## Syllabus

*Course Title*

**Climate Change Mitigation and Adaptation: Case Studies and Best Practices in Healthcare**

*General Information*

*General description of the required education/training, outlining the main objectives and explaining the necessity of the education/training at the organizational/country/regional level*

This course provides an in-depth and practical overview of effective approaches to climate change mitigation and adaptation in the healthcare sector, drawing on case studies and global best practices. Particular emphasis is placed on examining successful strategies for managing the risks associated with heat stress, changes in the dynamics of infectious diseases, improving air quality, supporting mental health, and addressing the impacts of extreme weather events.

The course explores in detail the mechanisms through which climate change affects various aspects of public health, analyzes the role of intersectoral collaboration in implementing adaptation measures, and examines the application of mitigation practices within healthcare systems. The curriculum includes a critical review of case studies that illustrate real-world examples of implementing best practices at both regional and local levels.

*Audience*

*The main target audience of the course and any secondary audience, if it may influence decisions regarding the structure or content of the course*

*Expected level of knowledge and skills of the main audience (current or minimally required), as well as other factors (for example, cultural characteristics, level of technical training, access to the Internet) that should be considered when planning the course, as they may affect the choice of teaching methods, materials, and approaches to interaction with the audience*

**Primary target audience**: PhD students and graduate students enrolled in programs related to climate services, climate change adaptation and mitigation, meteorology, environmental sciences, public health, and healthcare management, particularly those working at the climate–health interface.

**Secondary target audience**: Early-career lecturers and researchers in departments of meteorology/climatology, epidemiology, and public health; specialists from public health centers and the National Health Service of Ukraine (NHSU) / Ministry of Health of Ukraine; policy analysts and local government officials working in the


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health sector; coordinators of “green hospitals” and healthcare managers; staff of national meteorological and hydrometeorological services; and representatives of NGOs and INGOs working in the fields of climate and health.

Entry requirements:

- Basic statistical literacy and proficiency in working with spreadsheets;
- Skills in the critical analysis of scientific literature;
- Preferably: a basic understanding of climate indices and scenarios (RCP/SSP), GIS or R/Python (not mandatory), and knowledge of the organization of Ukraine’s healthcare system;
- English language proficiency sufficient for reading primary-source literature.
- Prerequisites: basic knowledge of epidemiology and public health, microbiology, virology and immunology, general hygiene, infectious diseases, medical statistics, and healthcare systems; basic digital literacy is desirable.

## *Competencies*

*Training needs at the individual or organization/country/regional level, as well as a description of how these needs were identified and recognized as relevant.*

*Competencies targeted by the training.*

C4: Climate Change Impact Assessment

C5: Climate Communication

C6: Climate Resilience Policy and Strategy Development / Integrated Climate Impact and Risk Assessment.

## *Learning outcomes and performance criteria*

*Learning outcomes and performance criteria formulated with regard to the knowledge and skills to be acquired during the training process.*

**Learning outcomes:**

- Apply knowledge of the fundamental concepts of epidemiology and the chain of infection to analyze outbreaks of infectious diseases.
- Analyze and interpret climate data to assess the potential impacts of climate change on the epidemiology of infectious diseases.

- Evaluate the risks of the emergence or changing endemicity of infectious diseases at the local level by integrating climate projections with epidemiological information.
- Develop recommendations for monitoring and forecasting the spread of climate-sensitive infectious diseases.
- Identify the healthcare sector's needs for specific climate information and climate services to support adaptation measures.
- Propose evidence-based measures for the use of climate services to strengthen prevention and control systems for climate-sensitive infectious diseases.
- Use modern information resources and tools to collect, analyze, and visualize data on the impacts of climate change on health and epidemiology.

**Performance criteria:**

- Knowledge: The learner demonstrates a comprehensive understanding of climate-related health threats, knowledge of climate change mitigation strategies, and the principles of healthcare sector adaptation to climate-related challenges.
- Analytical Skills: Able to analyze complex relationships between climate factors, epidemiological trends, and the effectiveness of adaptation strategies in healthcare.
- Practical Competence: Possesses the skills required to design and implement adaptation measures and climate services aimed at reducing climate change–related risks in the health sector.
- Independence: Capable of conducting independent research, critically evaluating information sources, and formulating practice-oriented conclusions based on current scientific evidence and policy frameworks.
- Communication: Able to clearly and persuasively present the results of comprehensive analyses and justify proposals for climate change mitigation and adaptation, including through written assignments such as essays, case studies, and reports.

## *Course Content*

*Provide a content outline that corresponds to the learning objectives and outcomes. This may be a course outline as it will be presented to students, but not necessarily a complete curriculum.*

*Include a general list of all topics that you consider necessary to cover. If you believe it would help clarify the scope, indicate what will NOT be covered.*

**Activity Distribution (Fully Asynchronous):**

- Video lectures (14 × 15–20 min) — 6 academic hours
- Module quizzes (3 × 10–12 questions with explanations) — 3 academic hours
- Independent study (reading, glossary review, additional materials) — 5 academic hours
- Practical assignment (mini-project) — 4 academic hours
- Final test — 1 academic hour

**Module 1. Basic Principles of Epidemiology and Global Change**

**Key Topics:**

- Fundamentals of infectious disease epidemiology
- The chain of infection and epidemic process
- Drivers of global change and infectious disease risk

Videos: 15–20 minutes per topic
Module 1 Self-Assessment Quiz: 17 questions (mandatory completion, with answers provided)
Practical Assignments

**Module 2. Climate Factors, Causal Relationships, and Global Threats**

**Key Topics:**

- Concepts of causal relationships in research on climate impacts on infectious diseases
- Interconnected global threats: climate change, biodiversity loss, and infectious diseases
- Climate change and cascading risks of infectious diseases

Videos: 15–20 minutes per lecture
Module 2 Self-Assessment Quiz: 30 questions (mandatory completion, with answers provided)
Practical Assignments

**Module 3. Socio-Demographic Dimensions of Risk**

**Key Topics:**

- The impact of climate change–related population migration on infectious diseases
- The impact of anthropogenic climate change on childhood viral diseases

Videos: 15–20 minutes
Module 3 Self-Assessment Quiz: 20 questions (mandatory completion, with explanations)
Practical Assignments

**Module 4. Climate-Sensitive Infectious Diseases: Case Studies**

**Key Topics:**

- The cholera paradigm
- Climate-sensitive infectious diseases: waterborne infections
- Climate-sensitive infectious diseases: foodborne infections
- Climate-sensitive infectious diseases: soil- and dust-related infections
- Climate-sensitive infectious diseases: zoonotic infections
- Climate-sensitive infectious diseases: vector-borne infections

Videos: 15–20 minutes
Module 4 Self-Assessment Quiz: 60 questions (mandatory completion, with explanations)
Practical Assignments

**Module 5. Outlooks, Forecasting, and Adaptation**

**Key Topics:**

Future impacts of climate change on infectious disease outbreaks: Is there sufficient evidence?
Videos: 15–20 minutes
Module 5 Self-Assessment Quiz: 10 questions (mandatory completion, with explanations)
Practical Assignments

*Learning Solutions and Methods of Implementation*

*List the learning solutions (teaching methods) that will be used and explain why they were chosen. For example: classroom learning, online learning, blended learning, workplace learning, online resources for self-study, coaching or mentoring, etc.*

**Mode of Study**

The course is delivered in a blended learning format, combining traditional in-person classroom instruction with online learning methods. This approach provides flexibility, supports more effective acquisition of theoretical knowledge, and promotes the development of practical skills essential for application in the healthcare sector under conditions of climate change.

**Practical Sessions**

- Conducted in person under the supervision of an instructor in classroom settings, where learners have the opportunity to discuss complex issues, receive individual consultations, analyze real-life cases, and review examples of the implementation of adaptation and mitigation strategies.
- Ensure direct interaction with instructors, contributing to a deeper understanding of the material and the development of decision-making skills in intersectoral contexts.

**Lectures (Online Format)**

- Provide access to lecture materials at any convenient time and from any location, expanding learning opportunities for a broad audience, including students from different regions.
- Promote the development of skills in independently searching for, processing, and analyzing up-to-date information in the field of climate change and healthcare.
- Enhance inclusivity in education by enabling learners with diverse needs to access knowledge without time or geographic limitations.

**Independent Learning**

- Implemented through the study of lecture materials, completion of practical assignments, work with climate and epidemiological data, and preparation of analytical presentations and case studies.
- Develops critical thinking, the ability to work with large datasets, and the capacity to formulate conclusions based on evidence.

- Includes the development of recommendations for adapting healthcare practices in response to climate change, contributing to the development of practical competencies.

**Role of the Instructor**

The instructor acts as a mentor and facilitator, supporting learners throughout the learning process, helping them apply knowledge in practice, coordinating discussions, and providing expert guidance during practical assignments.

**Role of the Learner**

Learners are actively engaged in the learning process: they independently study materials, participate in practical sessions and discussions, and complete analytical tasks aimed at developing competencies for adapting healthcare systems to climate-related challenges..

## *Learning Strategies*

*Consider which learning strategies you will use. Provide justification for why you intend to apply them, including reasons why they will help participants achieve the planned learning outcomes.*

*Combine different learning strategies to create a diverse learning environment that accommodates different learning styles of participants. This will increase the effectiveness of learning and help achieve the planned learning outcomes. This section does not require a detailed description of specific activities.*

1. Flipped Classroom
   Learners review theoretical materials in advance (short micro-lectures, reading guides with key terms). This allows in-class practical sessions to focus on discussion, case study analysis, and solving complex problems, promoting deeper understanding and the development of practical skills for adaptation in healthcare.
2. Lectures and Readings
   Structured online materials and curated reading lists are provided for independent learning of core concepts and current research, helping learners build a solid theoretical foundation.
3. Discussion Strategies
   Active discussion of problem-based topics and case studies during practical sessions enhances critical thinking, encourages knowledge exchange, and supports collaborative solution development in addressing climate-related health challenges.

4. Case-Based Learning
   Analysis of real or simulated scenarios related to climate impacts (e.g., consequences of heatwaves, infectious disease risks after floods) helps integrate theory with practice and develop analytical and decision-making skills.
5. Project-Based Learning
   Completion of individual or group projects focused on developing adaptation strategies and interventions provides practical experience while fostering interdisciplinary collaboration and critical thinking.
6. AI Guidance
   The use of artificial intelligence tools for information retrieval and data analysis enhances learning efficiency and introduces an innovative approach to data collection and processing, while maintaining ethical standards and academic integrity.

This set of strategies creates a diverse and flexible learning environment that accommodates different learning styles, supports the achievement of course objectives, and develops practical competencies in mitigating and adapting healthcare systems to climate change.

## *Learning Activities*

*Describe the main learning activities that will be included, such as lectures, readings, case studies, discussions, exercises, practical assignments, simulations, role-playing games, etc.*

*Also describe the roles of instructors and students during these activities.*

All activities are conducted asynchronously in the LMS with clearly defined deadlines and standardized templates.

1. Micro-lectures and structured notes: viewing 14 micro-lectures (15–20 minutes each) with a guiding worksheet (prompt questions) and completing structured notes using a provided template.

- Role of the instructor: records micro-lectures; provides the guide and note-taking template; publishes a list of recommended sources and a self-check checklist.
- Role of the learner: watches the videos; completes the notes; formulates at least one clarifying question or comment in the LMS.

2. Concept map “Climate → Health”: Construction of a causal concept map (climate factor → risk → health outcome → indicator/action).

- Role of the instructor: provides a glossary, an example format, instructions for building the map, and a list of sources.
- Role of the learner: develops the concept map and uploads the file.

3. Case analysis “Climate and Healthcare”: Analysis of a case study for an outpatient clinic or hospital (vulnerable groups, communication channels, readiness indicators) with responses to targeted questions.

- Role of the instructor: provides the case description, input data (e.g., heat stress index, visit frequency), guiding questions, and an assessment rubric.
- Role of the learner: analyzes the case; provides written responses (250–300 words) with references to sources; proposes 1–2 actionable measures for the healthcare facility.

4. Scenario Planning (Module 2): climate change, biodiversity loss, impacts of climate-induced migration, cascading risks, and effects on childhood viral diseases.

- Role of the instructor: prepares case materials and supervises task implementation.
- Role of the learner: conducts research, analyzes scenarios, and proposes adaptation solutions.

Module self-assessments: five quizzes, each consisting of 10 questions with explanations and multiple attempts allowed.

- Role of the instructor: designs the question bank; sets the passing threshold (≥60%) and number of attempts; provides correct answers.
- Role of the learner: completes quizzes until the threshold is achieved; reviews explanations; revisits learning materials as needed.

5. Mini-Project (Practical Assignment): development of adaptation measures or a risk communication plan.

- Role of the instructor: provides a brief template (1–2 pages), a presentation template (3–5 slides), and an assessment rubric; responds to questions on the forum.
- Role of the learner: selects an option; completes the brief (problem, data, solution, SMART indicators); prepares a presentation; participates in peer assessment if required.

6. Final Test: integrative assessment of overall learning outcomes. 20 questions in multiple formats; one attempt; time-limited.

- Role of the instructor: designs the test; sets timing and passing threshold; provides technical support.
- Role of the learner: completes the test within the allocated time; adheres to academic integrity principles.

7. Forum Reflection and Peer Assessment (optional): one short reflective post (100–150 words) + one constructive comment on a peer's mini-project draft using the rubric.

- Role of the instructor: moderates discussions; provides examples of high-quality feedback; ensures ethical standards and academic integrity.
- Role of the learner: submits a reflection post; provides one rubric-based peer comment.

## *Assessment of Learning*

*Describe the assessment plan for participants before, during, and/or after the course, including tests, exercises, activities, and projects that will be assessed. Indicate whether self-assessment or peer assessment will be used.*

*Explain how the assessment is linked to the learning outcomes.*

Formative tests after each module: 40%

Mini-project (practical assignment): 20%

Final test: 40%.

## *Storyboard of Learning (Learning Storyboard)*

*Use this to create a visual scenario of your blended learning activity*

## *Learning resources and tools*

*List the available resources that will be used for different types of learning activities and recommended to students.*

*Describe the technologies that will be used to implement learning solutions, including educational technologies and operational equipment (hardware, software, collaboration tools).*

- Lecture texts (6,000–8,000 characters each) in .html / .pdf format.
- Lecture presentations in .pptx / .pdf format (search-enabled).
- Video lectures (15–20 minutes each) in .mp4 format with full captions/transcripts.
- Course glossary (minimum 12–15 terms, up to 20 for more advanced topics).
- Practical assignment package (description, sources, worksheet in .xlsx if needed, assessment criteria).
- Recommended literature::


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4. Tarasov, Y. (2025). Biostatistics in Health (1st ed.). Allied Health Press.
5. Tarasov, Y. (2025). Epidemiology (1st ed.). Allied Health Press.
6. OpenStax College. (2016). Microbiology. OpenStax CNX. https://openstax.org/details/books/microbiology
7. Gordis, L. (2014). Epidemiology (5th ed.). Elsevier Saunders.
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Additional (key articles and reports):


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2. Baker, R. E., Mahmud, A. S., Miller, I. F., Hay, S. I., & Grenfell, B. T. (2022). Infectious disease in an era of global change. Nature Reviews Microbiology, 20(4), 193–205. https://doi.org/10.1038/s41579-021-00648-9
3. Baker-Austin, C., Oliver, J. D., Alam, M., Ali, A., Waldor, M. K., Qadri, F., & Martinez- Urtaza, J. (2018). Vibrio spp. infections. Nature Reviews Disease Primers, 4(1), 8. https://doi.org/10.1038/s41572-018-0005-8
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climate on infectious diseases. Nature Ecology & Evolution, 9(2), 349–363. https://doi.org/10.1038/s41559-024- 02594-3
5. Bartlow, A. W., Manore, C., Xu, C., Kaufeld, K. A., Del Valle, S., Ziemann, A., Fairchild, G., & Fair, J. M. (2019). Forecasting Zoonotic Infectious Disease Response to Climate Change: Mosquito Vectors and a Changing Environment. Veterinary Sciences, 6(2), 40. https://doi.org/10.3390/vetsci6020040
6. Carlson, C. J., Albery, G. F., Merow, C., Trisos, C. H., Zipfel, C. M., Eskew, E. A., Olival, K. J., Ross, N., & Bansal, S. (2022). Climate change increases cross-species viral transmission risk. Nature, 607(7919), 555–562. https://doi.org/10.1038/s41586-022-04788- w
7. Castonguay, A. C., Chowdhury, S., Shanta, I. S., Schrijver, B., Schrijver, R., Wang, S., Fazil, A., Gachon, P., Ogden, N. H., & Leighton, P. A. (2024). A Generalizable Prioritization Protocol for Climate-Sensitive Zoonotic Diseases. Tropical Medicine and Infectious Disease, 9(8), 188. https://doi.org/10.3390/tropicalmed9080188
8. Charnley, G. E. C., & Kelman, I. (2024). Perspectives on climate change and infectious disease outbreaks: is the evidence there?. npj Climate Action, 3, 61. https://doi.org/10.1038/s44168-024-00115-3
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10. Colwell, R. R. (1996). Global climate and infectious disease: the cholera paradigm. Science, 274(5295), 2025–2031. https://doi.org/10.1126/science.274.5295.2025
11. Grobusch, L. C., & Grobusch, M. P. (2022). A hot topic at the environment-health nexus: investigating the impact of climate change on infectious diseases. International Journal of Infectious Diseases, 116, 7–9. https://doi.org/10.1016/j.ijid.2021.12.350
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Environmental Health Reports, 5(2), 272–282. https://doi.org/10.1007/s40572-018-0199-7
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Co-funded by the Erasmus+ Programme of the European Union