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Global and regional trends in particulate air quality and attributable health burden over the past 50 years

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Long-term exposure to ambient particulate matter (PM2.5, mass of particles with an aerodynamic dry diameter of < 2.5 μm) is associated with premature mortality. Previous studies have focussed on present day or future attributable health burdens. Few studies have estimated changes in PM2.5 concentrations and associated health burdens over the last few decades, a period where air quality has changed rapidly. Here we used the HadGEM3-UKCA coupled chemistry-climate model, integrated exposure-response relationships, demographic data and background disease prevalence to provide the first estimate of the changes in global and regional health burdens attributable to ambient PM2.5 exposure over the period 1960 to 2009. Over this period, simulated global mean population-weighted PM2.5 increased by 37% to 48% dominated by large increases over China (53% to 66%) and India (70% to 116%). We find that global attributable mortality due to long-term PM2.5 exposure increased by 124% to 147% between 1960 and 2009, substantially more than the increase in PM2.5 concentrations over the same period. This increase is dominated by India and China and is driven by population growth and an ageing population combined with increased PM2.5 concentrations. Our results show that PM2.5 concentrations in China and India will need to be reduced substantially to slow the increasing attributable health burdens that are being driven by population growth and an older population.