Q&A: Is DNA key to whether you get COVID-19?

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The strength and health of one's immune system is one key indicator of susceptibility to contracting pathogens, including the novel coronavirus. However, new evidence that may suggest more men get coronavirus than women has motivated an international hunt for which genes make people especially vulnerable or resistant to COVID-19.

Canada, in partnership with teams in the United Kingdom and the United States, hopes to contribute the fully decoded genomes of 10,000 COVID-19 patients to better understand the genes behind the disease—part of a global mission that's aiming for 100,000 genomes. With support from the SEAMO (Southeastern Ontario Academic Medical Organization), the Canadian arm of the project is being coordinated by David Maslove, Clinician Scientist with the Department of Medicine and Critical Care Program at Queen's and intensive care doctor at Kingston Health Sciences Center.

Dr. Maslove spoke to the Queen's Gazette about the potential links between DNA and coronavirus as well as the international project underway.

What is the suspected connection between DNA and coronavirus susceptibility?

Previous studies have shown that susceptibility to infection may be, at least in part, genetically determined. For instance, large-scale, epidemiological studies show that likelihood of dying from an infection is at least five times more heritable than the likelihood of dying from cancer, even though we typically think of the latter, rather than the former, as a genetically determined condition.

The genes that control the immune system are some of the most diverse among humans, and lab studies have shown how different molecular characteristics influence the way in which people respond to infection. With respect to coronavirus in particular, early studies have identified some risk factors, such as age, hypertension, and diabetes, but these don't appear to tell the whole story. Additional variability is seen in who gets a mild case, and who develops critical illness, with reason to suspect that some of that variability is determined by our genetics.

Are there specific genes that make people more likely to be infected by coronavirus?

Early studies are beginning to shed some light on this, though the results remain preliminary. A European research group found associations between genes involved in determining blood type and the need for breathing support in COVID-19. Other groups have proposed that differences in the genetic regulation of ACE2—a protein that the virus uses to gain entry into cells—may be associated with different outcomes for coronavirus patients. Others are looking to see if genetic differences in sex chromosomes (X and Y) may in part explain why early reports showed worse outcomes among males as compared to females.

Are the reports that COVID-19 is more dangerous for men true?

Reports from some areas that have been hardest hit do suggest a higher mortality rate among men. Others are a little more equivocal. The reasons for these differences remain unclear. Genetics may play a role, since biological sex is genetically determined, though other factors may be important as well.

If you can pinpoint the genes, will it lead to more treatment options?

This is our hope. Identifying specific genes means identifying the molecular pathways they influence. The hope is that these will yield important insights into how the coronavirus infects our cells, and how the body responds. This could lead to treatments that make susceptible people react more like those who are resistant to severe infection.

Can you tell me about the objectives of the GenOMICC study, the international initiative to fully decode the genomes of 100,000 COVID-19 patients? What is Canada's contribution to this project?

Pinpointing the genetic determinants of COVID-19 will require sequencing the genomes of a great many patients—likely tens of thousands. There are large-scale coordinated efforts going on internationally to try to harmonize studies and get to these large sample sizes as quickly as possible. We at Queen's are collaborating with researchers in the UK who have already sequenced genomes from about 2,500 patients there, through a research program called GenOMICC. Here at Queen's, Dr. Michael Rauh and I have received funding from SEAMO to coordinate the Canadian arm of the GenOMICC study. We are also coordinating our efforts with a Canadian consortium that has benefited from federal funding to be used for this purpose. Canada has a key role to play because of our expertise in genomics, as well as a longstanding and internationally renowned track record of collaborative critical care research.

Provided by Queen's University

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