EAAS 1: Climate change, air pollution and allergy

Desert dust exposure and allergy - in era of climate change -

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1. Climate change and desert dust formation in the air

Aerosol particles are produced by a variety of natural and anthropogenic processes. Desert dust constitutes about 35% of aerosol mass injected into the troposphere[1]. Large quantities of desert dust are transported over the oceans from arid continental regions, and deposited in various regions around the world[2]. Accumulating evidence suggests that desertification and climatic change can contribute to increased desert dust formation in the air[3].

Asian dust (also yellow dust (黃砂, or 黃沙), yellow sand, yellow wind or China dust storms) is a meteorological phenomenon that affects much of East Asia year round but especially during the spring months[4]. The dust originates in the deserts of Mongolia, northern China and Kazakhstan where high-speed surface winds and intense dust storms kick up dense clouds of fine, dry soil particles. These clouds are then carried eastward by prevailing winds and pass over China, North and South Korea, and Japan[4]. Water scarcity, a big contributor to dust formation in the air, is expected to be a big challenge in many Asian regions because of increasing water demand from population growth and consumption per capita with higher standards of living, although here is low confidence in the projections of specifically how climate change will impact future precipitation on a sub-regional scale[5].

2. Asian dust and allergies

Many toxicological and controlled human exposure studies have demonstrated that particulate matter (PM) exposure alters the immune response to antigens, suggesting that PM may act as an adjuvant[6] (U.S.EPA 2009). Animal experiments have shown that desert dust also aggravates antigen-induced allergic

inflammation[7].

We showed that Asian dust exposure is associated with increased risk for exacerbations of asthma and allergic symptoms in children or pregnant women in Japan; Asthmatic children showed increased risk for hospitalizations (OR 1.71, 95% CI, 1.18-2.48) on protocol-defined high desert-dust days (>0.10/km of 24-hour average in Light Detection And Ranging; LIDAR measurement)[8], and pregnant women showed an increased risk of allergic symptom development on protocol-defined desert-dust days (>0.07/km of 12-hour average in LIDAR measurement) (OR 1.24, 95%CI 1.16 – 1.32)[9]. This risk elevation was observed from a low level of desert dust in a dose-dependent manner even on control days. The risk-increase according to desert dust levels was observed when the air simultaneously contained pollen from Japanese cedar and cypress among subjects with positive serum IgE antibodies to Japanese cedar pollen, while no clear risk-increase was observed in the absence of pollen in the air, consistent with the adjuvant effects observed in animal model experiments.

3. Actions we need now to reduce allergy risk

Unfortunately, it appears that climate change may favor the growth of fungal spores, and trees with more allergenic pollen. Asthmatics and patients with allergies may have to deal with the double threat of more allergens and more air pollution.

In order to improve prevention and treatment of dust-related diseases, what determine the vulnerability in human, as well as its mechanism should be further studied. Moreover, a dust alarm system could be a preventive measure to decrease exposure, and its alarm system should be internationally implemented to advise the vulnerable to avoid exposure to dust storms.

Some parts of the works were supported by the Environment Research and Technology Development Fund from the Ministry of the Environment of Japan, and were conducted as an adjunct study of Japan Environment and Children's study. The findings and conclusions of the presentation are solely under the responsibility of the authors and do not represent the official views of the Japanese government.

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