The US Health Care Sector's Carbon Footprint: Stomping or Treading Lightly?

See also Eckelman and Sherman, p. S120.

Climate change is a well-recognized and urgent threat to health.[1] The specific risks vary from place to place, and although nobody is exempt, vulnerable populations—the young, the old, the poor, the disenfranchised—are particularly threatened. Health professionals need to work both to limit climate change and to protect people from its impacts—strategies known as mitigation and adaptation, respectively.

A necessary step in controlling any hazard is characterizing it. Accordingly, researchers have analyzed many human activities—including electricity generation, transportation, manufacturing, and food production—to quantify their contribution to climate change. This is not an abstract academic exercise: quantifying emissions can highlight opportunities to shrink a carbon footprint by using less energy and by relying on clean, renewable energy sources.

It is possible to go a step further—estimating not only the greenhouse gas (GHG) emissions of particular activities but also the health burden these emissions impose. The article by Eckelman and Sherman in this issue of *AJPH* (p. S120) aims to do just that, focusing on the US health care sector. Building on their previous estimates of US health care–related GHG emissions,[2] the authors consider a range of emissions scenarios. To those emissions they apply published damage factors (quantitative relationships between GHG emissions and health outcomes) and calculate health impacts. This is daunting work.

HEALTH IMPACT PATHWAYS

What challenges did the authors confront? First, climate change threatens health through many pathways, and estimates of health impacts are highly sensitive to what pathways are considered (or omitted). Eckelman and Sherman considered five health impacts: malaria, floods, malnutrition, diarrhea, and cardiovascular disease. Consider just one of the pathways that was excluded: heat. Hot weather increases mortality, but heat also leads to less obvious outcomes, such as a higher risk of kidney disease, reduced sleep quality, increased violence, and reduced work capacity, not all of which are readily quantified in standard units (disability-adjusted life-years).

And that's just heat. What about the health consequences, direct and indirect, of severe weather? Degraded air quality? Prolonged allergy seasons? Expanded disease vector ranges? Reduced nutrient content in foods? Higher food prices? Climate-related armed conflict? Climate-related anxiety and depression? A full accounting would go well beyond the five outcomes included in Eckelman and Sherman's article, likely yielding far higher estimates of health impact.

QUANTITATIVE ASSUMPTIONS

Second, estimates of health impacts are sensitive to the quantitative assumptions used. These assumptions include both the predicted levels of GHG emissions over time—which reflect expected economic growth, technology change, and other factors—and the damage factors used. Both sets of assumptions range widely, reflecting quantitative uncertainties. For example, the authors report that published damage factors range over three orders of magnitude. However, the authors opted to use only one emission scenario and a correspondingly narrow range of damage factors. These decisions likely resulted in understating the uncertainty of their estimates.

Third, climate impacts vary geographically; ideally, health damage factors would also vary geographically, on the basis of robust local data. Fourth, climate impacts (and resulting health damage) will vary with the adaptive measures we implement—and predicting these measures is devilishly difficult.

LIFE CYCLE ASSESSMENT

A fifth challenge is posed by life cycle assessment. Suppose I want to quantify the carbon footprint, and the associated health consequences, of eating a hamburger. I need to consider proximate issues, such as the energy used to cook it. To be thorough, I also need to consider the fuel I burned driving to the market to buy the burger, the energy used in shipping the meat from slaughterhouse to market, and the embedded energy in the plastic packaging. More importantly, I need to consider the methane emitted from both ends of the cow before it became a burger. I need to consider the

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loss of forests that created the cropland that produced the feed that was fed to the cow, and the carbon footprint of the fertilizer applied to that cropland, and the carbon footprint of shipping the feed from field to cattle farm. The authors faced similar complexities in assigning GHG emissions to the health care sector. Life cycle assessment is conceptually compelling but almost endlessly complex.[3]

It is no wonder that the science of quantitatively attributing health impacts to climate change is still emerging.[4] The authors braved these challenges and arrived at a range of estimated global disability-adjusted life-years attributable to US health care sector GHG emissions: between 123 000 and 381 000 disability-adjusted life-years annually. For the reasons I have noted, one hesitates to put much stock in these numbers. Indeed, Eckelman and Sherman's article illustrates the complexity of applying risk analysis tools to wickedly complex public health problems. Many more such efforts are required before we understand the full implications of climate change.

THE BOTTOM LINE

However, the authors are almost certainly qualitatively correct. GHG emissions from the US health care sector, especially when considered over the life cycle of products and services, account for a nontrivial portion of the nation's overall GHG emissions and of the resulting global health impact.

This should matter greatly to health professionals. After all, our calling is to "do no harm" and to promote health and well-being. If providing health care imposes a heavy carbon footprint, and if that in turn threatens health, we need to know so we can reduce the burden. How do we act on these realities?

First, the health care sector needs to work to reduce its carbon footprint. Excellent examples are available, including major US health care systems such as Kaiser Permanente (https://share.kaiserpermanente.org/article/environmental-stewardship-overview) and the Gundersen Clinic (http://www.gundersenenvision.org/envision), as well as Britain's National Health Service (http://www.sduhealth.org.uk). Health professionals can find much useful information at Health Care without Harm (https://noharm-uscanada.org).

Second, what gets measured gets managed. There is great potential value in quantifying the carbon footprint and its health impact. As the science improves, we will be able to apply such measurement to specific health care practices to identify opportunities for improvement. Available examples include assessments of the carbon footprint of emergency medical services[5] and renal care[6] and of the benefits of telemedicine.[7] Ultimately, we should incorporate such assessments into broader cost–benefit analyses in health care. If a treatment is costly and yields marginal health benefit, its use might be debated. But if it is costly and yields marginal health benefits *and* carries a large carbon footprint, the argument against its use should gain force.

Third, the heavy carbon footprint of health care is in many ways a "first world problem." Health care systems in low- and middle-income countries struggle to provide basic services, often handicapped by inadequate access to energy and materials—ironically, while serving the very populations that are highly vulnerable to the health threats of climate change. We need to redouble our efforts to strengthen health care systems in low-resource settings, albeit in environmentally sustainable ways.

PREVENTION IS IMPERATIVE

Finally, prevention is imperative. Those in public health have always recognized that keeping people healthy is more humane, more practical, and more economical than treating them once they are sick. To these rationales for prevention we may add another: obviating the need for medical treatment by keeping people healthy reduces demand on the health care system and thereby reduces its carbon footprint. This reduces the health care sector's contribution to climate change, which itself helps to keep people healthy. AJPH

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