

Introduction

Climate change, defined as a long-term change in the Earth's temperature and weather patterns,¹ will pose significant challenges to healthcare, including for patients with endocrine disorders and diseases. Many direct human health impacts of climate change are recognized, with our understanding of other direct and indirect effects still emerging. Increasing temperature is also expected to impact the incidence and progression of a variety of diseases, especially in vulnerable populations.

As the world's oldest and largest professional organization dedicated to the understanding of hormone systems and the care of patients with endocrine diseases, the Endocrine Society is committed to excellence in endocrine research and incorporation of scientific knowledge into patient care and public health. Our members from over 120 countries are concerned about the progression of climate change and the impact of rising temperature on the health and well-being of patients with endocrine diseases and disorders.

Given the known, anticipated, and potential impacts on endocrine health, the Endocrine Society's members recognize the need to help policymakers make informed decisions to protect endocrine health from the effects of climate change.

Background

Climate change, driven principally by greenhouse gas emissions such as carbon dioxide (CO₂) to the atmosphere via energy production/consumption and other activities, has already caused a significant increase in global average temperatures with further temperature increases expected if current trends related to energy and land use continue. Moreover, climate change is expected to affect the frequency and severity of extreme weather events^{2,7}. These changes will affect the practice of endocrinology and outcomes for patients with endocrine diseases; recent scientific research indicates that rising temperatures may have adverse consequences for patients with e.g., diabetes, obesity, and reproductive health issues. Emerging evidence also suggests that climate change may impact cardiovascular and bone health. For example, patients with diabetes may struggle with regulating body temperature in response to extreme temperatures due to impaired blood flow and perspiration³. Additionally, exposure to rising temperatures and particulate matter from air pollution are associated with a negative impact on ovarian reserve⁴.

The indirect effects of rising temperatures and extreme weather are also consequential. Patients may have difficulty accessing or storing insulin at appropriate temperatures following hurricanes and other natural disasters. Individuals will be exposed to particulate matter and other pollutants,

¹ United Nations. What is climate change? | United Nations. <https://www.un.org/en/climatechange/what-is-climate-change>

² IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, In press, doi:10.1017/9781009157896.

³ Kenny, G. P., Sigal, R. J., & McGinn, R. (2016). Body temperature regulation in diabetes. *Temperature*, 3(1), 119–145. <https://doi.org/10.1080/23328940.2015.1131506>

⁴ U.S. Global Change Research Program. (2016, April 4). The Impacts of climate change on Human health in the United States: a scientific assessment. <https://health2016.globalchange.gov/>

including endocrine disrupting chemicals (EDCs), from fossil fuel combustion and wildfire smoke⁵. These exposures are associated with a variety of adverse endocrine and other health effects, and the health impacts are amplified through precipitation followed by absorption into food supplies. Additionally, floods, hurricanes, drought, tornadoes, and other events driven by climate change can cause mental and physical stress, generating allostatic load⁶.

Global energy consumption is estimated to grow through 2050⁷; however, national and international policymaking bodies have begun to appreciate the environmental and public health threat posed by climate change⁸. A variety of solutions have been proposed including:

- reducing energy consumption and increasing efficiency
- transitioning to alternative, lower-carbon energy sources (e.g., solar, wind, geothermal) to meet global energy needs and reduce environmental impact
- developing decarbonization strategies and technologies to remove carbon dioxide (CO₂) from the atmosphere for burial underground

Recognizing that policies and strategies to address climate change may take years to reach full effect, adaptation strategies are also necessary to protect human health from the current effects of climate change.

Considerations

Coordinated, multi-sectoral action driven by the development of science-based policy and implementation of health-protective measures is necessary to address climate change. Regulatory action will also be needed to set standards and rules governing activities that drive climate change. In the United States, the Environmental Protection Agency (EPA) has taken action to regulate emission standards for vehicles⁹. Because agriculture contributes to as much as 10.5% of greenhouse gas emissions in the United States, the United States Department of Agriculture (USDA) works to mitigate climate change by providing incentives and financial assistance to improve agricultural practices and land use¹⁰. Collaborative action through a multi-agency agreement by these agencies and the US Food and Drug Administration (FDA) is aimed at reducing food loss and waste¹¹, which will minimize greenhouse gas emissions from the breakdown of food in landfills.

⁵ Woodruff, T. J. (2024). Health effects of Fossil Fuel–Derived endocrine Disruptors. *New England Journal of Medicine*, 390(10), 922–933. <https://doi.org/10.1056/nejmra2300476>

⁶ Crews, D. E., Kawa, N. C., Cohen, J. H., Ulmer, G. L., & Edes, A. N. (2019). Climate change, uncertainty and allostatic load. *Annals of Human Biology*, 46(1), 3–16. <https://doi.org/10.1080/03014460.2019.1584243>

⁷ U.S. Energy Information Administration - EIA - Independent Statistics and Analysis. <https://www.eia.gov/pressroom/releases/press542.php> (Accessed August 25, 2024.)

⁸ Congressional Research Service. (2021). U.S. Climate Change Policy. <https://crsreports.congress.gov/product/pdf/R/R46947>

⁹ Final rule: Multi-Pollutant emissions standards for model years 2027 and later Light-Duty and Medium-Duty vehicles | US EPA. (2024, December 4). US EPA. <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model>

¹⁰ Climate solutions. USDA. <https://www.usda.gov/climate-solutions> (Accessed December 5, 2024.)

¹¹ Final rule: Multi-Pollutant emissions standards for model years 2027 and later Light-Duty and Medium-Duty vehicles | US EPA. (2024, December 4). US EPA. <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model>

Actors outside of government also will have a role to play, including our own Society. The healthcare sector contributes an estimated 5% of greenhouse gas emissions¹² from the manufacturing and use of medical supplies to energy use for transportation and maintaining healthcare facilities. The academic research sector also contributes to climate change through the generation of waste (e.g., single-use labware) derived from fossil fuels¹³. Identifying opportunities to mitigate fossil fuel consumption and decrease greenhouse gas emissions in these sectors will be critical. Importantly, healthcare workers and scientists can contribute not only through decarbonization of the sectors in which they work, but also by building trust and engaging with patients and community members about the impacts of climate change on health.

We appreciate that the direct and indirect impacts of climate change disproportionately affect vulnerable populations such as children, the elderly, people who live in underserved or socioeconomically disadvantaged communities, or communities who already experience health disparities. Additionally, the effects of climate change will depend in some part on geography, for example residents in urban areas already experience higher exposure to air pollution, increasing the likelihood of developing chronic endocrine diseases. A person's work environment will also create different exposure scenarios and vulnerabilities, for example individuals employed in construction or farming who predominantly work outdoors may have disproportionate exposure to extreme temperatures while also engaging in strenuous physical activity. Special considerations should be made to protect these and other vulnerable populations from the effects of climate change.

Positions

The Endocrine Society is concerned about the severe health threats that climate change brings to patients with endocrine diseases and disorders. Without action from policy makers, federal agencies, researchers, clinicians, research and healthcare institutions, and other relevant stakeholders, endocrine health threats from increased temperature and natural disasters will become more severe as climate change continues unabated. Coordinated, multi-sectoral approaches will be necessary to reduce the drivers of climate change and protect human health.

To protect endocrine health from the effects of climate change, the Endocrine Society supports the following positions:

- Policymakers should enact laws and regulations to reduce greenhouse gas emissions, taking into account lifecycle impacts from the extraction of fossil fuels through production of materials derived from fossil fuels and waste management.
- All laws and regulations aimed at addressing climate change should consider the perspectives of and effects on vulnerable populations.
- Governments should support the development and adoption of alternative energy sources that decrease carbon emissions, providing that they do not cause further harm to human health or the environment.
- Government agencies and healthcare institutions should develop adaptation strategies, with particular consideration for patients with chronic health conditions and vulnerable populations, to mitigate the effects of extreme temperatures and severe weather events.

¹² Or, Z., & Seppänen, A. (2024). The role of the health sector in tackling climate change: A narrative review. *Health Policy*, 143, 105053. <https://doi.org/10.1016/j.healthpol.2024.105053>

¹³ Tay, A. (2024). Can science cure its addiction to plastic? *Nature*. <https://doi.org/10.1038/d41586-024-03010-3>

- Federal agencies should support research on the intersection of climate change and human health.
- Healthcare and research institutions should develop strategies to reduce their fossil fuel consumption, including energy and product (e.g., plastic) use.
- Professional societies should develop educational materials to discuss how climate change impacts the health of patients.