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Effects of air pollution on neurodegenerative diseases (Alzheimer's disease and vascular dementia) over Europe for present and future climate change scenarios

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Air pollution has a serious impact on health and this problem will be aggravated under the action of climate change. This climate penalty can play an important role when trying to assess future impacts of air pollution on several pathologies. Among these diseases, the scientific literature is scarce when referring to the influence of atmospheric pollutants on neurodegenerative diseases for future climate change scenarios. Under this framework, this contribution evaluates the incidence of dementia (Alzheimer's disease and vascular dementia) occurring in Europe due to exposure of air pollution (essentially NO_2 and PM2.5) for the present climatic period (1991-2010) and for a future climate change scenario (RCP8.5, 2031-2050). The GEMM methodology has been applied to climatic air pollution simulations using the chemistry/climate regional model WRF-Chem. Present population data were obtained from NASA's Center for Socioeconomic Data and Applications (SEDAC); while future population projections for the year 2050 were derived from the United Nations (UN) Department of Economic and Social Affairs-Population Dynamics.

Overall, the estimated incidence of Alzheimer's disease and vascular dementia associated to air pollution over Europe is 498,000 [95% confidence interval (95% CI) 348,600-647,400] and 314,000 (95% CI 257,500-401,900) new cases per year, respectively. An important increase in the future incidence is projected (around 72% for both types of dementia) when considering the effect of climate change together with the foreseen changes in the dynamics of population (expected aging of European population). The climate penalty has a limited effect on the total changes of Alzheimer's disease and vascular dementia (approx. 0.5%), since the large increase in new annual cases over southern Europe is offset by the decrease of the incidence associated to these pathologies over more northern countries, favored by an improvement of air pollution caused by the projected enhancement of rainfall.