Universität Basel

Research Project

Effects of airborne pollen on cardiorespiratory health and allergic symptoms

Third-party funded project

Project title Effects of airborne pollen on cardiorespiratory health and allergic symptoms
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As the duration and intensity of the pollen season increase due to climate change, allergies to airborne pollen are also increasingly common in Europe. Yet, it is not well recognized that high pollen concentrations may increase respiratory and cardiovascular events, leading to mortality and excess hospitalizations. Moreover, combined exposure to pollen, air pollution and weather conditions could have synergistic effects, that alter the allergenicity of pollen - a research area which has been hardly explored.AimI aim to investigate how short-term exposure to pollen is related to mortality, hospitalization and allergic symptoms, both on its own and synergistically with air pollution and weather. Moreover, in light of increasing allergy prevalence, I aim to study how the relationship between pollen and health has developed over the study period, and which subpopulations might be most at risk. MethodsI will develop spatiotemporal exposure models of pollen for the years 2003-2022 based on a network of 14 pollen measurements stations in Switzerland. These maps will allow me to attribute individual exposure to pollen, air pollution and weather by location and by day, and will be used as the exposure metric for the health analyses. For the health endpoints, I will use large, real-world datasets without selection bias: individual cause-specific mortality is available from the Swiss National Cohort (2003-2018) and hospital admissions from the hospital admission database of the Federal Office of Statistics. Taking advantage of the efficient case-crossover study design, I will investigate the population effects of pollen on daily respiratory and cardiovascular mortality and hospitalization, accounting for air pollution and weather as time-varying confounders. I will investigate: trends in how pollen affected each outcome over the last 16-year study period; identify potential interactions with air pollution or weather; and explore the effect modifiers age, sex and urban/rural residence.To explore individual sensitivity, I will study repeated accounts of self-reported symptoms from the “e-symptoms” app, launched in 2012 by aha! Swiss Allergy Centre and CK-care. Using random forests machine learning techniques, I will analyze the user base’s symptom severity reports in relation to actual prevalent pollen, air pollution and weather triggers, and the diagnosed allergies they indicate. The trained model will allow me to predict personalized symptom severity for future days based on pollen forecasts and provide personalized prevention recommendations and thus enhance quality of life for the allergic population. Ultimately, as a single user contributes more symptom reports, I will be able to gradually improve their personalized symptom prediction based on their personal sensitivity, which is derived from their previous reports. Data collection is already ongoing, and will continue throughout the study until 2022.SignificanceThis highly innovative project utilizes available nationwide health datasets and a systematic smartphone-based data collection method, to better understand the role of pollen in self-reported symptoms, respiratory and cardiovascular diseases at both personalized and population levels. This study will add substantially to the small body of scientific

evidence that airborne pollen is adversely related to severe health effects such as mortality and hospitalizations. The project will prevent and reduce health effects due to pollen, which constitute a large burden on health and economy. This is particularly relevant in light of the increasing prevalence of allergies and the earlier start to and lengthening of the pollen season.

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