

NEWS AND COMMENTARIES

Personalized pollen-related symptom-forecast information services for allergic rhinitis patients in Europe

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Background

The occurrence of IgE-mediated allergies is constantly increasing, and pollen-related allergies already have a considerable socioeconomic impact. Avoiding allergens may be the best preventive measure, but this proves to be impossible to achieve. The percentage of sufferers is considerable, especially among the younger population: a recently published study demonstrates that between 10% and 20% of adolescents aged 13–14 years suffer from severe allergic rhinitis (1). Monitoring atmospheric concentrations of pollen provides information about temporal and spatial variations during the flowering periods of allergenic plants, which is the basis for pollen information (forecasting) services.

Aeroallergen concentrations have a direct impact on the quality of life of those suffering from allergies. A common assumption is that a certain level of pollen concentration in the air has to be reached in order to evoke symptoms in pollen allergy sufferers (2). However, this threshold concept faces difficulties due to the dynamic, exposure-dependent, and personalized character of such a level. Furthermore, the severity of symptoms is not directly proportional to the pollen count, due to biogenic (e.g., the amount of allergen carried per grain), as well as to individual (e.g., atopy status and medication) and environmental (e.g., air quality) factors (3). For this reason, a personalized forecast of symptoms may be better appreciated than the prediction of pollen concentrations. Development of personalized symptom forecasting requires detailed information from the hay fever sufferers on their symptoms and their severity, on anti-allergic medications

being used, as well as environmental information, in order to evaluate their exposure to pollen grains and chemical and aerosol pollutants.

New developments

The data necessary for the development of personalized symptom-forecasting information services are being collected for the first time in Europe with the aid of (i) the Patient's Hay-fever Diary (PHD) system (4–6), (ii) information on actual pollen concentrations from around Europe accumulated in the European Aeroallergen Network (EAN) database (ean.polleninfo.eu), (iii) Europe-wide air quality and pollen concentration forecasting (currently available for birch, grass, olive and ragweed) based on SILAM modeling system ['System for Integrated modeling of Atmospheric composition' (7, 8)], and (iv) application of computational intelligence methods (CIMs), to allow for joint analysis of these data to fulfill the needs of personalized symptom forecasting (9, 10).

The PHD has been developed in cooperation with the Austrian Pollen Information Service, the Stiftung Deutscher Polleninformationsdienst, the Réseau National de Surveillance Aérobiologique in France, the ORL Department at the Medical University of Vienna and the Allergy-Centre-Charité in Berlin, and is operated by the Medical University of Vienna. This new system has now been improved with a new interface that allows users to be directly connected and exchange information with the PHD via mobile internet devices (smartphones, tablets, etc. www.pollendiary.com). The services available to date include the history of all personal symptoms of the PHD users and

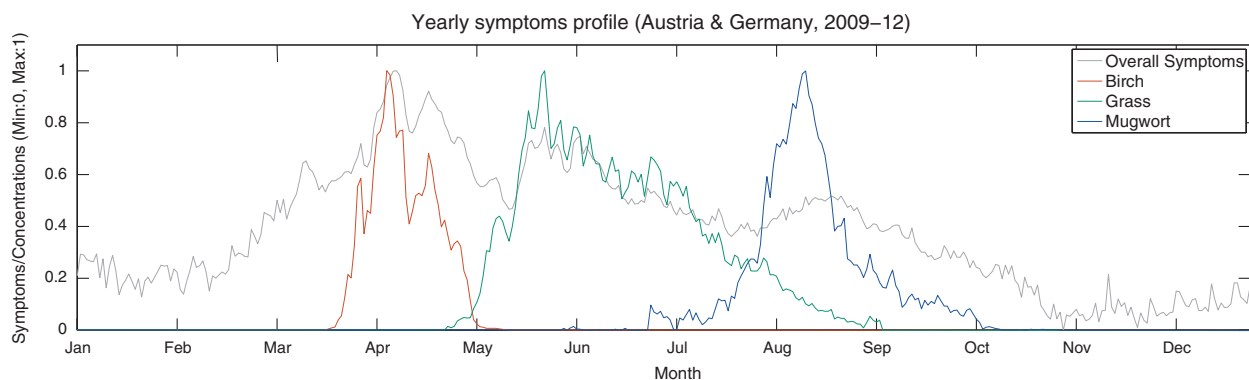


Figure 1 Occurrence and severity of overall symptoms for 8586 hay fever sufferers in Austria and Germany in 2009–2012 during birch, grass, and mugwort seasons, according to PHD and EAN

data. Pollen data represent mean pollen counts per day. All data are normalized (between 0 and 1).

graphs that combine their symptoms with the relevant pollen count data. A graph on overall symptoms and pollen-level information collected via the PHD and the EAN is presented in Fig. 1. These services will be complemented by two new features: sensitivity categorization and symptoms forecasting. These features will be offered in a personalized scheme based on symptom history and local pollen concentration levels. This will provide up-to-date relevant information and health-related warnings to each individual user.

A new addition to PHD services for patients will also be the threshold identification for the development of general (overall), nasal, and eye symptoms. The relevant analysis has already begun (10), while related literature has also started to appear (11). A further envisaged PHD service would be defined threshold levels per category of patients with geographical and pollen taxa specification.

Information on pollen concentrations is, for the first time, made available from two complementary sources: daily – and in some cases bi-hourly – observations of the EAN in 39 countries – 716 sites, of which approximately 350 are active – all over Europe, and forecasts of air quality and pollen concentrations via the SILAM model (<http://silam.fmi.fi>). In addition, day-to-day reports on symptom types and their scores which have been contributed by the PHD users have created a unique database. These datasets are being linked together to create an entirely new service of individual symptoms forecasting within the PHD. CIMs are employed for the analysis of the aforementioned datasets and for the development of symptom-forecasting models, which will be made available on an operational basis (10).

This broad array of information services is currently under development and will be provided by a personalized delivery scheme, and is planned to make it available for all PHD contributors from March 2013 onwards. The information service based on sensitivity categorization on an individual basis will be made available for all PHD users. The threshold identification and the personalized symptoms forecast are planned to be made available in the first instance for Austria and Germany, who have the largest number of PHD entries. This will then be further developed for other countries in Europe.

Conclusions

The development of a pollen-related, personalized sensitivity categorization, threshold identification, and symptom-

forecasting information service is expected to improve disease management from the patients' as well as from the physicians' point of view. We believe that the early – that is, one or 2 days ahead – forecast of symptoms and their severity combined with detailed sensitivity and threshold identification can lead to a new paradigm of the way pollen allergy is recognized and treated. Patients therefore receive better advice and long-term disease management guidelines, including immunotherapy. In addition, this may have a positive day-to-day influence on the everyday operations of healthcare providers due to the availability of improved symptom-related information from their patients.

Author contributions

K.K. drafted the manuscript. U.B., D.V., O.B., K.Ch.B., and M.Sv. co-edited the text. All other co-authors are directly involved in the development of the EAN and of the PHD systems. All authors approved the final manuscript.

Conflict of interest

No conflict of interest stated for any of the authors.

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