** and **co-benefits of climate change mitigation action for the environmental and human health.**
- Discussion on the existing different interventions and measures in Bangladesh to mitigate the health impacts of climate change.

Lecture 6.4: Climate Change and Public Health – Future Challenges and Interventions

- Discussion on possible upcoming challenges for public health sector due to climate change.
- Discussion on interventions to manage these challenges and on the scope of integrating enhanced technologies in the field of climate change prediction and public health sector.

References

- World Health Organization. "Climate change and health." (2008).
- Patz, J. A., and Olson, S. H. (2006). Climate change and health: global to local influences on disease risk. Annals of Tropical Medicine and Parasitology, 100(5-6), 535-549.
- Solomon, C. G., and LaRocque, R. C. (2019). Climate change—a health emergency. *New England Journal of Medicine*, *380*(3), 209-211.
- Friel, S. (2019). Climate change and the people's health (Vol. 2). Small Books Big Ideas in Popul.
- Tong, S., Confalonieri, U., Ebi, K., and Olsen, J. (2016). Managing and mitigating the health risks of climate change: calling for evidence-informed policy and action. *Environmental Health Perspectives*, *124*(10), A176-A179.
- Harlan, S. L., and Ruddell, D. M. (2011). Climate change and health in cities: impacts of heat and air pollution and potential co-benefits from mitigation and adaptation. *Current opinion in environmental sustainability*, *3*(3), 126-134.
- Davoudi, S., Crawford, J., and Mehmood, A. (Eds.). (2009). *Planning for climate change: strategies for mitigation and adaptation for spatial planners*. Earthscan.

Module 7: Research Methodology

Introduction to the Module

This module intends to provide participants with the information and abilities needed to undertake rigorous and productive research. Research is an essential component of many fields today, from social sciences and humanities to engineering and scientific sciences. As a result, it is crucial for participants to obtain a full awareness of the research methods and techniques, as well as the critical thinking abilities required to design and carry out research projects. Research design, data collecting and analysis, and ethical issues in research are just a few of the topics that will be covered in this course on research methodology. The identification of research questions, formulation of hypotheses, design of research, data collection and analysis utilizing both qualitative and quantitative approaches are among the skills that participants will learn. Participants will also learn how to effectively convey research results and critically assess study findings. The course will be organized around a mix of lectures, discussions in groups, and hands-on activities that will provide participants real experience in planning and carrying out research projects. Participants will be well-equipped at the end of the course to conduct research projects and expand knowledge in this subject.

Specific Objectives:

- To understand the research methods and strategies used in Earth and Environmental Science, as well as knowledge of general research tools and practices.
- To learn data collection methods, observation and monitoring techniques, relevant analysis and synthesis techniques, surveying and sampling techniques, mapping etc.
- To learn to identify research problems and design and subsequently select a research problem.
- To understand the process of developing a research project.
- To demonstrate the ability to think and interact critically with primary and secondary materials.
- To learn how to maintain ethical issues.
- To learn how to write with clarity and grace.

Number of Lectures: 04

Lecture 7.1: Research Methods and Techniques for Climate Change and Public Health

- Research methods and techniques in Earth and Environmental Science and Public Health sector as well as knowledge of general research tools and practices (types, description and application, observation and monitoring techniques, relevant analysis and synthesis).
- Different types of **surveying** (Interviews, RRA/PRA, FGD etc.), **mapping** and **sampling** techniques.

- Discussion on effective **library use**, **literature search/review**, and compilation of data from various sources (primary/secondary); Finding public health information: WHO Library, the Bio-Medical Library, PubMed, google scholar etc.
- Concept of **Systematic review**.
- Concept of measurements in various study designs; Challenges and Constraints in conducting research.
- Discussion on **recent evolutions and research agenda** in the field of climate change and public health sector.
- Basic idea on STATA

Lecture 7.2: Research Design and Methodology Development

- From topic to research questions: **Formulating problems, objectives and questions**; Assumption and Hypothesis testing.
- Frameworks: Conceptual, Process, Analytical and Research Framework.
- Types of research and epidemiologic studies: experimental and observational (descriptive studies, analytic studies).
- Introduction to epidemiological study designs: **Cross-sectional study**, **Cohort study**, **Case-control Study**.
- Experimental designs: **pre-experimental, true experimental, quasi-experimental and statistical**.
- **Survey Design**: Survey research, Questionnaire design, Measurement and Representation.
- **Sampling Methods**:
    - ✓ Sample size determination and Sample size calculation (statistical concept)
    - ✓ Probability and Non-probability sampling
    - ✓ Systematic random sampling
    - ✓ Bias in sampling
- Concept of selection bias; Randomized Controlled Trial (RCT).

Lecture 7.3: Data Collection Methods and Knowledge Management

- Types of Data (primary/secondary); Sources of Data (primary/secondary).
- Data collection methods: Qualitative and Quantitative.
- **Broad discussion on qualitative methods**: observation methods; questionnaires; Interview; RRA/PRA; FGD (Focus Group Discussion) etc.
- Analysis of Qualitative and Quantitative data; **Quantitative data analysis**, **Interpretation and Result validation methods**: univariate, bivariate and multivariate methods; time-series analysis; spatial analysis; directional data analysis.
- Discussion on **bias in data collection**, **internal and external validity**, and reliability.
- Database creation, **data quality control and management**; data screening and data processing for quantitative data.
- Data presentation (table, maps, graphs, figures, photographs etc.)

- Application of Geoinformation for Disaster Management and Public Health: Micro-zonation mapping, early warning, Vulnerability analysis, Real–time mapping, Hazard Monitoring, Decision making, Relief operation and Response Mapping, Food Security Analysis.

Lecture 7.4: Report Writing and Research Ethics

- Discussion on how to write proposals and different types of reports (writing abstract; preparing contents; arranging the body of text; summarizing and conclusion; giving references and bibliography; adding appendices etc.)
- Discussion on the publishing process: Scientific articles; publication of report; grey literature; conference paper etc.
- Discussion on research ethics and critical appraisal of research publication; Ethics and Professionalism in science.
- Scientific writing and standard research protocol format.

References

- D.G. Rossiter (2011) *Research Skills and Methods*, An ITC Publication
- Dawson C. (2007) *Practical Research Methods: A User-friendly Guide to Mastering Research Techniques and Projects*. 3rd Edition. How to Books Ltd. UK.
- B.D. Phillips. 2014. *Qualitative Disaster Research: Understanding Qualitative Research*, Oxford: Oxford University Press.
- Rodriguez H. et al. (2006) *Hand Book of Disaster Research (Handbooks of Sociology and social Research)*. Springer. Netherlands.
- Singleton Jr. R.A. and Stratis B.C. (2009) *Approaches to Social Research*. 5th Edition. Oxford University press. UK.
- Shahidur R. Khandker, Gayatri B. Koolwal, Hussain A. Samad. 2010. *Handbook on Impact Evaluation: Quantitative Methods and Practices*, Washington DC: World Bank.
- Williams M. and May T. 1996. *Introduction to the Philosophy of Social Research*. UCL Press. UK.