Changing the Climate of Respiratory Clinical Practice

Insights from the 2016 Climate and Health Assessment of the U.S. Global Change Research Program

John M. Balbus, Kimberly G. Thigpen Tart, Caroline H. Dilworth, and Linda S. Birnbaum

National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina

ORCID IDs: 0000-0003-3356-8332 (J.M.B.); 0000-0003-1633-1624 (K.G.T.T.); 0000-0002-4477-7722 (C.H.D.); 0000-0001-5429-5658 (L.S.B.).

A focus on the treatment of pulmonary diseases and critical illness ensures that American Thoracic Society (ATS) members are acutely aware of the effect of the quality of the air we breathe on our health and wellbeing. This awareness extends to the effects of climate change on air quality and the resulting impacts on patients. A recent survey of ATS members showed that nearly 9 out of 10 recognize that climate change is occurring. Roughly 2 out of 3 feel both that humans are causing climate change and that it is relevant to the care of their patients (1).

While ATS physicians may recognize the importance of climate change to the wellbeing of their patients, translating that recognition into clinical practice has been a challenge. A recent publication of the U.S. Global Change Research Program, "Impacts of Climate Change on Human Health in the United States: A Scientific Assessment" (hereafter referred to as "Climate Health Assessment"), offers ATS members a new resource to inform the care and guidance they provide to their patients (2). In this editorial, we highlight some of the assessment's findings of greatest clinical relevance to ATS members, as well as point to critical research questions that may be of particular interest.

As the report states, climate change exposures occur through many different routes and result in a wide variety of health outcomes. The assessment breaks new ground, first by providing quantitative estimates of exposures and risks related to heat, air pollution, and infectious agents, and second by examining issues like indoor

air quality, food safety and nutritional quality, and mental health impacts in more depth than previous assessments. In doing so, the assessment provides respiratory and critical care physicians with new insights into familiar issues like air pollution and pollen concentrations, but also into effects on patients and patient care from a changing climate that may not have been previously considered.

As ATS members know, ozone formation is more rapid under warmer atmospheric temperatures, leading to higher peak ozone concentrations for a given amount of precursors emitted. The new report estimates that, assuming emissions of precursor pollutants in 2030 to be at the same level as those in 2000, climate change effects on ozone concentrations will lead to tens of thousands more cases of illness and premature death annually in the United States alone (see Figure 1).

While the newly revised ozone 8-hour standard of 70 parts per billion provides greater regulatory protection to safeguard patients' health, climate change adds to communication challenges for physicians in explaining to patients why more days now exceed such standards and generate public health alerts they must heed to stay healthy. A critical related research topic is how extreme heat may interact with ozone and other air pollutants to cause harm to people's health. With more frequent extreme heat events predicted, a positive interaction could mean that physicians will need to advise even greater

avoidance of outdoor exposures for sensitive patients.

A number of other climate change impacts raise respiratory health concerns related to indoor air exposures. Increases in intensity of precipitation, and more frequent and severe incidents of flooding, contribute to greater risks of indoor mold contamination associated with asthma and allergies. Changes in typical summer and winter temperatures are likely to result in increases in the use of air conditioning and heating systems, respectively, resulting in increased infiltration of outdoor air pollutants into homes, schools, and other buildings. Because most people in the United States already spend the majority of their time indoors, changes in indoor concentrations of air pollutants could have a significant impact on health, particularly of children, the elderly, and others who may be more vulnerable to such exposures.

One of the most important findings of the report for clinicians is that many commonly prescribed medications can alter a patient's sensitivity and ability to cope with extreme heat. Findings from data on emergency room admissions during extreme heat events indicate that many medications that alter autonomic nervous system activity, including beta-blockers, antihistamines, and a variety of antipsychotic and anticholinergic drugs, impair the body's cooling mechanisms and increase risk of illness and death. Other medications, including angiotensin-converting enzyme inhibitors and angiotensin receptor blockers used to treat

(Accepted in final form July 8, 2016)

Correspondence and requests for reprints should be addressed to John M. Balbus, M.D., M.P.H., 31 Center Drive, Room B1C02, Bethesda, MD 20814. E-mail: John.balbus@nih.gov

Ann Am Thorac Soc Vol 13, No 8, pp 1202–1204, Aug 2016

Copyright © 2016 by the American Thoracic Society

DOI: 10.1513/AnnalsATS.201607-535ED

Internet address: www.atsjournals.org

Projected Changes in Temperature, Ozone, and Ozone-Related Premature Deaths in 2030

Figure 1. The air quality response to climate change can vary substantially by region across scenarios. Two downscaled global climate model projections using two greenhouse gas concentration pathways estimate increases in average daily maximum temperatures of 1.8°F to 7.2°F (1°C to 4°C) and increases of 1 to 5 parts per billion (ppb) in daily 8-hour maximum ozone in the year 2030 relative to the year 2000 throughout the continental United States. Unless reductions in ozone precursor emissions offset the influence of climate change, this “climate penalty” of increased ozone concentrations due to climate change would result in tens to thousands of additional ozone-related premature deaths per year, shown here as incidences per year by county. Reprinted by permission from Reference 2.

hypertension and congestive heart failure, decrease thirst and thereby can also increase a person’s sensitivity to heat stress. Additional research is needed to understand the contribution of medications to morbidity and mortality during periods of non-extreme heat. As understanding of this interaction improves, clinicians will need to consider this new information in dose adjustments and monitoring interventions to ensure their patients’ health.

The report also explores, in greater depth than any previous climate health assessment, aspects of mental health and wellbeing affected by climate change. Certain aspects are quite familiar to ATS members who understand implicitly how physical illnesses, especially respiratory diseases, can rob patients of easeful breathing and lead to anxiety and

depression. The report considers impacts on mental health of exacerbation of chronic illnesses by climate change, as well as post-traumatic stress disorder and other conditions associated with experiencing weather-related disasters. It also reviews the literature linking exposure to media and communications on the threat of climate change with increases in anxiety and stress disorders among some people. This suggests that clinicians caring for sensitive patients, especially children, should inform themselves about these potential stressors and ways to counsel patients who experience them. Further research in this area is warranted to better understand the interaction between physical and mental illness, and to identify effective interventions that can help to build a person’s overall health resilience.

Though the Climate and Health Assessment can enable ATS members to better understand how climate change may exacerbate respiratory and other illnesses, translating such understanding into everyday clinical practice remains a challenge. And while the assessment focuses on the health impacts of climate change, clinicians should be aware of other implications of climate change for health and health care not explicitly discussed in the report.

For example, research indicates that actions to limit greenhouse gases by lowering emissions of particulate matter and other harmful air pollutants can significantly reduce the burden of illness and death currently associated with air pollution. One study, supported by the National Institute of Environmental Health Sciences (NIEHS),

has estimated that millions of deaths could be averted each year if greenhouse gas emissions were strongly curtailed (3).

Another recent study estimated that roughly 10% of all greenhouse gas emissions in the United States are associated with activities of the health sector (4). Respiratory and critical care physicians can play an important role in advocating and leading health care

institutions toward more energy-efficient—and consequently healthier—facilities and operations. NIEHS and the Department of Health and Human Services have developed information on enhancing the sustainability and climate resilience of health care facilities (5).

The ATS and its members have long protected their patients by advocating for a healthier environment. The Climate and

Health Assessment provides a new tool for their arsenal. By educating themselves and their patients, as well as informing their practices and their profession about climate change and its implications for health, the ATS will continue to lead the charge for better lives. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

References

- 1 Sarfaty M, Bloodhart B, Ewart G, Thurston GD, Balmes JR, Guidotti TL, Maibach EW; EW. American Thoracic Society member survey on climate change and health. *Ann Am Thorac Soc* 2015;12:274–278.
- 2 Crimmins A, Balbus J, Gamble JL, Beard CB, Bell JE, Dodgen D, Eisen RJ, Fann N, Hawkins MD, Herring SC, *et al.*, editors. The impacts of climate change on human health in the United States: a scientific assessment. Washington, DC: U.S. Global Change Research Program; 2016.
- 3 West JJ, Smith SJ, Silva RA, Naik V, Zhang Y, Adelman Z, Fry MM, Anenberg S, Horowitz LW, Lamarque JF. Co-benefits of global greenhouse gas mitigation for future air quality and human health. *Nat Clim Chang* 2013;3:885–889.
- 4 Eckelman MJ, Sherman J. Environmental impacts of the U.S. health care system and effects on public health. *PLoS One* 2016;11:e0157014. 10.1371/journal.pone.0157014.
- 5 U.S. Federal Government. Sustainable and climate-resilient health care facilities toolkit [accessed 2016 Jul 8]. 2016. Available from: <https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector>