Climate Change and Health

A Public Health Education Toolkit

March 2022
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BACKGROUND

Addressing the health impacts of climate change is a critical skill set for public health professionals. Clear and unequivocal science as to the multifaceted impacts of climate change, particularly on human health, has become increasingly clear in recent years, as have the attribution studies linking human health outcomes to climate extremes. (3) Climate change is a clear health issue that affects morbidity, mortality, and societies’ ability to deliver healthcare and support healthy living. The effects of climate change are already harming health around the world, and impacts will only intensify in the coming years. Heat waves and rainstorms are becoming more deadly, disease outbreaks last longer and are seen in new regions, wildfire smoke from tinder-dry forests reduces air quality, and food and water security are threatened by extreme weather. Our best science warns that in order to prevent irreversible planetary changes and widespread impacts to humanity, we must keep the warming to below 1.5 degrees celsius. (4) The world is currently on a trajectory to warming 2.7-3.1°C this century alone. (4) The Intergovernmental Panel on Climate Change’s Sixth Assessment Report makes clear that governments must act now to make and implement decisive climate commitments that have a strong likelihood of limiting temperature rises to 1.5°C. Every tenth of a degree in excess of 1.5°C will take a serious toll on people’s lives and health. This requires unprecedented global cooperation and action.

Public health professionals are already on the front lines of this crisis even though many have no formal training in climate change and health. The US Centers for Disease Control and Prevention (CDC) and National Institutes of Health (NIH) have both identified climate change and health as urgent issues for public health to address, and CDC has identified priority actions for climate change and health that include workforce development and training the next generation of public health professionals to respond to health impacts of climate change. (5) Schools and programs of public health play an essential role in training the current and future public health workforce, but currently few have integrated climate change into their curricula and degree offerings. Furthermore, there is no standardization or guidance regarding what skills and knowledge are needed among public health professionals, nor a framework regarding how climate change and health can be integrated into existing programs.

The Association of Schools and Programs of Public Health (ASPPH), in collaboration with the Global Consortium on Climate and Health Education (GCCHHE), aims to provide a toolkit consisting of guidance, examples, and resources for Council on Education for Public Health (CEPH)-accredited schools and programs of public health to incorporate teaching on the intersection between climate change and health in their curricula. This toolkit identifies competencies and specific resources that can be used to meet them, as well as providing a sample course syllabi and frameworks for developing a climate change concentration.

Target Population for this Toolkit

Primary Target Audience: Faculty and staff in CEPH-accredited schools and programs who are involved in public health teaching and practice and/or planning curricula for Master of Public Health (MPH) students.

Other Potential Users: Faculty and staff in institutions that are not accredited but are seeking accreditation by CEPH, institutions not seeking accreditation that offer masters-level public health
programs, those who create core content, design courses, and/or are interested in establishing climate and health concentrations within public health programs—primary at the master’s level, but also potentially relevant for the undergraduate and doctoral level.

**Why Climate Change and Health?**

The adverse effects of climate change are now apparent and pose urgent and complex challenges to human health and health systems globally. (6) Heat waves and severe storms with resultant floods are becoming more intense and frequent, wildfire smoke from the ongoing use of fossil fuels coupled with drought and heat-driven wildfires is reducing air quality, and food and water security are threatened by extreme weather and sea-level rise. (7) These exposures result in a broad range of health outcomes including: increasing and changing the burden of communicable and noncommunicable diseases, mental health impacts, injury, loss of livelihoods, forced migration, conflict and more. (8) Furthermore, the distribution of these impacts is not uniform, disproportionately affecting vulnerable and marginalized communities, which have often been rendered both less resilient against climatic threats and inadequately resourced for recovery from unpredictable changes or after extreme weather events. (9) From an environmental justice perspective, climate change poses major and urgent challenges to protecting health equity. The health care sector, itself vulnerable to the effects of climate change, accounts for between 1 to 5% of total global carbon emissions (10) and 9-10% of greenhouse emissions in the United States. (11) If the global health sector were a country, it would be the 5th largest emitter of greenhouse gasses on the planet. (12) Reducing emissions while improving the resilience of the health sector will be crucial to protect infrastructure and access to critical public health services in impacted communities. There is an imperative for quick action on many fronts: to recognize and respond to climate health threats; address climate change at its source by reducing greenhouse gas emissions; support “greener” systems throughout the economy; understand the health co-benefits of adaptation and mitigation; and communicate effectively about these issues. Framing climate change through a health-impact lens can also help humanize the issue, make it relatable, and motivate action.

Public health professionals occupy a dynamic and unique position in the response to climate change. First, they are charged with protecting population health in the face of multiple new and compounding health risks that will become more costly and complicated to address as time goes on. Second, their institutional knowledge is indispensable in modifying health systems to become both resilient to climate threats and environmentally sustainable. And third, their voices and scientific expertise are necessary to advocate for cross-sectoral solutions to the climate crisis, and to articulate climate risks and solutions to patients, the public, and policy makers. Important to note is the distinction between the role of public health as opposed to other healthcare professionals; public health occupies a unique space and ensuring recognition of this will help prevent redundancies and inefficiencies as interprofessional efforts forge ahead. However, uncertainty over how best to impact public behavior and fear of professional repercussions from taking a public stance on what has, unfortunately, become a politicized issue, inhibiting engagement by public health professionals. (13) In addition, and most fundamentally, as climate change is outside the traditional education and training for the public health workforce, few have the skills and expertise to effectively lead preparations and respond to current and future compounding health risks.

Several recent studies have documented the mismatch between the training provided and the
knowledge actually necessary for public health professionals to adequately address climate change. In 2019, Hendrix et al. examined CEPH-accredited graduate programs for courses related to climate and health. Of the 90 institutions evaluated, only 50% offered a course on climate change. An evaluation of the course syllabi indicated that all courses relating to climate change and health were electives and were more likely to focus on foundational aspects of climate change in a national or global context. (14)

A 2019 study of CEPH-accredited MPH programs during 2018-19 examined courses that contained climate change content. No school was found to offer a climate change track for the MPH or required a course in climate change, although the majority did offer at least one lesson on climate change through environmental health courses. Climate change courses appeared at some universities in disciplines outside of public health, but there was no option available for MPH students to take these classes. (15)

Outside this study, there are several known existing climate and health certificate programs that began either before or after this study was published. While many schools and programs of public health on a global level have actively begun efforts - and many more have voiced interest and intent - to integrate climate change and health education into current curricula, they continue to face implementation challenges; a lack of funding, staff time, and space within the standing curriculum, as well as other competing institutional priorities constrain progress (16).

We see the gap in education on climate change and health borne out in the public health workforce, where the needs of relevant agencies are not met by existing professional expertise. According to Frumkin et al. (2020), 40% of websites for state public health departments and less than 4% of the county and city public health departments had information about climate change, with nearly half providing no explanation of its causes or their attribution. A lack of leadership, the absence of a mandate, insufficient content or knowledge, and constrained resources may all contribute to the inadequate presentation of climate change content. However inadvertently, this mismatch between acknowledging the urgency of climate change while maintaining only sparse educational resources reinforces the false impression that there is a lack of consensus on climate change among experts. (17)

Yet the value of education in climate change for the public health workforce is quickly gaining momentum among employers. A recent study examining employment opportunities for public health graduates uncovered that almost 92% of survey respondents believed there was a need for climate-trained public health specialists within their organizations. (18) Adequate preparation will include not only climate change and health content but must begin to incorporate practical skills in implementing climate-based solutions, helping translate knowledge into action.

The American Public Health Association states: “climate change is a health emergency.” (19) Indeed, the impacts we have already seen - and will continue to see - are diverse, complex, and global, presenting new risks and both amplifying and compounding existing health hazards. As the climate crisis continues to unfold, public health professionals must meet these challenges with coordinated proactive strategies for primary, secondary, and tertiary disease prevention. Therefore, public health schools and programs must provide training to the current and future workforce for this profound issue. To tackle training about climate, new and expanded materials need to be incorporated into all aspects of public health education as part of a systematic approach. Links among climate, health, and applied skills need to be developed through educational opportunities rarely afforded among current MPH programs. The ultimate goal of this toolkit is to equip all schools and programs of public health to effectively integrate climate and health into their curriculum and prepare future public health leaders for the reality of the climate change demands.
Association of Schools and Programs of Public Health

Founded in 1941, the Association of Schools and Programs of Public Health (ASPPH) is the voice of academic public health. ASPPH is a 501c3 membership organization representing schools and programs of public health accredited by CEPH as well as those in applicant status for CEPH accreditation. Its mission is to strengthen the capacity of members by advancing leadership, excellence, and collaboration for academic public health. ASPPH has developed numerous resources for faculty over the years, including numerous educational models and competency sets. In 2021, ASPPH launched a Task Force on Climate Change and Health, charged with developing a framework for its members to act collectively through four identified priority areas—education and training, research, practice, and policy and advocacy—and three cross-cutting areas—health equity, environmental justice, and social justice; interprofessional and interdisciplinary collaboration; and partnerships for impact. The framework is scheduled for release in late 2022.

The Global Consortium on Climate and Health Education Core Competencies

Launched in early 2017, the Global Consortium on Climate and Health Education (GCCHE) was developed over the course of 2016, born from a meeting at the December 2015 COP-21 conference in Paris. At COP-21, the Columbia University Mailman School of Public Health partnered with the White House on a special session to highlight the need for greater investment in the study of and planning for the health impacts of climate change. The White House and other partners spearheaded a pledge that was announced at the session, and which was signed by 115 health professions schools and programs around the world, to educate tomorrow’s leaders on the health impacts of climate change. As of February 2022, the GCCHE has secured over 250 member institutions from 36 countries who have committed to train their students in climate and health.

Core Competencies

Since 2018, the GCCHE has convened a panel of global climate and health experts to develop a set of health professional core competencies, which reflect foundational climate and health knowledge, abilities, and attitudes for health professions students to mitigate the health impacts of climate change. These competencies have been extensively peer-reviewed by an international peer-network. Intended as a guide for developing climate and health education in health professions schools’ curricula, the competency set can be applied as needed and included in a variety of formats and over different timescales. The competency set offers an overview of the different domains, units, and elements of competence shared by all health professions, as well as specific competencies for public health professionals.

INTERSECTION OF CLIMATE CHANGE AND PUBLIC HEALTH EDUCATION

Integrating Climate and Health Competencies into Public Health Core
Curriculum

Identifying how to integrate the GCCHE competencies on climate and health into the foundational competencies required by CEPH of all Master’s in Public Health programs is vital. Doing so will provide understanding of how this subject matter aligns with current curricula and determining how best to address any critical knowledge gaps. With this objective in mind, a crosswalk was completed comparing these two competency sets, indicating where competencies align and describing the nature of their similarity (Table 1).

This crosswalk is meant to demonstrate how the required CEPH MPH competencies can be met through integration of climate change and health content related to the GCCHE competencies. It does not propose that the GCCHE competencies should be added, but rather that they share commonalities with the CEPH MPH competencies. Therefore, content related to the GCCHE competencies is relevant to the CEPH MPH competencies. Figure 1 demonstrates this relationship between the two competency sets and the resources.

**Figure 1. Relationship Model for Competency Crosswalk and Resources**

While not every competency from one set has a direct counterpart in the other set, there is significant overlap between the focus and skills required for many of them. The counterpart competencies also do not always correspond to the same level in Bloom’s Taxonomy (20), but the resources identified can still be applied. For each GCCHE competency, at least one reading, lecture, and course has been linked. See the full reference for the linked resources in Appendix I.
<table>
<thead>
<tr>
<th>CEPH MPH COMPETENCIES</th>
<th>COMMON FOCUS, SKILLS, COURSEWORK</th>
<th>GCCHE COMPETENCIES</th>
<th>RESOURCE LINKS</th>
</tr>
</thead>
</table>
| Apply epidemiological methods to settings and situations in public health | | Define climate drivers (both natural and human-caused), weather, climate change, and climate variability. | - Reading  
- Lecture  
- Course |
| Select quantitative and qualitative data collection methods appropriate for a given public health context | Demonstrate capacity to interpret, merge, and critically assess various forms of quantitative and qualitative data as they relate to climate change and its known and foreseeable impacts on public health | Demonstrate understanding of the scientific consensus on climate change and concept of evolving science. | - Reading  
- Lecture 1  
- Lecture 2  
- Course |
| Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate | | Applies fundamental knowledge of ecology, biology, and complex systems in environmental science. | - Reading 1  
- Reading 2  
- Lecture  
- Course 1  
- Course 2 |
| Interpret results of data analysis for public health research, policy or practice | | | |
| Evidence-based Approaches to Public Health | Systems Thinking | | |
| Apply a systems thinking tool to visually represent a public health issue in a format other than a standard narrative | Examine the interconnected nature of climate change, human health and human systems; apply systems-based thinking and problem-solving to address climate adaptation and mitigation; gain an understanding of complex mechanisms and their dynamic impact on health outcomes and be able to visualize these concepts | Apply knowledge of levels of prevention, climate mitigation and adaptation, and explain health co-benefits of actions. | - Reading  
- Lecture  
- Course |
| Planning & Management to Promote Health | Apply concepts of DOH and how they impact population-level climate vulnerability; Assess the capacity of communities to respond to climate change based on health system capacities and relevant climate information; explore ethical and legal implications; assess opportunities and challenges posed by various levels of societal organization. | Describe public health and its determinants. | - Reading 1  
- Reading 2  
- Lecture  
- Course |
| --- | --- | --- | --- |
| Apply awareness of cultural values and practices to the design, implementation, or critique of public health policies or programs. | Assess the capacity of communities to respond to climate change based on health system capacities and relevant climate information; explore ethical and legal implications; assess opportunities and challenges posed by various levels of societal organization. | Access and interpret relevant local, regional, national, and global information about climate change effects on health. | - Reading 1  
- Reading 2  
- Lecture  
- Course |
| Design a population-based policy, program, project or intervention. | Critically assess PH resources, intervention programs, and policies. | Apply knowledge of the ethical, professional, and legal obligations relevant to climate and health. | - Reading  
- Lecture 1  
- Lecture 2  
- Course 1  
- Course 2 |
| Select methods to evaluate public health programs. | Design a population-based policy, program, or intervention that identifies and addresses climate risk and select methods for how this program might be evaluated. | Identify the health impacts of climate change and effective responses on the part of specific health services. | - Reading  
- Lecture  
- Course |
| Explain basic principles and tools of budget and resource management. | Appreciate and apply skills of intervention implementation under resource and time constraints to address disaster mitigation and response from climate-related events. | Apply knowledge of emergency planning skills. | - Reading  
- Lecture  
- Course |
| Select communication strategies for different audiences and sectors. | Communicate effectively with different groups, targeting messages and methods; utilize a range of communication tools and identify potential barriers or challenges to accessibility and impact on health issues that relate to climate change. | Demonstrate effective communication with stakeholders about climate and health topics. | - Reading 1  
- Reading 2  
- Lecture  
- Course |
| Communicate audience-appropriate (i.e., non-academic, non-peer audience) public health content, both in writing and through oral presentation. | Describe the importance of cultural competence in communicating public health content. | - Reading  
- Lecture  
- Course |
| Describe the importance of cultural competence in communicating public health content. | - Reading  
- Lecture  
- Course | **THE VOICE OF ACADEMIC PUBLIC HEALTH** |
<table>
<thead>
<tr>
<th>Interprofessional and/or Intersectoral Practice</th>
<th>Integrate relevant cross-disciplinary expertise both within and beyond healthcare; recognize the unique perspectives and roles of other professions on PH issues; develop skills in collaboration and teamwork through direct interaction;</th>
<th>Work collaboratively and across disciplines on climate and health issues.</th>
<th>- Reading - Lecture - Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Identify relevant stakeholders in solving population-level climate and health threats and devise strategies to solve climate-related health issues which account for the concerns of each stakeholder</td>
<td>-</td>
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<tr>
<td></td>
<td>Apply negotiation and mediation skills to address organizational or community challenges</td>
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<td></td>
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<tr>
<td>Policy in Public Health</td>
<td>Develop an understanding of how policy is developed and implemented; familiarization with U.S. government bodies and frameworks whose regulatory oversight impacts climate change; critically evaluate climate policy for how it impacts public health and health equity</td>
<td>Explain the role of subnational, national and global policy frameworks and governance structures to address health risks associated with climate change.</td>
<td>- Reading - Lecture - Course</td>
</tr>
<tr>
<td></td>
<td>Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluate policies for their impact on public health and health equity</td>
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### Framework for Building a Climate Change and Public Health MPH Concentration

The Climate Change and Public Health concentration is designed to prepare students to make strong contributions to climate change research, policy, education, advocacy, and practice. Concentration programs in this area intend for students to develop an in-depth, masterful understanding of climate change, its effects on public health, and ways to mitigate the impacts of the most pressing issue of our time. The integration of education on climate change and public health via new concentration programs in schools and programs of public health will help close the critical knowledge gap that exists among health professionals and foster a new generation of public health leaders that are capable of translating climate change and health science into action. This section is intended to assist faculty and educational leaders in constructing climate and health concentrations at their own institutions.

### How this framework was developed:

A working group consisting of staff and fellows from ASPPH and GCCHE was convened by ASPPH in order to determine best practices and requirements for the concentration. Current CEPH accredited Master’s of Public Health (MPH) programs that offer a Climate and Health concentration were cross-referenced to identify similarities and differences in both structure and curriculum offerings. Concentration program educational objectives of three ASPPH member institutions were compared alongside the GCCHE Core Competencies to identify six major overarching conceptual blocks that are

### Table:

| Public Health & Health Care Systems | Identify ways to act on, advocate for and influence policy to address health equity in a changing climate, mobilize stakeholders, and integrate consideration for equity | Explain climate-health activism and policy engagement roles of health professionals. | - Reading 1  
- Reading 2  
- Reading 3  
- Lecture  
- Course |
|---|---|---|---|
| Advocate for political, social or economic policies and programs that will improve health in diverse populations | Identify and discuss health disparities and vulnerabilities related to climate change; recognize how systems or interventions may re-affirm or be challenged by inequities; describe ways to overcome health inequities through public health interventions | Apply climate and health knowledge to improve decisions about public health services, and adapt and improve population health. | - Reading  
- Lecture  
- View Slides  
- Course |
| Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community, and systemic levels | Apply knowledge of the connection between habitat and biodiversity loss and infectious diseases. | - Reading 1  
- Reading 2  
- Lecture  
- Course 1  
- Course 2 |
expected with the degree completion as seen in Figure 1. The six identified climate and health conceptual blocks associated with GCCHE and MPH concentration core competencies are as follows:

1. **Climate Science** - Demonstrate understanding of the scientific consensus on climate change, its drivers and variability, and confidently speak broadly about climate change in personal and professional settings.
2. **Climate and Health Impacts** - Explain the connection between climate change and public health outcomes, and demonstrate the ability to critically analyze environmental health analytics that relate to climate and health impacts.
3. **Climate and Health Policy** - Explain the role and responsibility of local, state, national and global government structures to address climate and health risks and describe the policy tools for advancing solutions.
4. **Mitigation and Adaptation** - Apply strong knowledge and understanding of the health co-benefits of climate change mitigation and adaptation.
5. **Global and Regional Risks** - Assess how differing social structures, economic statuses and preexisting health equities will be influenced by climate change both internationally and domestically.
6. **Communication and Collaboration** - Summarize the roles of various sectors in climate and health action and demonstrate the ability to effectively communicate with multidisciplinary stakeholders to address climate and health impacts.

This framework was designed to ensure that Climate and Health Concentrations newly developed or in existence encompass the content of the major conceptual blocks. In Figure 2, required courses drawn from institutional curriculum were outlined and categorized into these conceptual blocks. Relevant elective course options, offered by current climate and health programs, were provided in the most appropriate concentration blocks for cases in which required courses did not sufficiently cover the comprehension guidelines of a particular block. For instance, some schools and programs of public health may not have the capacity to offer courses on climate and atmospheric science. In this case sponsoring departments, such as schools of environmental science, engineering or physics, may be relied upon to supply courses that effectively meet concentration program objectives.

**Sample Concentration Content and Guidelines**

This sample concentration schedule and related content illustrate the potential use of the conceptual blocks in the development of new or preexisting concentration programs. Lead program faculty can select various approaches in creating a climate and health concentration to ensure students successfully demonstrate desired competencies expected for each educational objective. This example concentration schedule, seen in Figure 3, was built under the assumption that the foundational MPH curriculum at a school or program of public health already offers a basic course on environmental health sciences including content on climate change as a dominant driver of negative health outcomes. Additionally, it is expected that practical data management and analysis skills will be taught in the foundational curriculum.

Based on the demands of the observed institutional curriculum, MPH students are commonly awarded a concentration in Climate and Health in addition to their departmental degree following the completion of between 5-8 concentration-specific courses as detailed in Figure 2. This range of courses was used to develop an example course schedule across a standard two-year MPH concentration schedule as seen in Figure 3. A consistent structure including a seminar style course, two advanced climate and health
courses and two elective courses was recognized across all existing concentration programs. With the goal to incorporate all conceptual blocks in this sample concentration schedule, it is recommended to include one climate or atmospheric science course and a “selective” course consisting of a variety of options that correspond with differing conceptual block teachings. Some institutions may elect to have students complete a specific climate and health related integrated learning experience or thesis as a concentration requirement in addition to their course load. To develop a more substantive concentration experience, students can be encouraged to focus their integrated practice experience on an assessment of the health impacts of climate change, or impacts of climate change on health policy and public health interventions. Although this is not currently an observed common practice among schools and programs of public health, as thesis work is typically established at the department level, elective or selective courses can alternatively be removed and replaced with a thesis requirement.

*Figure 2. MPH Climate and Health Concentration Building Blocks*
**Figure 3. Sample Two-year Climate and Health Concentration Schedule**

### MPH Climate and Health Concentration Building Blocks

<table>
<thead>
<tr>
<th>Climate Science</th>
<th>Climate and Health Impacts</th>
<th>Climate and Health Policy</th>
<th>Mitigation and Adaptation</th>
<th>Global and Regional Climate Risks</th>
<th>Communication and Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define climate drivers (both natural and human-caused), weather, climate change, and climate variability.</td>
<td>Explain the connection between climate and public health, ranging from temperature-related mortality to increasing rates of disease and explain effective responses on the part of specific health services.</td>
<td>Explain the role of international, national and global policy frameworks and governance structures to address health risks associated with climate change.</td>
<td>Apply strong knowledge of levels of prevention, climate mitigation and adaptation, and explain health co-benefits of actions.</td>
<td>Access and interpret relevant local, regional, national, and global information about climate change effects on health.</td>
<td>Summarize the role of various sectors (government, private and non-profit) in addressing climate change's impact on public health.</td>
</tr>
<tr>
<td>Demonstrate understanding of the scientific consensus on climate change and evolving science.</td>
<td>Demonstrate a strong understanding of policy tools for describing the health impacts of climate change and or advancing solutions that address those impacts.</td>
<td>Develop and discuss strategies that effectively mitigate and prevent adverse health effects caused by climate change.</td>
<td></td>
<td>Demonstrate ability to effectively communicate with stakeholders and work collaboratively across disciplines on climate and health topics.</td>
<td></td>
</tr>
<tr>
<td>Better prepare students to speak broadly about climate change in both professional and community-outreach settings.</td>
<td>Explain climate-health activism and policy engagement roles of health professionals.</td>
<td></td>
<td></td>
<td>Apply climate and health knowledge to improve decisions about public health services, and adapt and improve population health.</td>
<td></td>
</tr>
</tbody>
</table>

### Example Required Courses

- Atmospheric and Climate Science for Public Health
- Energy, Environment, and Public Health
- Air Quality in the Urban Environment
- Global Climate Change and Air Pollution
- Public Health Impacts of Climate Change
- Climate Health and Public Health: The Global Environment, Climate Change, and Public Health
- Global Climate Change: Health Impacts and Response
- Frameworks for Environmental Health Policy and Practice
- Climate Change and Global Environmental Sustainability (relevant elective option)
- Water, Sanitation, and Human Health
- Climate and Health Weekly Seminar
- Climate Change and Public Health: Problem Solving Seminar: Global Challenges and Solutions for Mitigation, Adaptation, and Sustainability
- Advanced Seminar in Climate Change and Health
- Public Health Consequences of Disasters (relevant elective option)

### Example Elective Courses

- Applied Regression
- Analysis of Categorical Data
- Principles of Toxicology
- Environmental Epidemiology
- Food Security, Plant Biology, Climate Change, and Public Health
- Food Systems and Public Health
- Climate Change and Mental Health: Research, Practice, and Policy Perspectives
- Climate Change and Mental Health
- Spatial Analysis in Disease Ecology
- Intro to Satellite Remote Sensing of the Environment and Its Applications in Public Health
- Planetary Health
- Environmental Determinants of Infectious Disease
- Natural Disasters and Health
- Environmental Health Economics
- Introduction to Environmental and Occupational Health Law
- Transportation Policy and Health
- Advanced Topics in Climate Change Policy
- Global Environmental Health Policy
- Politics of Public Health
- Health Diplomacy/Global Health Diplomacy
- Outbreak Preparedness and Response in Resource-Limited Settings
- Health Behavior Change At the Individual, Household and Community Levels
- Applying the Social Ecological Model in Tobacco Control and Climate Change
- Sustainable Development and Next-Generation Buildings
- Built Environment and Public Health
- Public Health Preparedness and Practice
- Psychosocial and Mental Health Issues in Forced Migration
- Migration and Health Global and Local Perspectives
- Environmental Justice Advocacy
- Community-Driven Epidemiology and Environmental Justice
- Environmental Justice and Public Health Practice
- Issues for Water and Sanitation in Tropical Environmental Health
- Food- and Water- borne Diseases
- One Health Tools to Promote and Evaluate Healthy and Sustainable Communities
- Public Health Communication for Environmental Justice
- Water and Sanitation in Complex Emergencies
- Risk Assessment, Communication, and Management
- Introduction to Public Health Emergency Preparedness
- Food and Nutrition in Complex Humanitarian Emergencies
Framework for building a climate and health course:
The core competencies outlined by the GCCHE can serve as a framework for building dedicated climate change and health courses within schools and programs of public health due to the commonalities with CEPH MPH competencies identified in Table 1. Faculty can select various approaches in creating...
coursework to operationalize learning objectives and to assure their students can demonstrate the desired knowledge and skills. Table 2 lists the GCCHE core competencies with associated learning objectives that can be used by faculty building a course.

Table 2: GCCHE Core Competencies and Sample Learning Objectives

<table>
<thead>
<tr>
<th>GCCHE Core Competency</th>
<th>Sample Learning Objective</th>
</tr>
</thead>
</table>
| Define climate drivers (both natural and human caused), weather, climate change, and climate variability. | • Describe the measurement and evidence base of climate drivers.  
• Distinguish between “climate” and “weather,” and between climate change and climate variability.  
• Explain the general mechanism of the greenhouse effect.  
• Explain the main atmospheric drivers of climate change (or “radiative forcings”)  
• Explain the social dimensions of climate drivers, including population growth and economic growth. |
| Identify the health impacts of climate change and effective responses on the part of specific health services. | • Describe major health outcomes associated with climate events, including both direct and indirect impacts, and their mechanisms. Impacts include:  
  o asthma and cardiovascular disease from air pollution;  
  o spread of viruses and infectious diseases;  
  o increases in respiratory allergies and asthma due to increasing allergens;  
  o water quality impacts;  
  o impacts to water and food supplies;  
  o environmental degradation, biodiversity loss, loss of ecosystems and resultant impacts on human health  
  o impacts of extreme heat including heat-related illness and death MOOC: Centre  
  o injuries, death, and mental health impacts from severe weather;  
  o climate-induced migration and conflict.  
  o Climate-induced alterations on frequency and intensity of natural disasters and their impact on health.  
• Explain how the health impacts of climate variability/change will vary within and among different communities and regions and impact vulnerable populations  
• Give examples of how climate change may interact with other environmental changes, such as land degradation and biodiversity shifts, to affect health. Identify resources to guide action in response to the health impacts of climate change. |
| Apply knowledge of levels of prevention, climate mitigation and adaptation, and explain health co-benefits of | • Distinguish between climate mitigation and adaptation.  
• Distinguish between primary, secondary and tertiary prevention levels.  
• Describe the near-term health co-benefits that arise because of climate mitigation at the individual, local, and global scales. |
<table>
<thead>
<tr>
<th>Actions</th>
<th>Provide examples of sectoral policies that can reduce greenhouse gas emissions and improve health.</th>
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<tbody>
<tr>
<td>Apply knowledge of emergency planning skills.</td>
<td>Identify the risks and vulnerabilities to critical health infrastructure from extreme weather events and other climate impacts. Use emergency planning skills to plan for and respond to climate-related extreme weather events and disasters, including workforce surge needs, and distinguish the roles of and interactions between agencies involved in emergency care.</td>
</tr>
<tr>
<td>Access and interpret relevant local, regional, national, and global information about climate change effects on health.</td>
<td>Demonstrate how to access accurate science about local, regional, national, and global environmental conditions (e.g., air quality). Describe the association between climate change and global health.</td>
</tr>
<tr>
<td>Demonstrate understanding of the scientific consensus on climate change and concept of evolving science.</td>
<td>Practice communicating about the scientific consensus on climate change and concept of evolving science, and give examples of interactions between environmental changes that may affect public health.</td>
</tr>
<tr>
<td>Demonstrate effective communication with stakeholders about climate and health topics.</td>
<td>Demonstrate the ability to communicate climate and health topics to different groups Identify challenges to climate communication (e.g. climate skepticism and special interest lobbying). Identify lessons derived from local or regional climate change threats and disasters that can serve as opportunities for communication about climate change. Identify pathways of translating climate and public health science into policy instruments both globally and domestically.</td>
</tr>
<tr>
<td>Explain the role of local, regional., national and global policy frameworks and governance structures to address health risks associated with climate change.</td>
<td>Explain the role of current frameworks for understanding and responding to climate-health challenges, such as the United Nations Sustainable Development Goals and the Paris Agreement. Describe the role of governance as it relates to health policy and climate change. Explain how partnerships between universities and government health agencies can advance local action on climate and health.</td>
</tr>
<tr>
<td>Apply climate and health knowledge to improve decisions about public health services, and adapt and improve population health.</td>
<td>Identify measures that can be taken to provide health security and foster climate resilience at the individual, local, or global scales. Provide examples of how climate-health impacts in one location can affect public health, including through contagion, economic repercussions, and psychosocial well-being, in another, considering impacts across regions and scales. Use information on regional impacts to analyze the relationship between climate and public health data,</td>
</tr>
<tr>
<td>Deliver and improve local health services, and support public health impact assessment and political engagement.</td>
<td>Apply knowledge of the connection between habitat and biodiversity loss and infectious diseases.</td>
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</tr>
<tr>
<td>● Provide examples and describe the links between habitat loss, impacts on species, and potential for zoonotic transmission.</td>
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</tbody>
</table>

Sample climate and health course syllabus:
Faculty can choose how to incorporate the core competency elements and respective learning objectives into a semester-long course. Below is an example of how learning objectives might be linked together into a course with associated learning activities and evaluation strategies. This sample syllabus was developed by the ASPPH-GCCHE working group.

Course Outline

Topic 1: Climate change for the health professional

Learning Objectives:
- Describe the difference between natural climate variability and long-term climate change, including “climate” vs. “weather”
- Describe the measurement and evidence base of climate drivers.
- Explain the general mechanism of the greenhouse effect.
- Explain the social dimensions of climate drivers, including population growth and economic growth
- Communicate the degree of scientific consensus on climate change.

Suggested Reading:

Activity: Organize students into groups of 4-5 and assign each group an audience to communicate how and why climate change is occurring (Audiences may include: local policy makers, local health departments, community members, peers). Group members should take turns being the public health professional and the audience in a role-play experience.

Assessment: Create a brochure, poster, short video or letter to local policy makers, local health departments, community members, peers explaining how and why climate change is occurring

Topic 2: Extreme weather hazards
**Learning Objectives:**

- Describe the ways in which climate change increases the risk of extreme events such as hurricanes, floods and droughts
- Identify the short-term and long-term health threats to public health impacted by extreme weather events
- Define the role of disaster risk reduction and the strengthening resilience and adaptive capacity in the prevention of the health impacts of extreme weather events
- Explain how the health impacts of climate variability/change will vary within and among different communities and regions and give examples of how climate change may interact with other environmental changes, such as land degradation and biodiversity shifts, to affect health.

**Suggested Readings:**


**Activity:** Organize students into groups of 4-5 and create an extreme event scenario for which students take on roles with the emergency response team of a region. Have them consider the following:

- What populations are most vulnerable? How can they be accessed?
- What are your goals/primary objectives to safeguard health?
- What sectors could you partner with to achieve your goals (determined by students)?
- How can hospitals and public health departments respond? What guidance can you provide?
- How will you present this information to the media?
- What impending public health concerns should the local government and public health agency be concerned about?

**Assessment:** Identify a recent climate and health related extreme weather event. Write a critical one-page summary of the event, detailing what vulnerabilities existed in the affected communities and what steps could be taken to prevent health harms during future events.

**Topic 3: Water-related Illness**

**Learning Objectives:**

- Describe how climate change impacts the hydrosphere and the implications for water availability, quality and supply.
- Apply knowledge of climate impacts on the hydrologic cycle to the incidence and prevalence of waterborne pathogens including bacteria, parasites and viruses.
- Identify potential exposures to toxins resulting from flood waters, including industrial contaminants in flood waters and household mold.
- Explore case examples of direct impacts of hydrologic changes on Campylobacter, Salmonella, cryptosporidium, Norovirus, and Vibrio.
- Explain how changes to the hydrologic cycle may impact population health.
- Explore factors that contribute to community vulnerability.

**Suggested Reading:** United States Global Change Research Program, Climate and Health Assessment, Chapter 6: Water-related Illness. Available at: https://health2016.globalchange.gov/

**Activity:** Using the Environmental Protection Agency “How’s My Waterway” function (available at: https://mywaterway.epa.gov/), search for the current water quality in your state. Based on results,
brainstorm how climate change stands to threaten water quality. Do an internet-based search of available public health information or research to understand the causes behind the current water quality issues in your state. Report out to the larger group.

**Assessment:** Write an op-ed for a state/local newspaper about a water-quality issue you discovered in the above activity. Focus on communication strategies to reach the general public and to use the opportunity to educate readers about the issue.

**Topic 4: Temperature related illness and mortality**

*Learning Objectives:*
- Define “heat sensitive” health conditions and cite examples of ways in which heat impacts the pathophysiology of cardiovascular, renal, and respiratory disease
- Explore the role of heat early warning systems in preventing negative health outcomes for vulnerable populations
- Identify populations vulnerable to heat illness and steps health and partners professionals can take to protect these populations
- Identify vulnerable populations within a specific geographic region based on factors related to the built environment
- Develop communication strategies regarding risk mitigation, such as having access to a cooling center during heat crises or limiting outside work and recreation during heat waves

*Suggested Reading:*
- United States Global Change Research Program, Climate and Health Assessment, Chapter 2: Temperature-related Illness and Death. Available at: https://health2016.globalchange.gov/

**Activity:** Download and explore the “Heat Safety Tool.” This app is targeted towards an outdoor worker population. With your small group, devise how this app might be adapted towards the following heat-vulnerable populations: children, pregnant women, elderly, those with comorbidities.

**Assessment:** Locate a heat early warning system that is currently in practice and review its core components. Write a critical essay of 1-2 pages that highlights the exemplary aspects of the system as well as potential health vulnerabilities that were not included in the warning system.

**Topic 5: Food Security**

*Learning Objectives:*
- Describe how climate change affects all four dimensions of food security: food availability, stability of food supplies, access to food, and food utilization.
- Discuss how climate change and variability impacts key underlying causes of undernutrition: household food access, access to maternal and child care and feeding practices, environmental health, and health access.
- Identify populations (children, elderly, chronically ill) that are vulnerable to undernutrition and explore ways that health professionals can intervene
• Explore co-benefits of improving diets to address malnutrition and mitigate climate change
• Discuss relationship between food, animal and plant agriculture and carbonization (increase methane, carbon)

Suggested Reading:
• United States Global Change Research Program, Climate and Health Assessment, Chapter 7: Food Safety, Nutrition and Distribution. Available at: https://health2016.globalchange.gov/

Activity: Using the U.S. Climate-Resilient Toolkit, access the “Food Access Research Atlas.” Using this tool, view maps and data on food access indicators for your local region, including low-income designations, distance to nearest supermarkets, and vehicle availability. With your group, brainstorm how public health measures may help improve food insecurity in a changing climate. Share out with larger group. Have students provide peer feedback.

Assessment: Research current public health measures in your home community to protect the public from food-borne disease. Write a critical 1-2 page essay describing why or why not these existing measures are adequate to prevent climate-related threats to food safety and security.

Topic 6: Degraded Air quality

Learning Objectives:
• Describe the pathways through which climate change affects ozone, PM2.5, and other ambient respiratory irritants how these pollutants impact climate-sensitive respiratory diseases such as Asthma, COPD, Chronic Lung Disease, and allergic disease
• Analyze data related to hospital and ED usage for respiratory conditions as they relate to meteorological variables
• Describe how climate change makes air quality regulation more complex and difficult
• Identify populations that are vulnerable to climate-related degraded air quality.
• Describe how the health professionals can protect these vulnerable patients
• Explain how wildfires are impacted by climate change and the direct and indirect health implications
• Identify particularly vulnerable patients and families and teach about risk mitigation, such as limiting outside work and recreation during poor air quality days

Suggested Reading:
• United States Global Change Research Program, Climate and Health Assessment, Chapter 3: Air Quality Impacts. Available at: https://health2016.globalchange.gov/
• Ziska, LH, Epstein PR, Schlesinger WH. Rising CO2, climate change and public health: Exploring the links to plant biology. Environmental Health Perspectives. 2009 Feb; 117(2): 155-8

Activity:
• Explore the Air Quality Index tool on the U.S. Climate Resilient Toolkit. With your group, create public health messages for poor air quality days considering the following: Threshold for activation, mechanisms to disseminate information, key stakeholders in designing warning system, vulnerable populations
**Assessment:** The World Health Organization just passed new global air quality recommendations, knowing that over 90% of the world lives in areas that exceed current standards. In a 1-page critical essay, write a letter to your current state representative detailing the health case for improving air quality in your region.

**Topic 7: Vector-borne disease**

*Learning Objectives:*

- Explain the environmental processes changing as result of climate change and how they impact the prevalence, incidence, and distribution of vector-borne disease.
- For the following diseases, describe how climate change is influencing their distribution: Lyme disease, Dengue fever, Malaria, Hantavirus, West-Nile virus (will change based on geographic location of program).
- Explore actions health professionals can take to protect populations vulnerable to these diseases.
- Identify vulnerable populations including: women, outdoor workers, etc.
- Define steps the health sector can take to become prepared to address shifting geographic burdens of vector-borne disease.

**Suggested Readings:**

- United States Global Change Research Program, Climate and Health Assessment, Chapter 5: Vector-borne Diseases Available at: https://health2016.globalchange.gov/

**Activity:** The FAO has created a Rift-Valley Fever early warning system in attempt to prevent loss of livestock and resulting food insecurity. Examine this early warning system. Discuss with your group it’s strengths and limitations. Suggest other types of early warning systems for other VBD’s in the Americas, select a system to propose, and describe the potential challenges in establishing such a system.

**Assessment:** Choose a vector-borne disease of significance and create a public health pamphlet that describes the ways in which climate change stands to make this disease worse. Consider known endemic locations, how climate change might alter this, and which vulnerable populations you want to reach.

**Topic 8: Mental Health**

*Learning Objectives:*

- Discuss how natural disasters resulting from climate change impact the mental health of a population, specifically in regard to the incidence and prevalence of stress disorders, depression, domestic abuse, interpersonal violence and substance abuse.
● Explore the impact on the mental health of “climate refugees” or those that have been displaced from their home or livelihood from climate related environmental changes such as drought, sea level rise, wildfires or hurricanes. Cite and explore recent examples (examples will vary based on geographic region of program)
● Describe what can be done to mitigate the population mental health consequences of climate change
● Explore the unequal burden of climate related mental health disorders and discuss strategies for targeted interventions in vulnerable populations.

Suggested Readings:
● United States Global Change Research Program, Climate and Health Assessment, Chapter 8: Mental Health and Well-being at: https://health2016.globalchange.gov/

Activity: With your small group, brainstorm a comprehensive list of populations and communities who stand to have their mental health impacted by climate change and the mechanisms of this potential outcome. Create a “web” of connections on this theme, tracing heat exposure through the social and built environment to ultimately impact individual and community mental health

Assessment: Research and describe a potential intervention targeted to mitigate the population mental health consequences of climate change. Discuss its successes, challenges, and feasibility of scaling.

Topic 9: Climate Change and Health Equity

Learning Objectives:
● Define climate-health vulnerability and climate resilience.
● Identify social and environmental determinants of health that make individuals and communities more vulnerable to climate-related health threats.
● Apply the vulnerability framework to specific populations (women, workers, climate refugees, indigenous people).
● Describe the unique vulnerabilities of the following populations: elderly, children, socioeconomically disadvantaged, homeless, immunocompromised patients, patients with chronic medical conditions.
● Apply knowledge of the ethical, professional, and legal obligations relevant to climate and health.

Suggested Readings:
● United States Global Change Research Program, Climate and Health Assessment, Chapter 9: Populations of Concern. Available at: https://health2016.globalchange.gov/

Activity: Each group will be assigned a climate exposure and be asked to identify populations that may be differentially exposed to climate-related health threats and propose 2-3 public health interventions to combat these impacts.

Assessment: Write a letter to the editor of your local newspaper that describes the unequal impact of climate change on local populations. Practice using your voice and authority as a health professional.

Topic 10: Climate and Health Communication

Learning Objectives:
- Demonstrate the ability to communicate climate and health topics to different groups (incl. patients, families, professional colleagues, communities, and policymakers).
- Identify reliable sources of information at the local, regional, and international level that can help support your communication to interested parties.
- Identify challenges to climate communication (e.g. climate skepticism and special interest lobbying).
- Identify lessons derived from local or regional climate change threats and disasters that can serve as opportunities for communication about climate change.
- Determine members of the “climate team” or related group at your institution and their roles, for example community leaders, policy makers, hospital administrators, and other stakeholders.
- Describe best practices in interprofessional collaboration: information-sharing, collegial cooperation, and collective action.
- Identify ways to engage in transdisciplinary and interprofessional climate responses to maximize impact
- Practice communicating about the scientific consensus on climate change and the concept of evolving science, and give examples of interactions between.

Suggested Readings:
- Limaye VS, Grabow ML, Stull VJ, Patz JA. Developing A Definition Of Climate And Health Literacy: Study seeks to develop a definition of climate and health literacy. Health Affairs. 2020 Dec 1;39(12):2182-8.

Activity: In class student stakeholder debate (environmentalist groups, citizens, government bodies, industry etc.)

Assessment: Read an article and write a brief 1 page paper describing strategies to effectively engage an underrepresented stakeholder

Topic 11: Climate solutions and health co-benefits

Learning Objectives:
- Distinguish between climate mitigation and adaptation.
● Explain how adaptation and mitigation strategies can reduce adverse health impacts of climate change.
● Describe the role of vulnerability and adaptation assessments in responding to climate health hazards.
● Identify examples of climate change and health adaptation opportunities in the student’s region.
● Discuss how mitigation of climate change in various sectors including transportation, energy, and housing can lead to health co-benefits and reduced health risks.
● Identify pathways by which healthcare mitigation and adaptation may support or harm vulnerable populations.

Suggested Reading:

Activity: Students divide into groups of 4-5 and choose a current environmental/climate policy of interest and present to the group the benefits, barriers and the interests of involved stakeholders
Assessment: Identify a climate risk and describe its cascading effects, propose a public health intervention using a health systems approach that can effectively address these impacts.

Topic 12: Health Sector Mitigation

Learning Objectives:
● Apply the concepts of mitigation and adaptation to the health sector and explore examples of how health systems can perform both.
● Identify ways in which health care facilities can become more resilient in the face of increasingly severe and/or frequent climate-related weather extremes.
● Use emergency planning skills to plan for and respond to climate-related extreme weather events and disasters, including workforce surge needs, and distinguish the roles of and interactions between agencies involved in emergency care.

Suggested Readings:

Activity: Case study examination/walk through in groups. Identify a hospital that has demonstrated success in healthcare greening and how can their practices be translated to other facilities.
Assessment: Have students broadly identify barriers to greening healthcare systems, pick a medical specialty (pharmaceuticals, ER, surgery) and research and summarize how greening measures can be taken within specific medical professions.
# Appendix I

<table>
<thead>
<tr>
<th>GCCHE Competency</th>
<th>Resource Title</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course</td>
<td>University of Chicago: <em>Global Warming I: The Science and Modeling of Climate Change</em></td>
<td><a href="https://www.coursera.org/learn/global-warming">https://www.coursera.org/learn/global-warming</a></td>
</tr>
<tr>
<td>Reading</td>
<td>CDC: <em>Preparing for the Regional Health Impacts of Climate Change</em></td>
<td><a href="https://www.cdc.gov/climateandhealth/docs/Health_Impacts_Climate_Change-508_final.pdf">https://www.cdc.gov/climateandhealth/docs/Health_Impacts_Climate_Change-508_final.pdf</a></td>
</tr>
<tr>
<td>Lecture</td>
<td>Healthcare Without Harm: <em>Safe haven in the storm: Protecting lives and margins with climate-smart health care</em></td>
<td><a href="https://noharm-uscanada.org/safehaven">https://noharm-uscanada.org/safehaven</a></td>
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<tr>
<td>Course</td>
<td>Yale University: <em>Introduction to Climate Change and Health</em></td>
<td><a href="https://www.coursera.org/learn/introduction-climate-change-health?specialization=climate-change-and-health">https://www.coursera.org/learn/introduction-climate-change-health?specialization=climate-change-and-health</a></td>
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<tr>
<td>Reading</td>
<td>Global Climate Change and Human Health: <em>Chapter 19</em></td>
<td><a href="https://books.google.com/books?hl=en&amp;lr=&amp;id=xMAsEAAAQBAJ&amp;oi=fnd&amp;pg=PA343&amp;dq=climate+mitigation+and+health+cobenefits&amp;ots=jw2Ekv7R68&amp;sig=CIWwr9WaElpR7QNJp2SQGbEMAb/v=onepage&amp;q&amp;f=false">https://books.google.com/books?hl=en&amp;lr=&amp;id=xMAsEAAAQBAJ&amp;oi=fnd&amp;pg=PA343&amp;dq=climate+mitigation+and+health+cobenefits&amp;ots=jw2Ekv7R68&amp;sig=CIWwr9WaElpR7QNJp2SQGbEMAb/v=onepage&amp;q&amp;f=false</a></td>
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<tr>
<td>Course</td>
<td>University of Copenhagen: <em>Urbanisation and Health - Promoting Sustainable Solutions</em></td>
<td><a href="https://www.coursera.org/learn/urbanisation-health-promoting-sustainable-solutions">https://www.coursera.org/learn/urbanisation-health-promoting-sustainable-solutions</a></td>
</tr>
<tr>
<td>Lecture</td>
<td>Pediatric Perspectives: <em>Climate Change as a Social Determinant</em></td>
<td><a href="https://publications.aap.org/pediatrics/article/145/5/e20193169/36824/Climate-Change-as-a-Social-Determinant-of-Health">https://publications.aap.org/pediatrics/article/145/5/e20193169/36824/Climate-Change-as-a-Social-Determinant-of-Health</a></td>
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<tr>
<td>Lecture</td>
<td>Association for Prevention Teaching and Research: <em>Module 1: Determinants of Health</em></td>
<td><a href="https://www.aptrweb.org/page/module1">https://www.aptrweb.org/page/module1</a></td>
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<tr>
<td>Course</td>
<td>University of Michigan: <em>Assessing and Improving Community Health</em></td>
<td><a href="https://www.coursera.org/learn/assessing-and-improving-community-health">https://www.coursera.org/learn/assessing-and-improving-community-health</a></td>
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<tr>
<td>Reading</td>
<td>Int J Environ Res Public Health: <em>Climate Change Impacts on Disaster and Emergency Medicine Focusing on Mitigation Disruptive Effects: an International Perspective</em></td>
<td><a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6069477/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6069477/</a></td>
</tr>
<tr>
<td>Course</td>
<td>Johns Hopkins University: <em>Public Health in Humanitarian Crises I</em></td>
<td><a href="https://www.coursera.org/learn/humanitarian-public-health">https://www.coursera.org/learn/humanitarian-public-health</a></td>
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<tr>
<td>Access and interpret relevant local, regional, national, and global information about climate change effects on health.</td>
<td>Reading</td>
<td>New York Academy of Sciences: Impact of recent and future climate change on vector-borne diseases</td>
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<tr>
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<td>Reading</td>
<td>Environment: The Science Behind the Stories: Environmental Ethics and Economics</td>
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<td>Course</td>
<td>Technical University of Denmark: Environmental Management &amp; Ethics</td>
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<tr>
<td></td>
<td>Lecture</td>
<td>National Center for Science Education: New Climate Change Education Initiative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apply knowledge of the ethical, professional, and legal obligations relevant to climate and health.</th>
<th>Reading</th>
<th>Communication and Collaboration</th>
<th>Demonstrating communication with stakeholders about climate and health topics.</th>
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<tr>
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<td>Lecture</td>
<td>National Center for Science Education: New Climate Change Education Initiative</td>
<td><a href="https://d32ogqmya1dw8.cloudfront.net/files/cln/ncse-climateliteracynework-jr2.ppt">https://d32ogqmya1dw8.cloudfront.net/files/cln/ncse-climateliteracynework-jr2.ppt</a></td>
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<td></td>
<td>Lecture</td>
<td>American Public Health Association: Climate Changes Health Tools to Communicate the Problem</td>
<td><a href="https://www.apha.org/-/media/files/pdf/webinars/2016/climate_changes_health_tools_to_communicate_the_problem_luber.ashx?la=en&amp;hash=20CBB4CEB7CE077358F75C0F0C2A026C8E4BB1">https://www.apha.org/-/media/files/pdf/webinars/2016/climate_changes_health_tools_to_communicate_the_problem_luber.ashx?la=en&amp;hash=20CBB4CEB7CE077358F75C0F0C2A026C8E4BB1</a></td>
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<td></td>
<td>Course</td>
<td>Climate Change and Health: From Science to Action Specialization: Yale University: Climate Change and Health: From Science to Action Specialization</td>
<td><a href="https://www.coursera.org/specializations/climate-change-and-health">https://www.coursera.org/specializations/climate-change-and-health</a></td>
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<tr>
<td>Work collaboratively and across disciplines on climate and health issues.</td>
<td>Reading</td>
<td>Proceedings of National Academy of Science: Reflections on an interdisciplinary collaboration to inform public understanding of climate, mitigation, and impacts</td>
<td><a href="https://www.pnas.org/content/116/16/7676">https://www.pnas.org/content/116/16/7676</a></td>
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<td>Lecture</td>
<td>University of Minnesota: Climate Change and Human Health: Interprofessional Response</td>
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<td>Course</td>
<td>Civic Ecology Lab: Climate Change Science, Communication, and Action</td>
<td><a href="https://www.civicecology.org/course-cc">https://www.civicecology.org/course-cc</a></td>
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### Policy

<table>
<thead>
<tr>
<th>Explain the role of subnational, national and global policy frameworks and governance structures to address health risks associated with climate change.</th>
<th>Reading</th>
<th>Health Affairs: Adding A Climate Lens To Health Policy In The United States</th>
<th><a href="https://www.healthaffairs.org/doi/10.1377/hlthaff.2020.01352">https://www.healthaffairs.org/doi/10.1377/hlthaff.2020.01352</a></th>
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<td>University of Wisconsin: Climate Change Policy and Public Health</td>
<td><a href="https://www.classcentral.com/course/ccandph-2880">https://www.classcentral.com/course/ccandph-2880</a></td>
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<tr>
<td>Lecture</td>
<td>The Journal of Climate Change and Health: Health professionals as advocates for climate solutions: A case study from Wisconsin</td>
<td><a href="https://www.sciencedirect.com/science/article/pii/S266727822100493?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S266727822100493?via%3Dihub</a></td>
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### Public Health Practice Competencies

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<tbody>
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<td>Lecture</td>
<td>Climate Investment Funds: Climate Services for Good Health: Supporting Climate-Resilient Health Care</td>
<td><a href="https://www.climateinvestmentfunds.org/knowledge-exchange/climate-services-good-health-supporting-climate-resilient-healthcare">https://www.climateinvestmentfunds.org/knowledge-exchange/climate-services-good-health-supporting-climate-resilient-healthcare</a></td>
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<tr>
<th>Apply knowledge of the connection between habitat and biodiversity loss and infectious diseases.</th>
<th>Reading</th>
<th>J R Soc Interface: Habitat fragmentation, biodiversity loss and the risk of novel infectious disease emergence</th>
<th><a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6303791/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6303791/</a></th>
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<tr>
<td>Lecture</td>
<td>Proceedings of National Academy of Science: Impacts of biodiversity and biodiversity loss on zoonotic diseases</td>
<td><a href="https://www.pnas.org/content/118/17/e2023540118">https://www.pnas.org/content/118/17/e2023540118</a></td>
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<td>Course</td>
<td>ABRASCO: Examining the Links Between Biodiversity and Human Health</td>
<td><a href="https://www.powershow.com/view/3b93d8-ZjU4M/Examining_the_Links_Between_Biodiversity_and_Human_Health_A_Multidisciplinary_Approach_powerpoint_ppt_presentati">https://www.powershow.com/view/3b93d8-ZjU4M/Examining_the_Links_Between_Biodiversity_and_Human_Health_A_Multidisciplinary_Approach_powerpoint_ppt_presentati</a> on</td>
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Course University of Geneva: Global Health at the Human-Animal Ecosystem Interface
Princeton University: Bats, Ducks, and Pandemics: An Introduction to One Health Policy

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