

This is because whether it's happening in a city across the province or a country halfway around the world, unchecked spread of the SARS-CoV-2 virus leads to the emergence of new, more contagious and potentially vaccine-resistant strains of the virus. And these new variants can quickly grow from a local problem to a widespread one.

Variants are the product of mutations the virus undergoes as it replicates. Mutations can be minor or significant changes to the virus' genetic code that happen spontaneously while that code is being copied as part of the replication process, explains Omar Khan, who teaches biomedical engineering at the University of Toronto.

"Every replication event is an opportunity for a mistake and that mistake can randomly lead to a change that is actually favourable," Khan said. "It's a random change that happens because of an error. Most of these changes that happen are junk. They will change the virus in a way that it's no longer viable so it doesn't work as well anymore."

But one in every so many mutations makes the virus work better, adds Art Poon, an associate professor of pathology and laboratory medicine at Western University.

"Some of those mutations help it avoid our immune system. Other mutations make it better at latching on to our cells," Poon said. "And we don't know how many other mutations there are out there that could create an advantage for this virus."

The more times the virus replicates, the more likely it is to draw a winning lottery ticket in the form of a mutation that makes it stronger, which it can pass on through replication to create a new strain. The severity of a COVID-19 infection in an individual can raise the odds, since there's more replication happening, Khan said, but the main risk factor is the transmission of the virus from person to person.

"When you have a pandemic, lots of people infected, you're getting a lot of replication and these low chances of random changes then become amplified," Khan said. "This is why our goal is to stop viral replication, because viral replication is one means by which this mutation can happen."

High rates of transmission in Toronto, for example, can affect cities like Ottawa and Timmins if uncontrolled viral replication in Canada's largest city allows a more contagious or vaccine-resistant new variant to develop and spread throughout the