COVID-19 IMMUNITY TASK FORCE

GROUPE DE TRAVAIL SUR L'IMMUNITÉ FACE À LA COVID-19

Summary report #5

Omicron and other variants of concern: Finding our way forward

A panel discussion

Background

Beginning in November 2021, the Omicron variant of SARS-CoV-2 began to spread around the globe, quickly becoming the dominant form of the virus. It has proven to be highly transmissible and virulent. Though it is not necessarily more severe than the previously predominant Delta variant that it overtook, the sheer number of people who have contracted Omicron (over 750,000 cases in Canada since the first case of Omicron was detected in this country on November 28th, 2021) has meant that the Canadian healthcare system has been under intense pressure and death rates have remained significant through this latest wave of the pandemic.

This change in the pandemic landscape raises urgent questions about the continued mutation of the virus and the prospect that new, and perhaps even more troublesome, variants of concern (VOC) will emerge in the future. In an effort to address these issues, the CITF and CanCOVID, in collaboration with the Coronavirus Variants Rapid Response Network (CoVaRR-Net), convened a panel of experts for a discussion about Omicron and the future of VOCs.

Panelists

Dr. Mark Brockman, Simon Fraser University; Immunology & Vaccine Protection Pillar Deputy, CoVaRR-Net

Dr. Anne-Claude Gingras, Lunenfeld-Tanenbaum Research Institute, University of Toronto; Functional Genomics & Structure-Function of Variants of Concern Pillar Lead, CoVaRR-Net

Dr. Marc-André Langlois, University of Ottawa; Executive Director, CoVaRR-Net

Dr. Jun Liu, University of Toronto

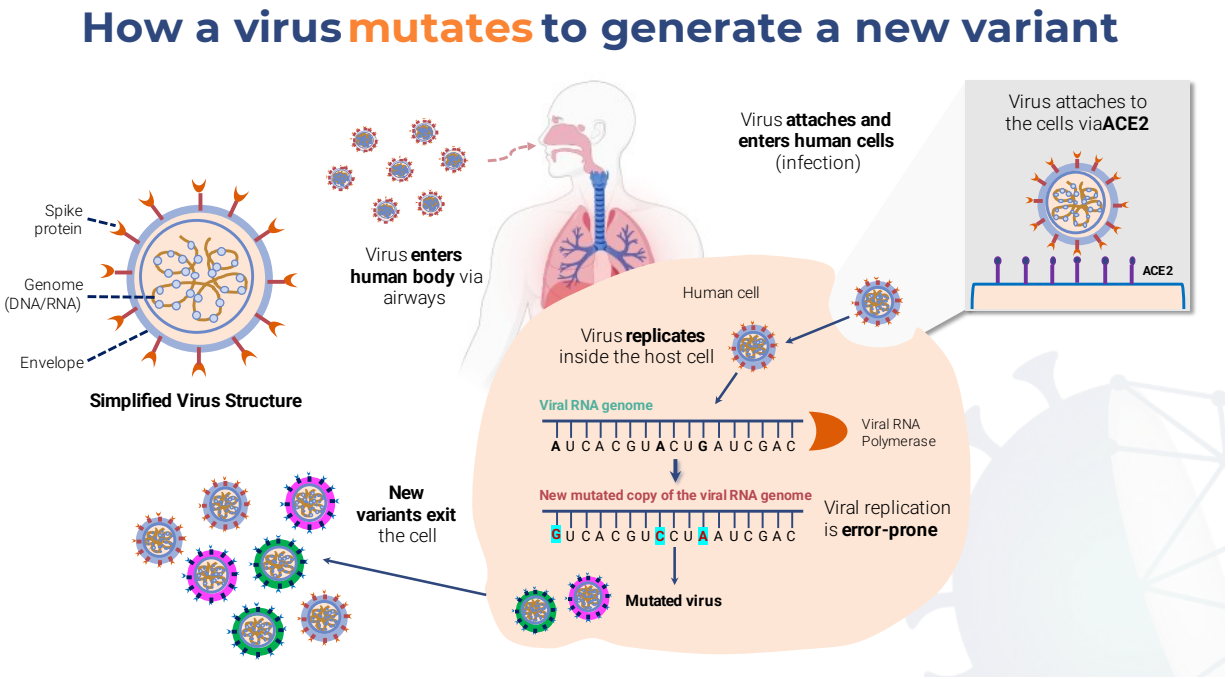
Dr. Ciriaco Piccirillo, Research Institute of the McGill University Health Centre; Immunology & Vaccine Protection Pillar Co-Lead, CoVarRR-Net

Dr. Jeff Wrana, Lunenfeld-Tanenbaum Research Institute, University of Toronto; Viral Genomics & Sequencing Pillar Deputy, CoVaRR-Net

Dr. Catherine Hankins (moderator), McGill University, Co-Chair of the COVID-19 Immunity Task Force.

What is a variant and what is a variant of concern?

Once a virus infects the body, it binds to a healthy cell via the cell surface receptors, enters it and begins to replicate. The process of replication involves the genetic code of the virus being copied over and over and over. Viral replication is error-prone. These errors are called mutations and are generated randomly. Mutations *may* (but not always) confer replicative and immune advantages and, as the virus continually evolves, iterations that include these favourable mutations will come to predominate through the process of natural selection and, thereby, emerge as variants of concern (VOC).



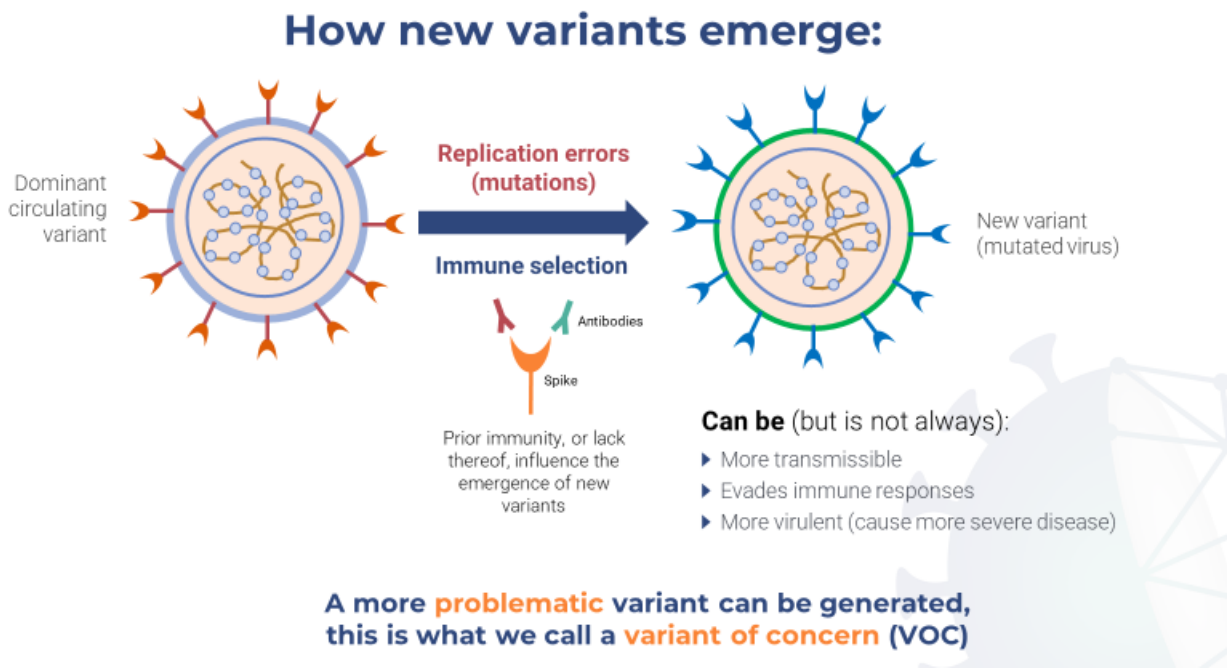
We have observed this several times with SARS-CoV-2. The original wild type of the virus with which the pandemic began in 2019, was eventually supplanted, most recently by Delta, which was overtaken by Omicron, of which there is now a further modification, known as BA.2, that is being closely monitored for its apparent capacity to evade existing detection techniques.

A mutation becomes a VOC when it demonstrates:

- more transmissibility (spreads more easily);
- evades existing immune responses (whether from vaccination or previous infection);
- greater virulence (causes more severe disease).

The virus' chances to mutate correlate with opportunities to spread. The more it mutates, the greater the likelihood for novel and unexpected VOCs to emerge and to, once again, change the course of the pandemic. This underscores the importance of broadening immunity via vaccination, not just in a particular community or country but globally, and makes the case for equitable vaccine distribution. A global vaccination

campaign is necessary to impede the spread of disease and to protect people all around the world.



The challenges posed by variants of concern

Mutation is part of the biology of a virus. A mutatated virus emerges, circulates, and either takes hold or disappears. The primary challenge is posed by mutations in viruses that make them capable of evading our immune protections.

Thus far, two doses of mRNA vaccines, bolstered by a third booster dose, continue to be extremely effective at preventing severe disease and death, including against the Omicron variant.

BA.2

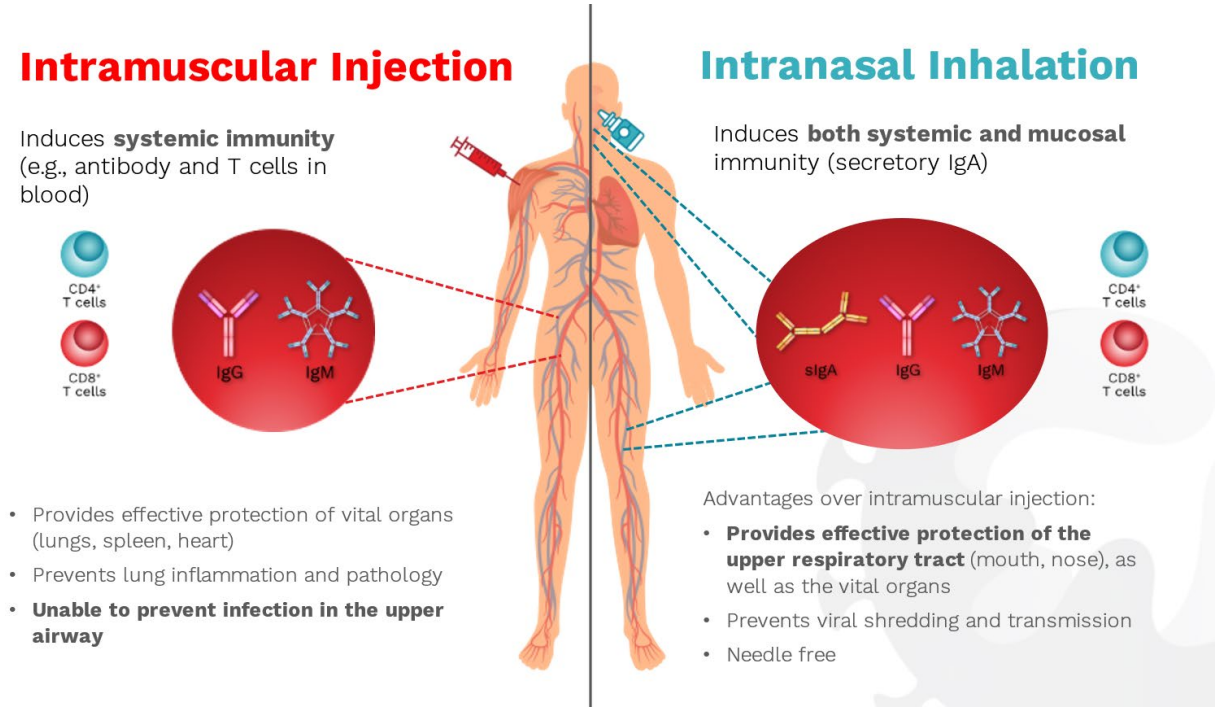
- BA.2, a sub-variant of Omicron that is also known as the “stealth variant,” is being closely monitored to determine its potential to evade immunity. It appears to be one to two times more transmissible than the original Omicron (Dr. Ciriaco Piccirillo).
- Data indicate that BA.2 has a shorter incubation period than the original Omicron. While there is evidence in animal models suggesting that it is a little more severe, early human data shows no difference in disease severity (Dr. Anne-Claude Gingras).
- Existing vaccines, including a booster dose, seem to be equally protective against severe disease from both variations of Omicron. However, monoclonal antibodies that are used to treat people who have become ill seem to be less effective against BA.2. Here, again, is a strong argument in favour of vaccination (Dr. Anne-Claude Gingras).

Novel vaccine technologies

Current COVID-19 vaccines are administered by intramuscular injection. Researchers, including Dr. Jun Liu, are developing intranasal inhaler options that would administer vaccine by a spray delivered through the nose, directly to the upper airway, where the virus gains entry to the body. This vaccine is intended to be employed as a booster, in conjunction with the current intramuscular injection, which would continue to be the primary form of vaccination.

With respect to Omicron, which is more highly transmissible and seems to be more active in the upper respiratory system – as compared with the other variants, which had more pronounced effects on the lungs – a vaccine that increases antibodies to protect the nose and mouth may decrease viral shedding and transmission.

Vaccine sprays may also encourage more people to get their full series of boosters as they are easier and quicker to administer, not requiring health professionals or needles.



Dr. Liu's team is working on a multivalent intranasal vaccine – that is, a vaccine that will respond against all known variants of SARS-CoV-2.

Intranasal vaccines have an established track record. The technology has been previously approved by Health Canada for use against influenza. He foresees this system serving in complement to existing intramuscular mRNA vaccines. (Dr. Mark Brockman)

By stimulating an immune response at the source of transmission, intranasal vaccines might hold the promise of impeding the spread of SARS-CoV-2.

Global vaccine inequality: the only way out

So long as SARS-CoV-2 is circulating around the globe, mutations will occur and, eventually, new variants of concern will emerge.

- Endemicity would only come to Canada when it comes to the world. None of the VOCs that we have seen thus far have been geographically contained. (Dr. Catherine Hankins)
- If we have learned anything, it is the inter-connectedness of public health. The key to moving from a condition of pandemic to endemicity is to get as many people as possible vaccinated and boosted. (Dr. Mark Brockman)

SARS-CoV-2 is going to be with us, in one form or another, for a long time to come. While it is difficult to predict its future course, it is conceivable that the virus may sacrifice some of its characteristics, such as severity, in order to preserve its ability to replicate and circulate among people with infection- or vaccine-acquired immunity as a less serious illness (Dr. Marc-André Langlois).

Continued surveillance

Given the expectation that SARS-CoV-2 will be with us for the foreseeable future, it is going to be necessary to continue monitoring the spread of infection and to identify the evolution of the virus. One of the most efficient methods to accomplish this is through testing wastewater. The method can provide advance warning when the concentration of infection spikes in a particular area and, thereby, suggest where public health mitigation measures might be warranted. CoVaRR-Net has created a Wastewater Surveillance Group, bringing together experts from across Canada to establish best practices for wastewater testing and surveillance.

Conclusion

How we move forward through the next stage of the pandemic depends a great deal on how we manage the ongoing threat of emerging variants. Data show that infection- and vaccine-induced immunity to COVID-19 wanes over time. While providing significant protection from severe outcomes, vaccine effectiveness has varied with the emergence of new variants, most notably Omicron.

The evidence is clear that vaccination offers people the best protection and society the best opportunity to curb the spread of the virus and impede its capacity to mutate into new and more menacing variants. The development of multivalent intranasal vaccines promises to make vaccination easier and more accessible, thereby contributing to the global effort to contain SARS-CoV-2.