

# Global climate change and health: recent findings and future steps

R. Sari Kovats, Andrew Haines

**M**ore than 7 years after the Kyoto Protocol was adopted at a United Nations conference on climate change, this international and legally binding agreement to reduce greenhouse gas emissions worldwide comes into force on Feb. 16, having finally been ratified by a sufficient number of nations. Although the commitments are small, the Kyoto Protocol represents an important political step in translating the rhetoric about the need for sustainable development into action.

The evidence that the climate is changing and that these changes can be attributed to human activities has become stronger in recent years.<sup>1</sup> The land surface of Earth has warmed by about 0.6°C since the late 19th century, and Canada has experienced some of the most rapid warming. The range of current projections, which predict an increase in the global average surface temperature of 1.4°C to 5.8°C by the year 2100 (relative to the 1961–1990 average), takes into account scenarios in which fossil fuel use remains intensive, and those in which reliance on renewable energy sources is increased.<sup>1</sup>

Scientific understanding of the potential effects of climate change on ecosystems and human health has progressed since this journal published a review of the subject in 2000,<sup>2</sup> although there are still many uncertainties. Epidemiologic studies have further quantified relationships between weather and climate parameters and disease outcomes. There were early claims that a change in climate might already be causing changes in the geographic range and seasonality of some diseases, particularly those transmitted by mosquito vectors. However, there is as yet no convincing evidence that this is happening.<sup>3</sup> Robust studies require more than 20 years of good-quality epidemiologic data, with complete information on confounders (e.g., antimalarial drug resistance and population movement), and therefore the opportunities to study the impact of observed climate change on disease patterns are limited.

The effects of climate change go beyond the potential gradual spread of disease. Extreme events such as floods, droughts and heat waves are likely to increase under global warming and will challenge our ability to manage health risks and test the resilience of our infrastructures in many areas, including health service delivery. In 2003, Europe experienced summer temperatures that were unprecedented in the instrumental record. In France, over 14 000 more deaths were reported during the August heat wave than were typical for that

time of year, and the total for Europe was in the region of 20 000. In Paris, the number of deaths increased by 140% over usual figures, and the mortality rate after the heat wave was not lower than usual; this indicates that the deaths that occurred during the heat wave were not simply a displacement of expected deaths for that year and that a substantial loss of life-years occurred in that population.<sup>4</sup> The European heat wave clearly demonstrates that, even in wealthy countries, populations may be susceptible to extreme temperatures and we cannot assume that physiologic adaptation will be sufficient to avert the health effects of rising temperatures. Climate scientists have declared it “very likely” that human influence on the climate has at least doubled the risk of heat waves such as this.<sup>5</sup>

A prerequisite for the prevention of adverse health effects of extreme events is public knowledge about the nature of the risk. Although public awareness increases after a natural disaster, it is often short lived. There is a clear need to develop and evaluate effective public health interventions for extreme weather events, such as heat health warning systems to reduce the impact of heat waves. However, the implication of the French heat wave was that not only public health officers but also the entire infrastructure was unprepared for such extreme temperatures. It will take many decades to adapt housing to maintain comfortable indoor temperatures in the face of prolonged extreme outdoor temperatures, especially in ways that will not increase energy consumption.

The effects of dramatic weather events on human health are clear, but we must look beyond the easily quantified and extrapolated effects of climate change. In particular, qualitative research can help us develop strategies to adapt to a changing climate. Climate change is projected to have a significant impact on the distribution of sea ice and on ecosystems in the Arctic Circle. Inuit in Nunavik and Labrador have reported significant changes in their environment in the past 20–30 years that have affected their ability to travel at certain times of the year, to find and hunt certain types of food, and to gain access to potable water.<sup>6</sup>

The modest climate change that occurred between the mid 1970s and the year 2000 is estimated to have caused the annual loss of over 150 000 lives and 5 500 000 disability-adjusted life-years.<sup>7</sup> If we do not alter the human activities that are driving greenhouse gas emissions, the health burdens of climate change are likely to approximately double by 2020, mostly because of increased rates of diarrheal disease and malnutrition in low-income countries.

There have been recent efforts to link policies to adapt to climate change with those for international development.<sup>8</sup> Improving the capacity of populations to adapt to climate change should also reduce the burden of disease related to climate variability, including the El Niño phenomenon,<sup>9</sup> and should therefore yield benefits in the near term as well as in the more distant future. The commitments made by governments in signing the Kyoto Protocol are not sufficient to tackle climate change; however, they form a basis for future, more far-reaching, agreements to promote increases in energy efficiency and the use of renewable energy technologies. Such approaches also have the potential to benefit health in the near term by reducing deaths resulting from air pollution.<sup>10</sup> There will always be uncertainty about the magnitude of the adverse effects of climate change, and the burden of those effects will most probably fall predominantly on populations who have contributed little to greenhouse gas emissions, but these considerations should not prevent nations that have benefited most from access to low-cost fossil fuels from leading the way toward reduced dependence on them.

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