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Review Article

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Knowledge of the health risks of climate change needed for health professionals, Kuwait as an example.

Muna A.A. Alkhabbaz¹, Kristie L. Ebi²

¹ Kuwait Ministry of Health, Environmental Health Department.

² Center for Health and the Global Environment, University of Washington, Seattle WA USA.

Abstract:

Background:

The hazards associated with a changing climate are adversely affecting human health and well-being. As the evidence mounts, it is critically important to incorporate understanding of these risks into education for health professionals, to ensure they can effectively prepare for and manage changing risks to population health and healthcare infrastructure.

The risks are illustrated using Kuwait as an example. Kuwait is one of the hottest and driest regions worldwide, making it particularly vulnerable to our changing climate, with rising temperatures and changing precipitation patterns increasing drought and dust, exacerbating already high levels of water stress; increases in the frequency, intensity, and duration of heatwaves and other extreme weather and climate events; and sea level rise.

Methods:

To illustrate the knowledge needed by health professionals, a narrative review was undertaken of climatic changes in Kuwait and the consequences for human health and well-being, based on a comprehensive search of publications about climate change and health in Kuwait through March 2025.

Results:

Key climate-sensitive health outcomes in Kuwait include heat stress and mortality, undernutrition, infectious diseases, and other climate-sensitive health outcomes. The risks are expected to increase with each additional unit of warming.

Discussion:

Educating health professions about the magnitude and pattern of current and likely future risks, and of options to increase preparedness, is needed to increase health system resilience to a changing climate.

Keywords:

Climate change, health, MENA, Kuwait.

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Address for Correspondence

Kristie L. Ebi.
Center for Health and the Global Environment, University of Washington, Seattle WA USA.
Email: krisebi@uw.edu,
Mobile: +1 206 453 4421



Introduction:

Medical education is beginning to focus on the critical need to train the next generation of health professionals about the current and projected health risks of climate change. This is a topic where few health professionals have training, requiring urgent efforts to increase the core competencies of current and future health workers [1].

In the World Health Organization Operational framework for building climate resilient and low carbon health systems, one of the key elements is a climate-smart health workforce [2]. This includes strengthening the healthcare workforce to effectively respond to climate-related health risks; promoting a fit-for-purpose workforce with core competencies to manage climate-related health threats; and providing actionable information and communications at scales relevant for decision-making.

Climate change is different from most environmental hazards in that everyone is exposed (e.g., there is no unexposed control group); hazards will continue to increase over coming decades, along with changes in socioeconomic and environmental drivers of adverse health outcomes, requiring use of scenarios to explore the range of uncertainties about what the future could look like; and multiple, interrelated causes and feedback mechanisms must be addressed when investigating complex disease/exposure associations.

Human emissions of greenhouse gas emissions and deforestation have caused global mean surface temperatures to increase 1.1°C between 1850-1900 to 2011-2020 [3]. The result has been widespread and rapid changes in the atmosphere, ocean, cryosphere, and biosphere, resulting in weather and climate extremes that are causing widespread impacts worldwide, with related losses and damages. Vulnerable people and communities are the most affected yet have contributed the least to climate change.

Exposures to the hazards created by a changing climate are interacting with a broad range of environmental, demographic, and socioeconomic factors to alter exposure pathways, including extreme weather and climate events; food, water, and air quality; infectious diseases; and mental health [3]. The magnitude and pattern of health risks are determined not just by exposure to climate-related hazards but also by population susceptibility and the capacity of health systems to effectively manage increases in demands for healthcare and consequences of extreme events for the functioning of health infrastructure. The Intergovernmental Panel on Climate Change (IPCC) concluded that climate change is already impacting the physical health of people globally and the mental health of people in assessed regions [3].

Using Kuwait as an example, we explore the breadth of health risks of climate change to illustrate the range of issues for which health professionals requiring training.

Methods:

A narrative review was undertaken of climatic changes in Kuwait and the consequences for human health and well-being. A comprehensive search of PubMed was conducted to identify all publications about climate change and health in Kuwait through October 2024; all are included in this review. Underinvestment in research on climate change and health in Kuwait and the MENA region means the literature database is limited. The literature search was supplemented by a search of the Government of Kuwait databases for national policies and plans, and other information.

The synthesis of the narrative review was informed by a competency framework that included climate and environment sciences; evidence, projections and assessments; risk management; and harnessing international/regional/local agreements and frameworks [1].

Results:

Kuwait is a small country located in the Northeast of the Middle East and North Africa (MENA) region, with a total area of 17,818 km². Kuwait is one of the world's largest oil producers. It has an energy-intensive infrastructure, such as desalination plants, and extensive use of air conditioning and transportation, that relies heavily on oil, further exacerbating CO₂ emissions. The combustion of fossil fuels, especially oil, is a major source of greenhouse gas emissions, which trap heat in the Earth's atmosphere, contributing to global warming. In 2016, the energy sector represented 96% of Kuwait's total greenhouse gas emissions, of which more than half came from public electricity and heat production 58% [4].

Kuwait is one of the hottest countries worldwide. It has a tropical, dry, and subtropical desert climate with dry, intensely hot summers and short, cool winters. Climate change is resulting in notable changes in its weather patterns. Examples include that in the summer of 2016, a temperature of 54°C was recorded in Mitribah, northwest Kuwait; one of the highest temperatures ever recorded in recent history. Looking to the future, the mean annual temperature is projected to rise by about 6.2°C on average from 1990 to 2100 under a high GHG emission scenario. Such high temperatures could make the region unlivable. If GHG emissions decrease rapidly, the temperature rise could be limited to about 1.7°C [4-7].

Seasonal rainfall also is shifting. According to the Meteorological Center in Kuwait, the yearly total rainfall has been relatively steady over the years, with a slight increase, but the number of rainy days decreased, which led to flooding in recent years. Climate change also increases desertification, which in turn can increase the frequency and severity of dust storms.

Health risks of changing weather patterns in Kuwait: Exposures to high temperatures are associated with many health outcomes including dehydration, heatstroke,



exacerbation of chronic conditions, mental health outcomes, and mortality [8]. Alahmad et al. (2024) showed that each year between 2017 and 2019, there was an excess of 282 diabetic admissions attributed to hot days [9]. Moreover, by the end of the century, it was projected that around 13.6 out of every 100 deaths are projected to be associated with heat driven by climate change [10-12].

Changes in the mean and variability of precipitation increase the risk of vector-borne diseases and exacerbate chronic diseases. Sea level rise with associated storm surges in Kuwait poses significant threats, especially for coastal areas. By the end of the century, the amount of sea level rise in Kuwait can reach one meter, which could displace 35% of the population [13]. The rise in sea levels and increased flooding are associated with a higher incidence of injuries, gastrointestinal diseases, mental health issues, and mortality [8, 14-16].

A 2018 study showed that between the years 2000 and 2012, Kuwait experienced an average of 137 dust-laden days per year, primarily during the hot summer months from May to August [16]. Another study showed that between 1996 and 2000, the risk of asthma admissions increased by 7% on days with dust storms compared to dust-free days, particularly impacting children [13]. It is worth mentioning that Kuwait is surrounded by five major dust sources located in neighbouring countries [16-18], indicating that a lot of dust in Kuwait is transboundary. The financial burden of desertification on Kuwait is estimated at around USD 614 million annually [19], mostly related to disruptions to transportation, agriculture, and infrastructure, in addition to health-related costs.

Dust storms increase PM₁₀ and PM_{2.5} concentrations in the atmosphere, which significantly reduces air quality. Long-term exposure to elevated PM_{2.5} and PM₁₀ during dust storms is associated with increased morbidity and mortality, particularly for individuals with pre-existing heart and lung conditions [20]. Over a four-year period (2014–2017), high ambient PM_{2.5} concentrations were recorded in Kuwait, which was associated with high excess mortalities from ischemic heart diseases and stroke [21].

Kuwait national policies and participation in international agreements: Kuwait demonstrated its commitment to addressing climate change by joining several international agreements, including the United Nations Framework Convention on Climate Change (UNFCCC) in December 1994, marking its initial step in global climate cooperation, the Kyoto Protocol, further solidifying its role in international efforts to reduce GHG emissions, and the Paris Agreement, aligning itself with global objectives to limit temperature rise to less than 2°C and enhance adaptive capacities [4].

In addition to international agreements, Kuwait has implemented a range of national policies and regulations aimed at environmental protection and climate resilience. This includes Kuwait Vision 2035 that has a pillar focusing on creating a sustainable living environment. Kuwait also has an

Environmental Protection Law (No. 42 of 2014, later amended (Law No. 99 of 2015), that represents a comprehensive governmental effort to protect the environment and natural resources, control pollution, and promote public health and biodiversity. Furthermore, Kuwait developed a National Adaptation Plan in 2019 to strengthen climate resilience and guide long-term environmental planning [5].

Kuwait is also advancing in various national projects to reduce GHG emissions and promote sustainability, especially in the oil and energy sectors. Oil companies in Kuwait are committed to achieving carbon neutrality by 2050. The government is investing in carbon capture technologies and implementing initiatives to reduce gas flaring emissions. In the renewable energy sector, the Ministry of Electricity and Water is leading a 1-gigawatt solar energy project, with the goal of generating 15% of Kuwait's electricity from renewable sources by 2030. Additionally, the Kuwait Fund for Arab Economic Development is collaborating with the Government of Iraq, UN-Habitat, and the Kuwait Institute for Scientific Research (KISR) on a joint project to enhance adaptation and resilience against transboundary sand and dust storms [6-7].

Discussion:

In response to increasing understanding of the health risks of climate change, the Ministry of Health (MOH) in Kuwait has taken active steps to address health-related impacts of climate change. In 2019, the MOH established the National Committee for Preparedness and Response to the Impacts of Climate Change and Environmental Disasters on Health. This committee is tasked with assessing the current situation regarding climate change and its effects on health and developing a plan to reduce the impacts of climate change on health. In 2023, Kuwait announced its commitment to COP26 Health Initiatives by declaring plans to build a climate-resilient health system [22]. This includes conducting a Vulnerability and Adaptation (V&A) Assessment, developing the Health National Adaptation Plan (HNAP), and aligning healthcare policies with the broader national goal of achieving carbon neutrality by 2060 [23-24]. These processes will inform further modifications of current and development of new policies to protect human health and well-being in a changing climate.

The information presented here illustrates the range of information needed by health professionals to modify current and develop new policies and programs to effectively and efficiently prepare for and manage the health risks of a changing climate. As described by the World Health Organization [2], health workforce competencies need to be developed through pre-service education, lifelong learning, and mentoring. The skills required include sufficient understanding of climate information so that health professionals can effectively apply this information in the design and implementation of health interventions. Health professionals also need to be able to effectively work with and communicate across disciplines.



Conclusion:

Resilient and sustainable communities and health organizations can only be achieved through commitments to and investments in health workforce development. This includes ensuring that the health risks of climate change are central topics included in education and training. Core competencies are needed in climate and environment sciences, including key drivers of climate change; identifying particularly vulnerable regions and populations, and interventions to increase their resilience; synthesizing observations and projections of risks under a range of climate and socioeconomic development scenarios; and developing and deploying effective and efficient adaptation and mitigation interventions to protect and promote population health and health systems, using iterative risk management approaches. Incorporating these competences into pre-service education, lifelong learning, and mentoring will facilitate strengthening health organizations and institutions to implement climate change and health policies and programs that promote resilience and sustainability.

Statements and declarations:

Ethics approval and consent:

Not applicable

Availability of data and material:

Not applicable

Conflict of interests:

The authors declare that they have no conflict of interest

Authors contributions:

MAAA and KLE conceived the review; and contributed equally to writing and editing the final manuscript.

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