APAAACI Environment, Climate Change, Air Pollution Committee

Chair: Jae-Won Oh, MD, PhD, FAAAAI

Objectives: To establish the Asian Pacific specific data of allergic diseases related to changing environment

Upcoming projects:
1. Influence of climate change to allergic diseases
2. Pollen calendar in Asian Pacific region

Resources (if any)

Timelines:
3-4 years

2.1 **The study for Influence of Climate Change to Allergic diseases**

Background

Most of the observed increase in global average temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. Moreover, the major changes to our world involve the atmosphere and its associated climate, including global warming induced by human activity, and they are causing an impact on the biosphere, biodiversity, and the human environment.

Observational evidence indicates that recent regional changes in climate, particularly increases in temperature, have already affected a diverse set of physical and biological systems in many parts of the world. A rapid increase has been observed in the number of severe meteorological events witnessed across the globe.

Quantitative increase in allergenic pollen will burden the patients with allergic rhinitis which are known as many as 10–30% of the total population, and 300 million patients with asthma. Especially, allergic diseases are supposed to increase in children. Climate change may induce the changes in ecological suitability of the allergenic plants, which may result in new allergy in the group with no previous problems.

Aim

Climate change has become a crucial concern of public health because it has the potential to alter the timing and abundance of aeroallergens, which may result in increased symptoms in those with allergic diseases, such as allergic rhinitis, allergic conjunctivitis, and asthma.

Climate change has already been suggested as one factor behind the increasing prevalence of allergic asthma. Pollens are a major cause of symptoms in people with allergic disease, but there is no quantitative assessment of how future climate change may affect the levels of pollen allergy in humans because the influence of climate change is complex. Thus, an altered air pollutants or meteorological factors will affect the range of allergenic species as well as the timing and length of the pollen season.

Elevated carbon dioxide (CO_2) may increase plant productivity and pollen production. CO_2 is one of the important gasses that have greenhouse effect. An increase in the concentration of atmospheric CO_2 is one of the most certain predictors of climate change models.

Methods

The growing degree hour model was used to establish a relationship between start and end dates of pollen production and differential temperature sums using observed hourly temperatures from surrounding meteorology stations.

Studies of climate change effects on distributions of allergenic pollens have focused typically on analysis of observed airborne pollen counts and their regression relationships with local meteorological and climatic factors. Observed pollen data for pollen collecting stations at locations representing a wide range of geographic and climatic conditions should be analyzed statistically to identify the trends of start date, season length, and annual mean and peak value of daily concentrations of allergic pollen.

Environmental and meteorological change, driven by increased concentrations of greenhouse gases such as CO_2, SO_2, NO_2, and O_3 have widespread impacts on biotic systems, including direct and indirect effects on human health. As with most environmental health issues, many factors are involved, and in the specific case of climate change, the future state of many of the factors as air pollutants as PM10, PM5 is uncertain.

Practically the study is to collect data of PM5, PM10, CO_2, SO_2, NO_2, and O_3 in any countries on Asian pacific region including Korea, Japan, China, Australia etc., if measurement is possible. On the same period, pollen data and clinical data for incidence of allergic diseases or symptoms will be recruited from each country if available.

Timeline

1st – 2nd Data collection of pollen and air pollutants from each Asian Pacific country

3rd – 4th Analysis of those data and the correlation between them

5th – 6th Adjustment of clinical data from each city or country to those data

Products

Publications on SCI Journal such as JACI, Allergy, Annals of Allergy, and WAO journal.

References

Ziska LH, Makra L, Susan Oh JW, et al. Temperature-related changes in airborne allergenic pollen abundance and seasonality across the northern hemisphere: a retrospective data analysis. Lancet Planet Health 2019;3: e124–31

Kim JH, Oh JW, et al. Changes in sensitization rate to weed allergens in children with increased weeds pollen counts in Seoul metropolitan area. Korean Med Sci 2012; 27: 350-355

Oh JW, Kang IJ, Kim SW, et al. The correlation between increased sensitization rate to weeds in children and the annual increase in weed pollen in Korea. Pediatr Allergy Respir Dis 2006;16:114-21.

1.2. Pollen Calendar in Asian Pacific region

Background

The frequency of pollen allergy including allergic rhinitis, has recently increased in children as well as adult, and many studies have investigated the relationships between the concentrations of allergic pollens and the clinical manifestations of allergic diseases in pollen season. The abundance

of pollen grains in the air is described by pollen season intensity: the more there are, the more intense the season is. Pollen in the air, which is the result of pollen production and the different aerobiological processes, emission, dispersion, and/or transport and deposition, is controlled by factors associated with climate. Any change in these factors may affect the phenological and quantitative features of the season. Monitoring airborne pollen provides substantial information on plants performance under different environmental conditions and could allow predictions of their response under the ongoing climate change.

The pollen season in a certain area is related to the local flowering season, as for pollen to be present in the air, it has to be previously produced and emitted by mature flowers. However, pollen seasons and flowering seasons usually do not fully coincide; this is the result of intervening winds that allow for long-range transport. In temperate regions, the main pollination period covers about half the year, from spring to autumn. The onset, duration, and intensity of the pollen season vary from year to year. In order to be able to predict future situations, it is necessary to know the determinants of all related processes. At an applied level, this is particularly important because the pollen season and its intensity affect the quality of life of allergic persons, who constitute a considerable part of the human population.

Aim

There is a necessity for pollen forecasting or a pollen calendar in order to prevent or reduce the prevalence of pollen allergy. A pollen calendar for each region of a country can be prepared by sampling one or more locations for at least 12 months. These calendars can be used in clinics and hospitals for symptoms correlation, selection of subsequent diagnostic kits (allergen panels), and finally for prevention and control purposes.

Updated information on pollen distribution and concentration in each region should be provided to the general public and persons with allergic diseases through a website in order to manage and prevent pollen allergy. Yearly variations in the airborne pollens of a region can be enumerated by allowing the pollen sampler to run for a longer period at one location (Figs).

Methods

Pollen calendars for each species and location were developed based on 10-day average pollen concentration. At least 10 weather elements that are thought to affect the concentration of pollen are used to develop equations for the pollen forecasts. The elements are: daily mean temperature, rainfall, average wind speed, relative humidity, maximum temperature, minimum temperature, temperature range, continued rainfall hours, accumulated sunshine hours, and accumulated mean temperature.

Predictive equations for each pollen species and month are developed based on statistical analyses using observed data with 10 weather elements during the last several years in some countries. Although very different in the way of being observed and measured, phonological events and pollen counts can be traced back to the same phenomenon, the flowering of plants. Similarly, both kinds of data can in many respects be modeled with a similar set of observation-based models.

Observation-orientated models relate pollen records (dependent variable) to one or more variables (independent variables) that can be measured or predicted, and are constructed without knowledge of the sources, emission, or calculations of diffusion. Pollen data usually produce mean daily values for the studied area. These data can be used for producing forecasts of day-to-day variations in pollen concentrations, or for predicting characteristics of the pollen season, such as start dates and severity. All methods use certain mathematical tools in order to describe and imitate the behavior of pollen count; they may be applied for better understanding, description, and knowledge concerning pollen season problems. The most rudimentary method for pollen forecasting is the pollen calendar.

Timeline

1-2nd yrs: Data collection for pollen counts in each country on AP region for at least 5 years.

2-3rd yrs: Weather date collection with the corresponding pollen data in the countries.

4-5th yrs: Calculation and product the pollen calendar on Asian Pacific region.

Products

Publications on SCI Journal such as JACI, Allergy, Annals of Allergy, and WAO journal.

References

Oh JW, et al. The Revised Edition of Korean Calendar for Allergenic Pollens. Allergy Asthma Immunol Res. 2012;4(1):5-11.

Park HJ, Lee JH, Park KH, Oh JW, et al. A Six-Year Study on the Changes in Airborne Pollen Counts and Skin Positivity Rates in Korea: 2008–2013. Yonsei Med J 2016;57(3):714-720

Oh JW, Lee HR, Kim JS, Lee KI, Kang YJ, Kim SW, Kook MH, Kang HY, Kim JS, Lee MH, Lee HB, Kim KE, Pyun BY, Lee SI, Han MJ. Aerobiological study of pollen and mold in the 10 states of Korea. Pediatr Allergy Respir Dis 2000;10:22-33.

Oh JW, Lee HB, Lee HR, Pyun BY, Ahn YM, Kim KE, Lee SY, Lee SI. Aerobiological study of pollen and mold in Seoul, Korea. Allergol Int 1998;47:263-70.