

# **The Impact of Global Climate Change on Public Health**

TESTIMONY

to the

**House Oversight and Reform Subcommittee on Environment**

April 30, 2019

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Chairman Rouda, subcommittee members,

Thank you for choosing the highly important but often neglected issue of the public health implications of global climate change (GCC) for the hearing today, and for giving me the opportunity to testify.

I am Bernard Goldstein, a physician and environmental health scientist who has been active in the field of environmental health since serving in the US Public Health Service Division of Air Pollution in the 1960s.

My experience includes serving as President Reagan's appointee as Asst. Administrator for Research and Development at EPA from 1983-85, and I note that EPA at that time received specific funding to consider the implications of what was then called global warming.

For my scientific activities, which include publication of over 200 papers on environmental health issues, I am an elected member of the National Academy of Medicine for whom I have chaired perhaps a dozen committees and served on many more. These include efforts related to sustainability, to US agriculture and to other topics for which GCC is a dominant factor.

I have also chaired committees for the World Health Organization and the United Nations Environmental Program. I am past president of the Society for Risk Analysis, and currently represent the Society of Toxicology on the Science Policy Committee of the Federation of American Societies of Experimental Biology.

My academic career includes serving as the Founding Director of the Environmental and Occupational Health Sciences Institute at Rutgers University, and as Dean of the University of Pittsburgh Graduate School of Public Health where I am now an emeritus professor of environmental and occupational health.

I will begin by using the paradigms of public health to discuss global climate change. To do that I will use an example that I struggle with, that of my weight. In public health and preventive medicine, we talk about primary, secondary and tertiary prevention.

Primary prevention is to avoid having the problem occur in the first place, one is never overweight; secondary prevention consists of early detection and change in life habits to avoid the adverse consequences – simply put, eat less and exercise more; tertiary prevention consists of lessening the consequences of the medical problem already caused by the preventable condition, such as

diabetes or a heart attack. The GCC use of the term mitigation is roughly equivalent to primary prevention and adaptation to secondary prevention.

### **The Primary Prevention of Global Climate Change**

We have missed our easiest opportunity for primary prevention. Global climate change is already occurring. The last five years are the hottest in global temperature on record for both air temperatures and ocean temperatures

(<https://www.nasa.gov/press-release/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa>; Cheng et al. 2018 Continues record global ocean warming. *Advances in Atmospheric Sciences* 36:249-253, 2019.)

But just like with obesity, we could get back to a healthy status, although for global climate change it will take decades. As a physician involved in the care of obese patients, I would not judge my anti-obesity efforts as successful after a month in which the patient only gained two pounds because it was less than the five pounds gained the previous month. It is the right direction but only slows the inevitable adverse consequences.

The most we can say about our present actions is that they have slightly slowed the inevitable and accumulating problems affecting our public health and our society. We need to accelerate our primary preventive activities; we need to do it as soon as possible; we need to take all routes to do so, including such uncomfortable ones as nuclear power; and we need to recognize that with only 5% of the world's population, the United States cannot do it alone.

Note that by using obesity as an example I have oversimplified the problem. Gaining weight just puts me at risk. Unnecessary release of greenhouse gases affects not just me, but every living thing on the planet, including my children and grandchildren, and the overall welfare of my country. Most importantly, it is different from obesity in that it is not just my actions that cause me adverse health and societal consequences – so I need to convince others to join with me.

### **The Public Health Impacts of Global Climate Change**

The health impacts of GCC are belatedly becoming increasingly documented. I say belatedly because in our democracy we cannot expect the public to endorse significant action based upon information expressed as parts per million of carbon dioxide or methane, or water temperature or even sea level rise.

While the US has led the world until recently in research funding on the underlying causes of GCC and its potential impact on ecosystems, we and others have done very little to answer the public's "so what?" questions. Public health impact is one of the major answers to the "so what" question.

It would take a textbook to describe all of the adverse public health implications of GCC. Let me start with a simple one. This is the time of year when local health departments rethink their approaches to preventing and tracking diarrheal diseases caused by food bought at outdoor fairs, which dot the summer countryside.

These are mostly caused by bacteria, and the rate of bacterial growth is directly dependent upon temperature. The hotter it is the more disease we will get and the worse will be the consequences. Bacteria also grow more quickly in warmer water, particularly in enclosed natural areas in which people swim.

We can expect more closure of food stands and beaches the hotter it gets. I chose this not because it is the biggest health problem that will be faced because of GCC – far from it. But it does illustrate how challenges to public health due to GCC are woven into the daily lives of our citizens and must be met by our public health system.

Unfortunately, our public health system is already highly stressed by a shortage of funding and trained personnel. Also, unfortunately, we have done a poor job of linking GCC to the more mundane issues pertinent to the public.

Heat itself is a cause of death. We can and will adapt to this threat by increasing air conditioning of homes and workplaces – but of course, this will require power, which if obtained from fossil fuels will just exacerbate the overall problem. Air pollution will increase, including ozone, which causes summertime asthma attacks and perhaps increased mortality.

As to the ozone mortality issue, I was looking forward to the judgment of the scientists on the Ozone Advisory Panel of EPA's Clean Air Scientific Advisory Committee. But EPA Administrator Wheeler has just peremptorily abolished that committee along with the Particulate Matter subcommittee for specious reasons

([https://www.washingtonpost.com/opinions/if-i-were-still-working-at-the-epa-i-would-resign/2019/04/02/88e6e2b8-519a-11e9-88a1-ed346f0ec94f\\_story.html?utm\\_term=.1306ab65af8a](https://www.washingtonpost.com/opinions/if-i-were-still-working-at-the-epa-i-would-resign/2019/04/02/88e6e2b8-519a-11e9-88a1-ed346f0ec94f_story.html?utm_term=.1306ab65af8a)).

Burning coal causes relatively high levels of particulates, so its replacement by lesser polluting fuels will cut particulate levels. Another source of particles likely related to GCC is forest fires.

Weather disasters cause death. GCC's impact includes increases in the number and strength of weather disasters, ranging from intensifying the force and reach of hurricane winds to mudslides burying homes and highways.

The extent of hot and dry conditions in mid-latitude US with intermittent heavy rains is occurring as was predicted earlier, with resultant wildfires, droughts, floods, stress on water resources, and major impacts on American agriculture, which will intensify.

Aflatoxin is just one example, again relatively minor compared to the major understood impacts of GCC on agriculture. But it again represents the major hidden costs to health and the economy of global climate change. Aflatoxin is a significant cause of liver cancer, which is a major cancer in tropical areas as compared to the US. Mitchell et al (Food Additives and Contaminants: Part A 33:540-550, 2016) have estimated the effect of GCC on increasing Midwestern corn aflatoxin levels and estimated the substantial costs of the need to destroy crops. They also point out the potential impact on the acceptability of US corn to our trading partners (US corn supplies over 50% of the world market and is a major contributor to our trade balance).

Particularly at risk to GCC are disadvantaged populations in our country and the rest of the world. In recent years, I have been involved in a program aimed at improving Federally Qualified Health Centers located in particularly hard-hit areas of our southern states affected by hurricanes and by the Deepwater Horizon Oil Spill. These Federally Qualified Health Centers provide health services to the poor. They will require more funding and more staff training to deal with recurrent natural and unnatural disasters.

There is also no question that the scientific community could do a better job of communicating in responding to the public's "so what" question. Risk communication is part of public health training and responsibility, and the public health community needs support to be more heavily involved in risk communication about GCC.

One of the most challenging aspects of public health practice is the need to act on threats with less than full certainty. For example, if one believes there is a 20% likelihood of the dam breaking, or the hurricane hitting a specific location, the appropriate public health recommendation is to evacuate the area at risk.

But if there is a 20% chance, that also means that there is an 80% chance it will not happen – so four out of five times the evacuation will have turned out to be unnecessary. In contrast, the evidence that global climate change is occurring and will intensify with increasing harm to public

health is overwhelming, well beyond the 90% certainty level. We should have acted more forcefully on this issue long ago.

Remember, this is not just a prediction for the future, it is the confirmation of past predictions strongly based on science. Let me give just one example of how the prediction has strengthened. I was in charge of science at EPA under President Reagan when EPA received funding for what then was known as global warming.

The underlying science governing the greenhouse effect, that more carbon dioxide and methane and other greenhouse gases would cause global climate change, had long been accepted by the scientific community. But there was some possibility that feedback loops might slow the process.

For example, it was unquestionable that hurricanes, which derive energy from the heat of the ocean, would be more powerful if the ocean were warmer, and that the devastation would be worse if sea levels were higher. It is also elementary science that warm air carries more water so that the rainfall component of hurricane flooding likely would be heavier.

But hurricanes hitting our Gulf states begin off of the shores of West Africa, and it was at least conceivable that desertification in West Africa, while not good for West Africans, would lead to more particles in the air and partially shield the ocean from sunlight.

Similarly, others thought that perhaps there would be more fog that would block the sun, or that melting of polar ice sheets would cool the ocean. The answer has been given by direct measurements of ocean water temperatures. They continue to rise. Warmer temperatures mean that there can be no question about GCC adding to the devastating effect of hurricanes hitting our coasts.

### **What Can Congress Do?**

Let me start with areas in which there is greater possibility of bipartisan support. These are mostly related to secondary prevention (adaptation). A very large percent of those who say that they do not believe that humans are primarily responsible for global climate change, now agree that GCC is occurring.

But they disagree about whether greenhouse gas emissions play a significant role in GCC and that primary prevention in the form of lesser greenhouse gas emissions will be effective. Note that we do not know how to prevent sun spots or similar putative mechanisms unrelated to human activities, however unlikely they may be as the major causes of GCC.

If one believes that GCC is occurring, whatever the cause, there should be no disagreement about secondary prevention, about adaptation. Unfortunately, this has not been the rule. For example, the Governors of both Texas and Florida, states which suffered heavily from major hurricanes in 2017, had previously claimed that GCC was occurring, but not necessarily due to human activities.

But they had failed their citizens by dismantling state programs aimed at protecting against the impacts of GCC. Whether primarily caused by human activities or not, if you believe that GCC is occurring, it is thoughtless not to be prepared for it. Perhaps this lesson has been learned and going forward it can be built upon.

There is also some history of success in bipartisan support for primary preventive approaches. One example was highlighted to me when rereading a report I coauthored on a conference on global climate change held by the National Institute of Environmental Health Sciences in 1989.

It is the identification of chlorofluorocarbons (CFCs) as being responsible for the ozone hole, and the resultant US actions and the Montreal Protocol. Success in greatly reducing CFC stratospheric levels also has implications to GCC in that they are greenhouse gases as well as ozone-eaters. We need to stop fooling around with our planet.

There is also bipartisan support for the long-overdue rebuilding of American infrastructure. Congress needs to consider Global Climate Change in this bill. As just one example, it would be foolhardy to rebuild on flood plains or in areas likely to be hit by weather disasters in ways that fail to take into account the heightened future vulnerabilities of our infrastructure due to GCC.

Congress also needs to confront the ticklish issue of whether states that negligently fail to adopt secondary preventive measures for GCC, such as raising sea barriers and changing building codes, should receive the same level of disaster relief as those who act preventively.

We accept that cigarette smokers pay higher health insurance rates, those prone to automobile accidents pay more for car insurance, and worker compensation rates are based on the risk level and the history of injuries at the specific workplace. As citizens, we willingly pay taxes to help out disaster victims. But how will we pay for the more insidious effects of GCC?

Another more recent example of bipartisan support for GCC activities occurred in the last Congress. There is perhaps no greater threat to public health than war – a threat potentially exacerbated by the consequences of more widespread nuclear armament.

The US military has long recognized the importance of global climate change to their operations, including the very distinct possibility that GCC will increase the likelihood of conflict. We hear relatively little about this issue, which usually is hidden under the more innocuous title of “threat intensification.” But it is very real. It is also a concern that has bipartisan support. An attempt to remove funding for the GCC program from the Defense Authorization Act was defeated because over forty Republican members of the House joined with Democrats to retain this program.

Wars often begin with migrations of people from productive to non-productive agricultural areas. Just one of many potential examples is to consider that over 90% of African agriculture is dependent on rainfall.

While total rainfall for Africa is not projected to change, its geographical and temporal pattern will change. The result will produce winners and losers, and a grave likelihood of conflicts beginning because of the movements of people to the more productive areas.

Some of our major international competitors will likely take advantage of such conflicts, causing pressures on the US that result in American military men and women serving in dangerous conditions overseas and leading to a continued battle in our homeland against those who believe it is justified to kill Americans.

Another crucial area for ensuring that we protect America for the long battle against global climate change has also received bipartisan support. This is STEM education. We need more Americans who understand science, who are able to think for themselves about the evidence, who will recognize that having the five hottest years on record is more meaningful than the quibbles raised by the cult of climate deniers.

And we need to have global climate change issues, including the “so what” implications, in the forefront of science teaching. STEM must extend to the everyday issues that we face as a nation – including GCC and other issues, such as vaccine denial, that affect the health of Americans.

We also must recognize the global climate change implications of such liberal anti-science fantasies as Genetically Modified Organisms (GMO) being inherently evil, when GMO could well provide answers to some of the GCC problems inherent in agriculture or food waste; or similar fantasies about the value of large-scale, free-range meat production without considering the land use implications to our planet of limited size with a growing population.



Congress must go beyond those issues for which there is already bipartisan support. Global climate change should be considered as a major threat to the United States worthy of both a comprehensive approach as well as being considered in every congressional action.

The comprehensive approach needed is one that considers public health and sustainability. To be truly comprehensive, it must include the potential value of nuclear power as an alternative fuel; recognize that increasing global population is a major driver of global climate change; and acknowledge the importance of science and technology to provide alternatives to our current wasteful approaches.

No bill before congress should be immune from at least having the question asked of what will this mean to global climate change. Whether you are considering agriculture or national parks, homeland security or transportation, the impact on GCC should be among the factors that are weighed in your deliberations.

I end with a lesson from an old fable. We all know about the three little pigs that were sent out into the world after a warning about a big bad wolf. One pig paid no attention, being too diverted by other issues, and took the easy way out by building a house of straw. We know the outcome.

The second little pig did pay some attention to the warning, but still frittered away useful time and built a house of wood, which only delayed the negative outcome.

The only survivor of the three was the pig who took the warning seriously and whose foresight and hard work prevented the damage.

That story describes secondary prevention, which I believe is what hard work in this Congress can accomplish. But we also need primary prevention. We need to kill the wolf before its huffing and puffing blows our house down.

I welcome responding to your questions.

Bernard D. Goldstein, MD