Multiple genes affect risk of asthma, hay fever and eczema

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In a new study from SciLifeLab at Uppsala University, researchers have found a total of 141 regions (genes) in our genetic material that largely explain the genetic risk underlying asthma, hay fever and eczema. As many as 41 of the genes identified have not previously been linked to an elevated risk for these diseases. The results are published in the

scientific journal *Human Molecular Genetics*.

The risk of developing asthma, hay fever or eczema is affected by genes, environment and lifestyle factors. Many patients diagnosed with one of these diseases also develop the other two at some stage in life. Although previous studies have found many genes that exert an effect on these diseases, research have been unable to explain the whole genetic background to the origin of asthma, hay fever and eczema.

In this study, which is the largest of its kind to date, researchers have analysed self-reported data from 350,000 participants in Britain's UK Biobank. Millions of gene positions were tested for their effect on people's risk of being diagnosed with asthma, hay fever and/or eczema. The 41 new genetic finds were also tested in an independent group of individuals comprising 110,000 clients of the American company 23andMe. This testing verified that most of these new genetic variants have an effect on the individual's risk of developing disease. Every 23andMe participant, or client, has paid personally to send in a saliva sample, used by the company to analyse the person's DNA. The participants then receive information about whether they carry various inherited genetic traits that may elevate their risk of a number of diseases. Researchers can apply to obtain results in which 23andMe have analysed clients' DNA, to find additional genetic variants that affect the disease(s) analysed (in this case asthma, hay fever and/or eczema). The researchers can never access any given individual's results, nor can they link their findings with specific individuals (the data are deidentified).

"For those interested in taking part in similar studies where they can get information about their own genetic inheritance, we'd like to point out that the results you can read from DNA in similar studies relate only to people's disease risk, which doesn't correspond to a diagnosis. External factors also affect our risk for these complex traits, and an elevated risk doesn't mean we're going to develop the disease," says Weronica Ek,

researcher at the Department of Immunology, Genetics and Pathology at Uppsala University, who headed the study.

The study showed that a large number of the genes identified entail a raised risk for all three diseases. This, in turn, shows that the elevated risk of suffering from allergy when asthma is diagnosed, or the elevated risk of asthma when allergy is diagnosed, seems to be largely due to genetic factors. The study was also able to identify several genes that boost the risk of one of these diseases in relation to the others, which demonstrates that a number of more disease-specific effects also exist.

All three diseases arise through a complex association among several genes and also with environmental and lifestyle factors. To be able to improve the patients' everyday lives, it is important to develop drugs that are adapted to individual patients' genetic risks, and also to understand how our environment and lifestyle can prevent disease and improve symptoms of disease.

"The results from this study are helping us to reach a greater understanding of why certain individuals are at higher risk of developing asthma and allergies, and we hope the results will be put to use both in clinical diagnostics and in drug development," Ek says.

More information: Åsa Johansson et al. Genome-wide association analysis of 350 000 Caucasians from the UK Biobank identifies novel loci for asthma, hay fever and eczema., *Human Molecular Genetics* (2019). DOI: 10.1093/hmg/ddz175

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