

# Direct Health Effects of Climate Change: an Overview

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## ABSTRACT

Allegations of harmful effects of climate warming on health are based on increased deaths observed in heat waves, especially in European cities. Year-round mortality data show, however, that death rates during cold weather are seven to nine times greater than during warm weather.

If the predictions of the climate modelers based on the hypothesis of anthropogenic warming were true, rising temperatures in the 21<sup>st</sup> century would save millions of lives and improve human health directly.

In fact, the predictions of the modelers have been proven wrong. Average surface and atmospheric temperatures have not warmed significantly, if at all. If natural phenomena cause significant cooling, longevity will decrease.

Responsible health professionals should prepare for the effects of climate change, no matter what the cause. Since warming would benefit health, there is no Clean Air Act mandate for the Environmental Protection agency to regulate CO<sub>2</sub> emissions, even if they did contribute to warming.

## Claimed Health Effects of Global Warming

Hypothetical predictions of anthropogenic global warming in the past decades have resulted in claims of harm to human health from malaria, infections, and other vector-borne diseases because of putative increased ranges of vectors from tropical into temperate zones. These claims of indirect harm to health have been refuted by Dr. Paul Reiter and others in multiple studies.<sup>1</sup>

Other claims of indirect harm to health emphasized deaths from floods, hurricanes, tornadoes, etc. that were supposedly caused by climate change. These claims have been decisively refuted by Indur

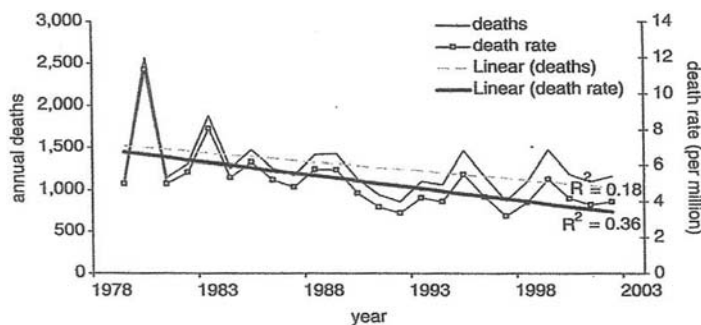


Figure 1. U.S. Deaths and Death Rates from Extreme Weather Events, after Goklany<sup>2</sup> (reprinted with permission)

Goklany.<sup>2,3</sup> Figure 1 (Goklany's Fig. 6.15<sup>2</sup>) shows the actual data on U.S. mortality from weather events and extreme temperature from 1979 to 2002, the period of maximum "global warming." It shows a strong decrease. Figure 2 (Goklany's Fig. 6.17<sup>2</sup>) also shows decreasing mortality due to climate-related disasters for the world, with a downward trend since 1930, continuing through the warming period from 1980–2000.

Direct effects of temperature on health, however, are the main focus of this article.

McMichael et al. predicted direct threats to health from warming in the prestigious British journal *Lancet* in 2006.<sup>4</sup> Figure 3 shows their model of the hypothetical dependence of mortality on daily temperature, for an idealized temperature range in 2005, compared to a potential temperature range in 2050, which shifts the distribution of daily temperatures to the right. Their assumption of the shape of the dependence leads to an expectation that the increase in heat-related deaths would be greater than the decrease of cold-related deaths. In fact, the actual data on mortality dependence on temperature are far different from the model.

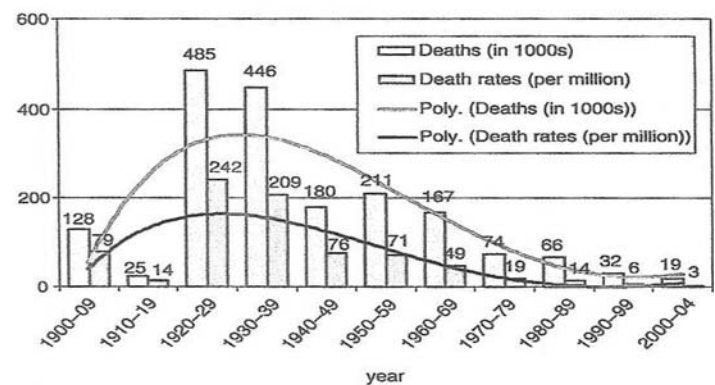


Figure 2. Global Deaths and Death Rates from Climate-Related Disasters, after Goklany<sup>2</sup> (reprinted with permission)

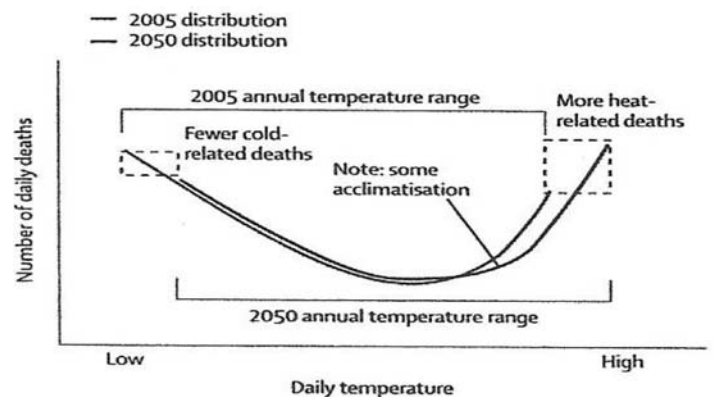
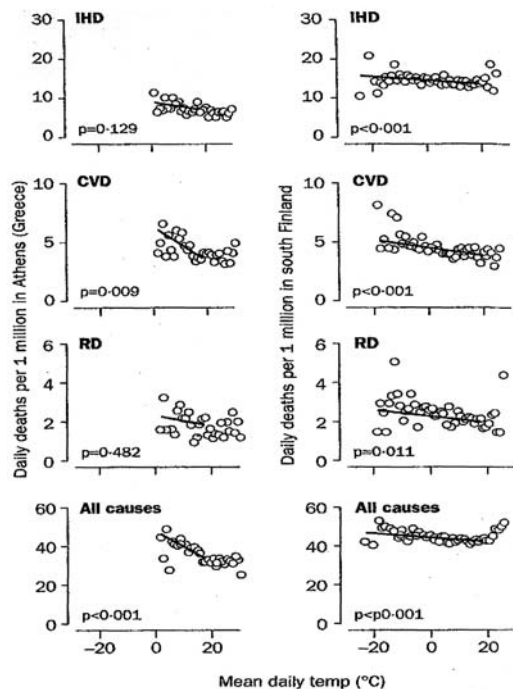


Figure 3. Predicted Effect of Increase in Average Temperature on Deaths, after McMichael et al.<sup>4</sup> (reprinted with permission)



**Figure 4.** European Mortality as a Function of Temperature, after the Eurowinter Group<sup>7</sup> (reprinted with permission)

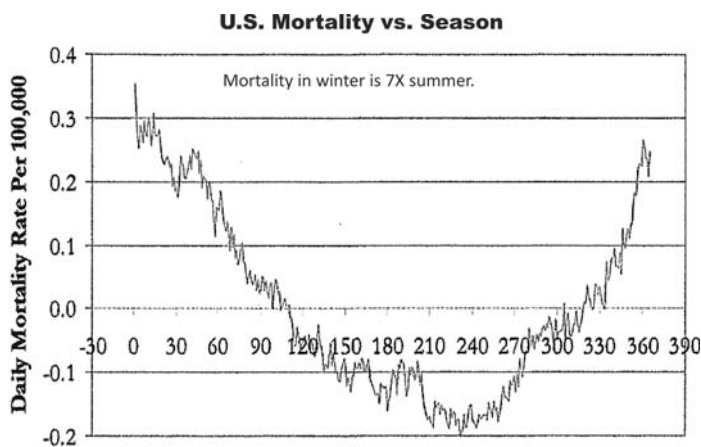
This should have been known to McMichael’s group, since it was published a decade earlier by Thomas G. Moore in 1995<sup>5</sup> and 1998.<sup>6</sup> Moore showed from U.S. Public Health Service data that mortality from cold in winter in the U.S. is *seven* times greater than summer mortality from heat waves and other effects.

Far-reaching and comprehensive research results on mortality and temperature in Europe were published by W. R. Keatinge and the Eurowinter Group in *Lancet* in 1997<sup>7</sup> and the *British Medical Journal* in 2000.<sup>8</sup> Figure 4 shows the actual data for mortality from ischemic heart disease (IHD), cerebrovascular disease (CVD), and respiratory disease (RD), as well as deaths from all causes, over the range of temperatures as far south as Athens, Greece, and as far north as Helsinki, Finland.

The mechanism of these phenomena is “hemoconcentration” or thickening of the blood in cold weather, and other cardiovascular reflexes at low temperatures. As summarized by Keatinge et al.,<sup>7</sup> this causes “sludging” of the bloodstream to the heart, brain, and lungs, resulting in increased heart attacks, strokes, pneumonia, and other adverse events.

In every data set, the death rate in the coldest weather is greater than the mortality in warmest weather. Furthermore, the slope of the dominant portion of the data is downward, i.e. fewer deaths as temperature increases. Thus, the model proposed by McMichael et al. must be rejected. If there is significant climate warming in the U.S. or Europe, death rates will *decline*, and people will live longer.

Recent data on climate and mortality in the U.S. have been published by Deschenes and Moretti in 2009.<sup>9</sup> Figure 5 plots mortality rate by the day of the year, i.e. day 1 is January 1, day 180 is June 30, and day 365 is December 31. This again shows the deep “trough” for mortality in summer versus winter months. A peak in June–September occurs in Australia and New Zealand. More recently Falagas et al.<sup>10</sup> published data on the U.S. compared to 10 other nations, showing similar seasonal variations in mortality, with much higher death rates in winter compared to summer.<sup>9</sup> This data, which includes much of the developed world, is shown in Figure 6.

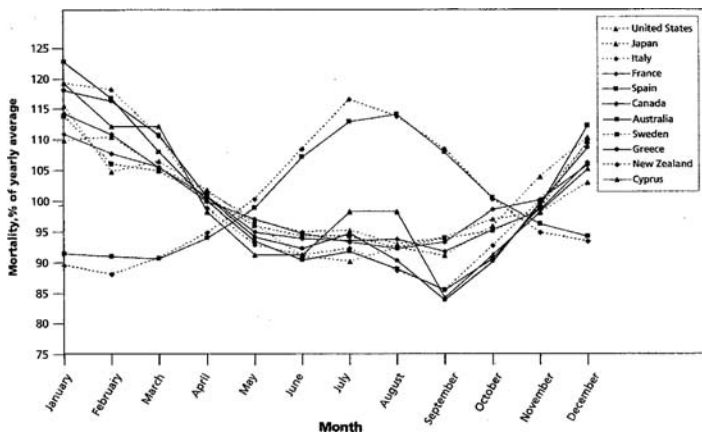


**Figure 5.** Average Daily All-Cause Mortality Rates, U.S., 1972–1988, after Deschenes and Moretti<sup>9</sup> (reprinted with permission)

### Calculations of Benefit

The slopes of the straight lines drawn by the Eurowinter Group are consistent with an estimated reduction of deaths by 1% to 2% for each degree Centigrade (°C) of warming. This would lead to an estimated decrease of 30,000 to 60,000 U.S. deaths per year per °C. This corresponds to a very significant public health *benefit* by comparison with 30,000 deaths per year from breast cancer, a similar number from prostate cancer, or 40,000 from motor vehicle accidents. If, as the UN Intergovernmental Panel on Climate Change (IPCC) has claimed, the temperature could rise by 4 °C by 2100, the net benefit in the US could be 6–12 million lives saved in this century. The calculation is based on 1% to 2% reduction of death rate multiplied by population and by average temperature increase (i.e. 2 °C, assuming a linear increase of 4 °C in 100 years).

Bjørn Lomborg, the distinguished Danish environmental economist (who accepts the anthropogenic hypothesis of global



**Figure 6.** Monthly Percentage Variation in Mortality Compared to Yearly Average, after Falagas<sup>10</sup> (reprinted with permission). Countries are listed in the legend according to the absolute number of deaths per day observed, in descending order.

warming) has estimated 170 million fewer deaths in the world by 2100.<sup>11</sup> This agrees with my calculation, multiplied by the ratio of the world population to that of the U.S.

Potential benefits of warming can extend beyond simple mortality rates. Consider that heat deaths often represent “displacement”; i.e. weakened people die a few days or weeks before prior expectation. Deaths due to cold, however, usually result in months to years of life lost.<sup>9</sup> Thus, the benefits to lifespan from warming in cold periods may be more than 10 times the lifespan lost in warm periods. Note also that deaths from warmth are preventable with improvements in air conditioning, architectural or natural shade, and public health measures, and are already falling in American cities.

### What about Severe Climate Warming ?

Many cities have already warmed by 2 °C to 4 °C, much more than global climate fluctuations, owing to the “urban heat island” effect. Mortality has *not* increased, because of better buildings, air conditioning, medical care, and other factors. Adaptation to climate change is not only possible, but already working. Large populations have already migrated south in the U.S. (and Europe) with average temperature exposures increased by more than 5 °C, resulting in improved health and life expectancy.

### Health Effects of Recent Climate Cooling

Although popular media have not recognized it, the actual measurements of temperature averages, in the lower atmosphere (troposphere) and at the earth’s surface, show *cooling* since 1998. The magnitude of the cooling is about 0.2 °C to 0.3 °C compared to the global average since 1979, and as much as 0.5 °C compared to the “central projections” of the UN IPCC. As previously shown, death rates *increase* by about 1% to 2% per °C for cooling, for the general population. The elderly are most sensitive to colder weather.<sup>8</sup> Mortality increases by 3% per °C cooling in Europe, for example, for populations age 65–74. Figure 7 shows daily mortality versus mean daily temperature for regions with the coldest, median, and warmest summer temperatures (May through August). For an average cooling of 1 °C, this data indicates 200,000 increased deaths per year in the U.S. and Europe, and an incalculable additional amount of sickness and hospitalization. This hazard to public health is of the same magnitude as the total number of deaths from breast and prostate cancer combined.

In the past 5 years, it has been shown that natural causes of climate change are of potentially greater magnitude than anthropogenic causation. These include fluctuations in cloud cover as affected by cosmic ray changes caused by variation in solar magnetic fields. This has been explained by Svensmark and Calder in *The Chilling Stars*<sup>12</sup> and by Svensmark et al. in a 2009 publication.<sup>13</sup>

More recently, McLean et al. have shown that oceanic fluctuations such as the Southern Oscillation, which is responsible

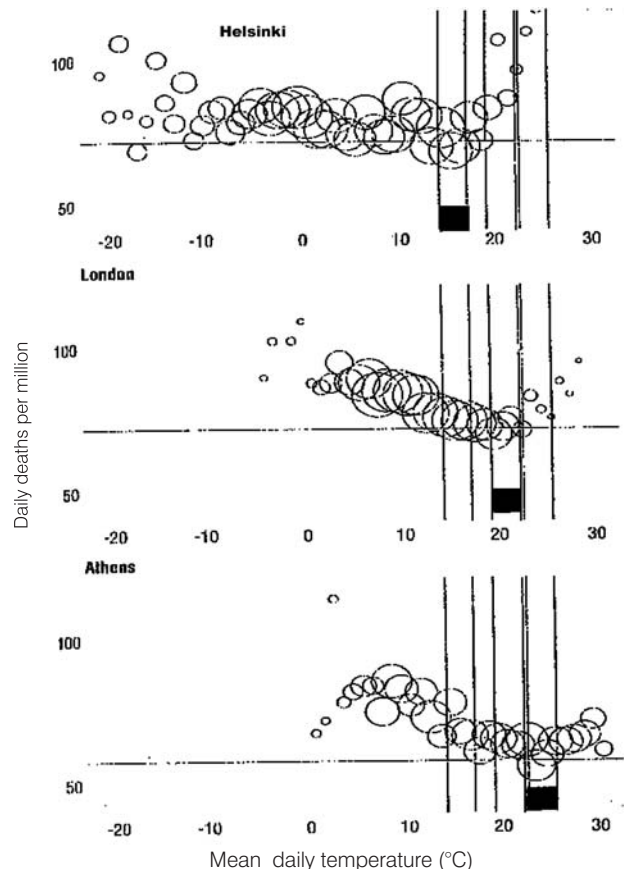
for El Niño and other phenomena, “exercise a consistently dominant influence on mean global temperature...except when equatorial volcanism causes ad hoc cooling.” Further, they write, “Mean global tropospheric temperature has for the last 50 years fallen and risen in close accord with the Southern Oscillation Index of 5–7 months earlier.”<sup>14</sup>

The most recent cooling is correlated with the “quiet sun,” which is showing the least sunspot activity (and magnetic field strength) in the past 50 years. Note that 2008 and 2009 had fewer sunspots than any other years in five decades.<sup>15</sup> Solar activity is chronicled at [www.spaceweather.com](http://www.spaceweather.com).

Given that there is little that can be done to modify these natural phenomena, there is little we can do to prevent climate change. Even those who believe the anthropogenic hypothesis of global warming understand that proposed catastrophically expensive programs of CO<sub>2</sub> control will not influence global temperature by more than a fraction of a degree.

### EPA Regulation of CO<sub>2</sub>

In December 2009, the Environmental Protection Agency published its “Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act.” The proposal is to control CO<sub>2</sub> emissions, because of the finding of



**Figure 7.** Mortality of Persons Age 65-74 in Relation to Daily Mean Temperatures, after Keatinge et al.<sup>8</sup> (reprinted with permission). The black squares show the 3 °C band of minimum mortality for the region, and the horizontal lines show mortality in this band.

potential harm to human health from climate warming. Their data referees accepted deaths from heat waves in summer, but rejected decreased deaths in winter months because deaths in winter are characterized as strokes, heart attacks, and pneumonia, and not attributed to cold on death certificates. These benefits of warming are real, as has been extensively documented. Since warming would be an overall benefit to health and longevity in the U.S., there is no mandate for the regulation of CO<sub>2</sub> under the Clean Air Act.

### Conclusion

If U.S. and world leaders are serious about protecting public health from climate change, they should be discussing methods of adaptation and alleviation of effects of cooling (or warming), not economy-killing schemes of carbon taxes or CO<sub>2</sub> emission limits. In the absence of politically responsible action in these areas, physicians and physicians' organizations should consider taking the lead in educating the public.

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