Changes in air pollution-related mortality in the United States since 1990.

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Abstract:

Concentrations of ozone and fine particulate matter (PM$_{2.5}$) have decreased across most of the United States since 1990, as a result of air pollution standards, regulations, and shifts in energy resources and technologies. Annual average PM$_{2.5}$, averaged over EPA monitoring sites, decreased by 42% from 2000 to 2016, and the maximum daily 8-hr average ozone decreased by 22% from 1990 to 2016. Here we use three different concentration datasets to estimate air pollution-related deaths annually from 1990 to 2016. These datasets include a self-consistent simulation of air quality using CMAQ (1990-2010), the North American Chemical Reanalysis project that used CMAQ and assimilation of satellite and surface observations (2007-2016), and a combination of satellite AOD observations with surface observations and a model for PM$_{2.5}$ for North America (1999-2011). We also use annual county-level population and baseline mortality data from the Centers for Disease Control. We attribute the overall mortality trends to changes in three factors: concentration, population, and baseline mortality rates. We find that PM$_{2.5}$-related deaths have decreased significantly since 1990, despite population growth. Ozone-related deaths have remained roughly constant, but would have likely increased without ozone concentration reductions due to increases in deaths from respiratory diseases. Inter-annual variability is greater for ozone-related than PM$_{2.5}$-related deaths, driven by the greater variability in concentration. Reductions in air pollutant concentrations in the US have very likely decreased the burden of air pollution on premature mortality.