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David Wallace-Wells

Just How Many People Will Die From Climate Change?

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How deadly could climate change be? Last fall, in an idiosyncratic corner of the internet where I happen to spend a lot of time, an argument broke out about how to quantify and characterize the mortality impact of global warming. An activist named Roger Hallam — a founder of Extinction Rebellion who now helps lead the harder-

line group Just Stop Oil — had told the BBC that, if global temperatures reach two degrees Celsius above the preindustrial average, "mainly richer humans will be responsible for killing roughly one billion mainly poorer humans."

Hallam was quoting from a somewhat obscure paper, published by an engineer and a musicologist and focused less on climate impacts than on climate justice. The claim was quickly picked apart by experts: "An oft-quoted adage within the climate-modeler community is that garbage in equals garbage out," the climate advocate Mark Lynas wrote. "Getting the science right will strengthen rather than weaken the case for climate activism, both in the public mind and in court."

These are inarguable principles, and I don't think it's right to suggest that reaching two degrees of warming (which now looks very likely) will mean a billion people dead. Certainly that isn't scientific consensus. But it did make me wonder: How big would the number have to be to strike you as really big? And how small to seem acceptable?

I ask because many more rigorous estimates, while lower, are still quite shocking. Some calculations run easily into the tens of millions. If you include premature deaths from the air pollution produced by the burning of fossil fuels, you may well get estimates stretching into the hundreds of millions. These are all speculations, of course. Estimating climate mortality involves a huge range of calculations and projections, all of which are shrouded by large clouds of uncertainty — it's literally a climate-scale puzzle, with billions of human variables and many more political and environmental ones,

and settling on a number also requires separating the additional impact of warming from the ongoing mortality produced by social and environmental systems running continuously in the background today.

In a recent commentary for Nature Medicine, the Georgetown University biologist Colin Carlson used a decades-old formula to calculate that warming had already killed four million people globally since 2000 just from malnutrition, floods, diarrhea, malaria and cardiovascular disease. As Carlson notes, this means that, since the turn of the millennium, deaths from climate change have already exceeded those from all World Health Organization global-health emergencies other than Covid-19 combined. “Vanishingly few of these deaths will have been recognized by the victims’ families, or acknowledged by national governments, as the consequence of climate change,” he says.

Going forward, most estimates suggest the impact should grow along with global temperature. According to one 2014 projection by the W.H.O., climate change is most likely to cause 250,000 deaths annually from 2030 to 2050. According to research by the Climate Impact Lab, a moderate emissions trajectory, most likely leading to about two degrees of warming by the end of the century, would produce by that time about 40 million additional deaths.

Other work is even more striking. In a recent paper published in The Proceedings of the National Academy of Sciences, a team led by Drew Shindell of Duke University calculated that heat exposure alone is already killing more than 100,000 Indians and about 150,000 Chinese

each year. Not all of these deaths are attributable to warming — people died from heat exposure in the preindustrial past, of course — but the trends for all the examined countries were clear and concerning. By the end of the century, the team calculated, even in a low-emissions, low-warming scenario, annual mortality from heat exposure could reach 500,000 in India and 400,000 in China. This is just from heat, remember, and as Shindell points out, there are plenty of known climate impacts that are so hard to model that they are often simply not modeled. “There’s all kinds of stuff missing, and we still get big numbers,” Shindell says. “That should actually be scary.”

One thing that is almost always left out is air pollution. This is the research area for which Shindell is best known, and his most notorious finding on the subject is that simply burning the additional fossil fuel necessary to bring the planet from 1.5 degrees of warming up to two degrees would produce air pollution that would prematurely kill an estimated 153 million people.

If that number shocks you, consider that, according to the new paper, the present-day figures are more than two and a half million Chinese deaths each year, more than two million in India and about 200,000 annually in Pakistan, Bangladesh and the United States each. Even given rapid decarbonization, Shindell and his co-authors find that, by the end of the century, particulate pollution might be responsible for the annual premature deaths of four million Indians, two million Chinese, 800,000 Pakistanis, 500,000 Bangladeshis and 100,000 Americans.

Not all of the particulate pollution is a result of the burning of fossil fuels. (And even fossil-fuel pollution isn't, technically, a climate impact, though it is produced by the same activities that produce the lion's share of warming.) But over the course of the century, even in a low-emissions scenario, the total mortality impact of air pollution in just those five countries could reach half a billion.

Now, air pollution is probably not what you have in mind when you picture significant climate change; probably diarrhea and malnutrition aren't either, or the elevated risk of stroke or respiratory disease that comes, empirically, with higher temperatures. Instead, you're likely to imagine mass heat death or a world-historical storm. But that is a major lesson of the research on mortality and warming: that our climate fantasies can lead us astray, pulling us toward apocalyptic visions of environmental disaster rather than the simple but tragic accumulation of what today look like ordinary, if unfortunate, events — heat waves like those we've already lived through, infectious-disease outbreaks like those we've already read about, air-pollution problems like those we've mostly left behind in places like the United States. Climate scientists worry a lot about what they often call "discontinuities" or "nonlinearities." But the world is a very large place, and you don't need a major phase-shift in our experience of climate to produce a harrowing death toll. You just need things that kill people now to be made worse by warming.

Perversely, it's also the case that some of the increased death toll can be seen as a sign of more general social progress. Everyone dies of something, mortality researchers like to point out, and you get to die

of environmental causes only if you don't die earlier from something else: childbirth, say, or measles, or smoking. Over the course of the century, Shindell says, he expects the share of overall death attributable to environmental factors to grow — not just because those conditions will worsen but also because other measures of human health and well-being will improve globally. There may well be catastrophic surprises in store, as well — extreme disasters, underestimated impacts and rapidly passed tipping points. But the science of climate mortality today suggests a different experience, of even large-scale climate mortality softening into a grim sort of background noise, never quite deafening, no matter how loud it gets.

When, a few years ago, in the midst of a period of intense climate alarm, a few more hardheaded climate minds invoked instead the analogy of planetary "diabetes," they got a whiplash of criticism from activists in response. But while we can't really see the deep future with much clarity, disease may prove a more precise analogy than apocalypse. This is not to say that the size of the impact will be small. It's to say that imagining a climate future dominated by sudden ruptures and overwhelming catastrophes is perhaps to risk preparing for the wrong future — and remaining oblivious, in the meantime, to the death and suffering of the present.

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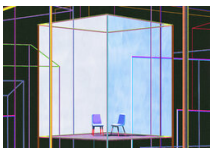

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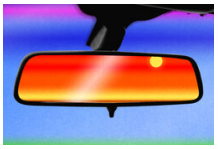

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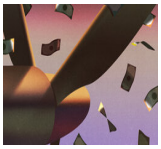

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