

# Climate change and preparedness for emerging diseases and medical treatments

**Prof Dr. Mohammad Abdollahi**, a renowned expert from TUMS and a distinguished Fellow and Council Member of the Islamic-World Academy of Sciences, delivered a comprehensive lecture on the above topic on 18th May 2024 in the Institute of Biochemistry and Biophysics, University of Tehran, instilling confidence in the academic members and students present.



## **The essence of his talks is as follows:**

Human activity's significant impact on climate change directly contributes to rising global temperatures and greenhouse gas emissions. This pattern worsens existing health conditions and markedly increases the likelihood of various human illnesses. As Prof. Dr. Mohammad Abdollahi explained, these diseases can be classified into main categories: infection, neurological, nephrological, and immunological.



As one of the main consequences of climate change, especially PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO, and O<sub>3</sub>, air pollutants may create or worsen respiratory disorders like asthma and cerebrovascular diseases such as dementia and Alzheimer's. Studies show a correlation between higher air pollution, such as NO<sub>2</sub> and PM<sub>2.5</sub> levels, and dementia. Global warming exacerbates dementia due to altered temperature homeostasis and Tau phosphorylation. Air pollution worsens Parkinson's disease by affecting cardiovascular function, increasing stroke risk, and causing respiratory injury. Parkinson's patients also struggle with thermoregulation during high heat or heat waves, experiencing excessive sweating and other symptoms.

**Climate** change can affect epilepsy risks by increasing seizure severity and frequency. Stress, fatigue, and sleep deprivation caused by climate change can harm epilepsy patients. Traumatic brain injuries can also be linked to seizure triggers. Additionally, Taenia solium infection is a significant risk factor for acquired epilepsy, and warmer environments and poor sanitation contribute to its spread. Climate change has a substantial impact on mental health, leading to trauma, mental illness, and distress, including eco-anxiety, eco-distress, and climate grief. Researchers are facing challenges in measuring the mental health burden, and mental health professionals require training and support to address this crisis. It is essential to recognize these situations and prognosis for the future using the Global Burden of Diseases studies.



**Climate** change has led to a longer and more intense pollen season. Air pollutants like ozone and volatile organic chemicals are linked to allergic respiratory diseases. Frequent thunderstorms can heighten pollen concentrations, increasing immunologic diseases due to a more extensive antigen. Pollutants can cause oxidative stress, damage respiratory mucosal cells, and release inflammatory mediators and bronchial hyperreactivity. Polluting particles can make it easier for allergens to enter the respiratory epithelium.

**Altered** conditions impact pathogens, vectors, hosts, and transmission. Temperature influences pathogen development, reproduction, and transmission rates. The following diseases will increase Tick-Borne Diseases (Lyme Disease), Malaria, Dengue Fever, Chikungunya, Zika Virus, Rocky Mountain Spotted Fever, Leishmaniasis, Food-Borne Diseases like Salmonella and Campylobacter, and Water-Borne Diseases like Cholera and Schistosomiasis.

**Climate** change and nephrological diseases from rising temperatures and extreme heat events impact the kidneys. Considerations for chronic kidney disease (CKD) and kidney stones are needed.

### **The effects of Climate change on Medications and Pharmaceuticals**

The impact of climate change on drug therapy is significant and multifaceted. Some of the effects include:

Extreme heat can reduce the effectiveness of certain medications, particularly for individuals with multiple health conditions. Dehydration resulting from high temperatures can also compromise drug efficacy. Additionally, heat exposure may alter the pharmacological properties of specific medications.

Climate change can exacerbate the opioid epidemic by complicating drug supply chains, leading to transportation challenges and potential quality issues. This, in turn, can result in higher costs and lower product quality for individuals using these drugs.

**Heat** can impact the effectiveness of certain medications, making it essential to be aware of potential interactions. Here are some specific examples:

**Antibiotics:** Tetracycline, doxycycline, ciprofloxacin, and ofloxacin can interfere with thermoregulation and reduce the body's ability to cool down.

**Antifungals:** **Griseofulvin** is another medication that may affect heat tolerance.

**Antihistamines:** Loratadine and cetirizine fall into this category. They can make the skin more sensitive to the sun, potentially causing a rash or sunburn.

**Statin Cholesterol Medications:** Simvastatin, atorvastatin, lovastatin, and pravastatin are statin drugs that may impact heat tolerance.

**Diabetes Medications:** Sulfonylureas like glipizide and glyburide can also affect the body's ability to handle heat.

Climate change has many intersections with pharmaceuticals. Some ways in which these two fields intersect are worth noting.

**1-Pharmaceutical drugs and chemicals** are the most significant contributors to greenhouse gas emissions within our healthcare system. These emissions result from various stages, including drug production, transportation, and waste management.

## **2. Antimicrobial Resistance (AMR):**

Evidence suggests that changes in the natural environment due to climate change increase the spread of infectious diseases, including drug-resistant infections. High usage of antimicrobial drugs across sectors exacerbates AMR, leading to "superbugs" resistant to antibiotics.

## **3- Heat-Related Risks and Medications:**

- Certain medications can increase the risk of hyperthermia (heat-related illness) and heat-related death. These include:
- Antipsychotics
- Major tranquilizers
- Antidepressants
- Antihistamines
- Drugs used to treat Parkinson's disease
- Some over-the-counter sleep medications.

## **4. Environmental Toxicities and Animal Health:**

- Pharmaceutical waste throughout the global supply chain can lead to environmental and animal toxicities. Antibiotic residues contribute to antimicrobial resistance and impact animal health.

### **5. Individual Considerations:**

It's essential to consider your local climate and how it might impact medication effectiveness. Extreme temperatures can change how certain drugs work, so it's crucial to stay informed and make adjustments as necessary. It's been emphasized that most harmful substances, including medications and metals, can lead to long-term toxicity through epigenetic mechanisms, causing diseases with unknown origins.



### **Conclusion:**

The medical community is working to address the health effects of climate change by improving health system resilience, reducing greenhouse gas emissions, and considering equity considerations. Extreme heat can affect the effectiveness of certain medications and worsen mental illness and emotional well-being. Pharmaceutical drugs and chemicals contribute to greenhouse gas emissions, increase drug-resistant infections, and cause environmental and animal toxicities.