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Assessing the health impacts of short-term exposure to ground-level ozone in the UK from 2001-2014

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Evidence from numerous epidemiological studies supports the association between daily concentrations of ground-level ozone and a range of adverse health effects ranging from exacerbation of existing respiratory conditions to increased risk of hospitalization and death. Exposure to ground-level ozone is of concern to the public health community, since northern hemispheric background concentrations have been increasing in recent years, and are currently at levels considered to be detrimental to human health across Europe. In addition, ozone is a pollutant whose concentration is driven by atmospheric conditions as well as emissions of precursor gases and land cover, which suggests that levels of ozone are likely to be affected by climate change.

Health burdens from short-term exposure to ozone can be calculated by applying coefficients which relate daily ozone concentrations to adverse health effects. Previous work quantified mortality and morbidity rates from daily exposure to ground-level ozone nationally, and by UK region, for a single year (2003) and for future emissions scenarios in 2030. This study showed that concentrations of ground-level ozone in the UK are highly related to emissions of precursor gases, and vary greatly across the UK, with the largest contrasts being between urban and rural areas. A smaller effect, whereby simulated annual mean ground-level ozone increased by up to 2 ppbv over the UK based on a modelled 5oC temperature increase, was also found.

In 2015, the Committee on the Medical Effects of Air Pollutants (COMEAP) published a report which re-examined the health effects of ground-level ozone, and recommended the use of updated concentration-response coefficients for short-term exposure to ozone and mortality, as well as morbidity (respiratory and cardiovascular hospital admissions) based on meta-analyses. We applied these updated coefficients to an extended set of ozone concentrations calculated with the EMEP4UK atmospheric chemistry transport model, at a horizontal resolution of 5 km x 5 km for the UK. The modelled concentrations cover a considerable time period (from 2001 to 2014), rather than a single year, which enables the investigation of inter-annual variability and trends resulting from changes in emissions and meteorological conditions. The health impact assessment of mortality and morbidity for the UK was conducted by country and region, examined annual trends in ozone concentrations over the studied period, and investigated inter-annual variability using the most up to date concentration-response coefficients.