



Quantifying the health effects of climate change upon pollen allergy: a combined cohort and modelling study

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Abstract

Background Globally, pollen allergy is a major public health problem, but a fundamental knowledge gap exists on the effect of climate change on pollen allergies. The annual herbaceous plant common ragweed (*Ambrosia artemisiifolia*) is highly invasive; it thrives on disturbed land, with each plant producing up to 62 000 seeds per year. Ragweed is particularly harmful for public health because each plant produces up to 1 billion grains per year. Our study aims to quantify the consequences of climate change on pollen allergy in people in Europe.

Methods We used a process-based model to estimate the change in the distribution of ragweed plants across Europe under climate change. A second model simulated plant invasion, pollen production, pollen release, and the atmospheric distribution of pollen to estimate current and future ragweed pollen levels. These findings were translated into two different measures of health burden: pollen sensitisation rates and changes in allergy symptoms. Changes in pollen sensitisation rates were estimated using a dose–response curve generated from a systematic review and from current and future population data across Europe (baseline 1986–2005, future 2041–60). Changes in allergy symptoms were modelled by obtaining dose-response relationships between pollen and symptoms from a cohort of 85 sensitised individuals in Croatia. These relationships were then applied to future pollen loads, which considered two different regional climate and pollen models, two greenhouse gas emissions scenarios (representative concentration pathways 4.5 and 8.5), and three different plant invasion scenarios. A second set of health effects (sensitisation rates and allergy symptoms) were obtained from future pollen models.

Findings We estimated that sensitisation to ragweed will more than double in Europe, from a baseline estimate of 33 million people (1986–2005) to 77 million by 2041–60. According to our projections, sensitisation will increase in countries with an existing ragweed problem (eg, by 27% in Hungary, 26% in Croatia, and 21% in Serbia), but the greatest proportional increases will occur where sensitisation is uncommon (an increase of 235% in Germany, 292% in Poland, and 231% in France). Higher pollen concentrations and a longer pollen season might also increase the severity of symptoms.

Interpretation Our quantitative estimates indicate that ragweed pollen allergy will become a common health problem across Europe, expanding into areas where it is currently uncommon. Control of ragweed spread might be an important adaptation strategy in response to climate change.

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Contributors

IL was principal investigator on the project, NJ did most of the analysis on sensitisation rates and FC and NJ jointly analysed the cohort study.

Declaration of interests

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