



COVID-19
IMMUNITY
TASK FORCE

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

JANUARY
2023

CITF MONTHLY **REVIEW**

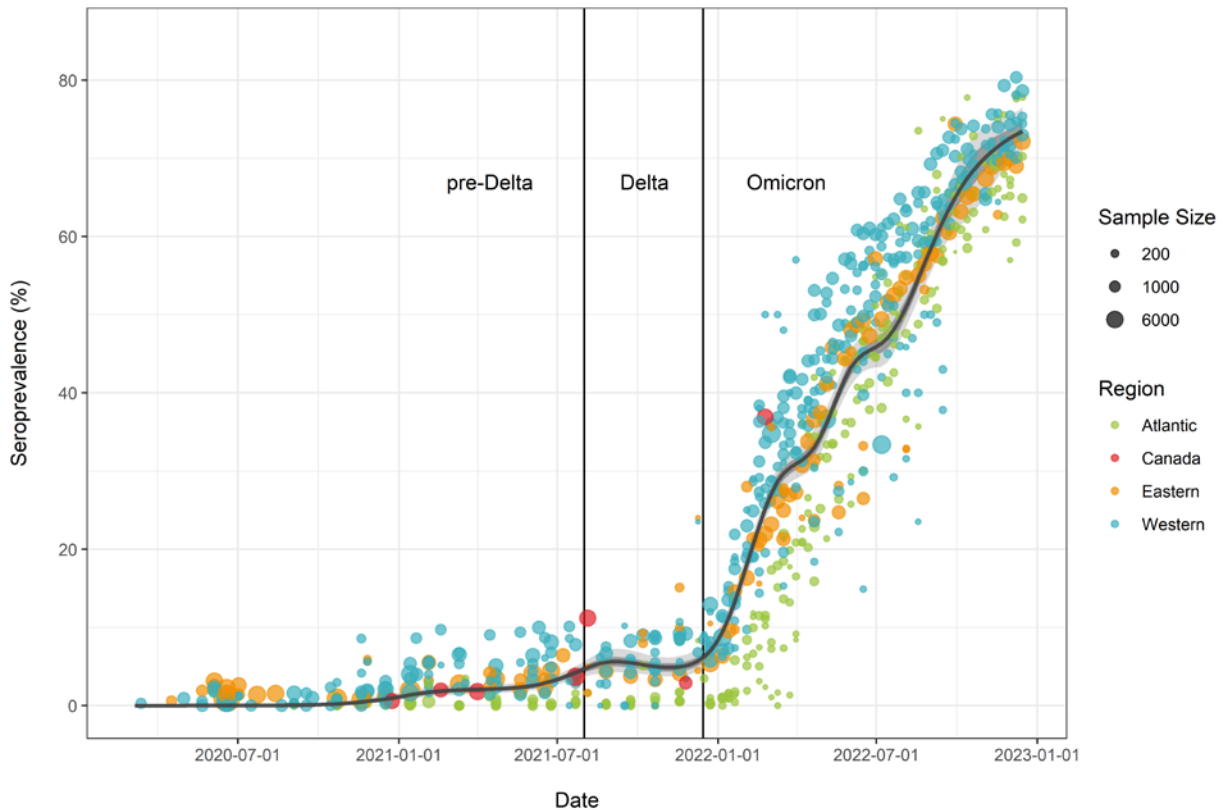
The race
to **improve**
vaccines

Hybrid
immunity in the
Omicron era

The latest on
seroprevalence
across Canada

SEROPREVALENCE IN CANADA | MID-DECEMBER RESULTS

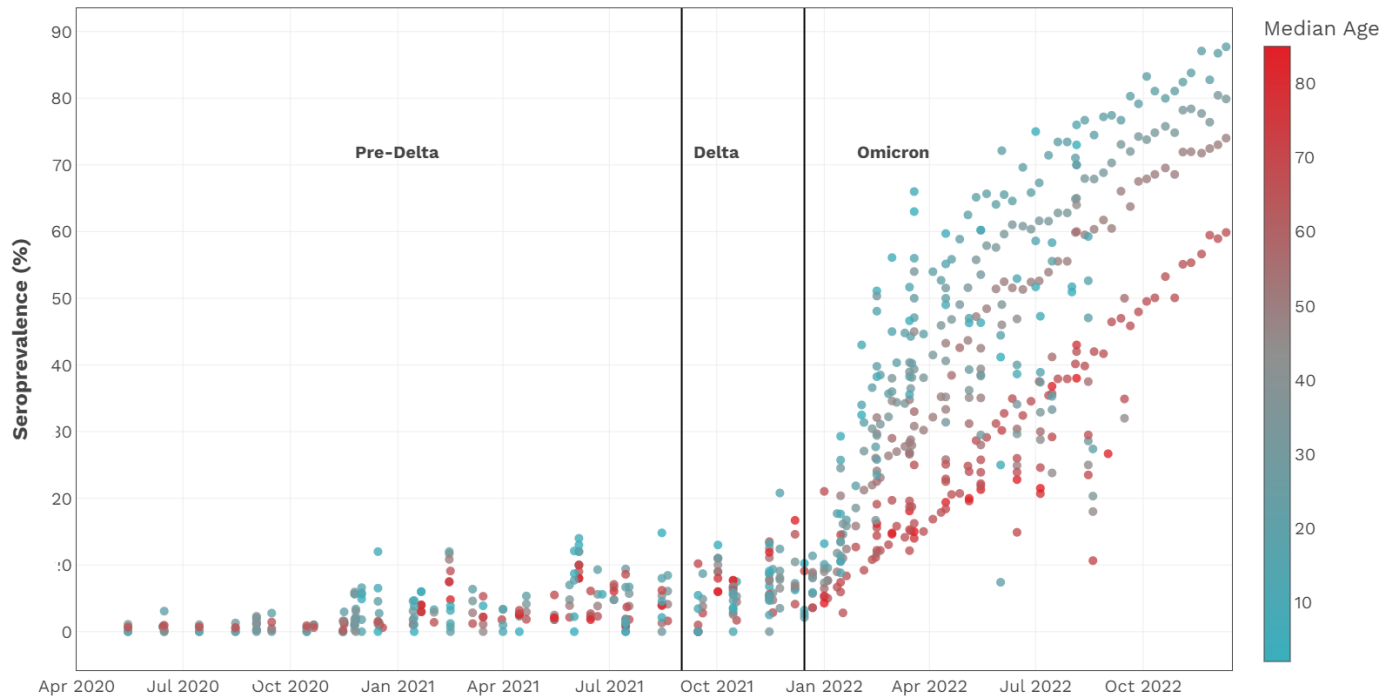
Seroprevalence rises only slightly between November and mid-December



Seroprevalence due to infection rose in Canada, but only slightly, between November 30, 2022, and December 15, 2022. This was in stark contrast to the dramatic increase in infection-acquired seroprevalence between August 2021 and December 15, 2022: from 4.6% (95% credible interval [CrI]: 3.5 to 5.6%) in the pre-Delta wave to **73.5% (95% CrI: 70.0 to 76.7%) by mid-December 2022** – after a year with circulating Omicron variants. We estimate that this rise in seroprevalence during the Omicron phase of the pandemic corresponds to at least 26 million (95% CrI: 24.9 to 27.4 million) Canadians being infected between December 1, 2021 and December 1, 2022.

The actual number of newly infected (or reinfected) Canadians may have been higher because some people infected early in the Omicron phase of the pandemic may no longer have detectable anti-N antibodies. The average infection rate over the past year is equivalent to about **72,000 infections per day**.

Infection-acquired seropositivity continues to rise most in young adults



Infection-acquired seroprevalence increased in all age groups since the Omicron variant appeared. In blood donors, the highest levels of seropositivity due to infection continued to be in **young adults** (17–24 years), with approximately **88% seropositivity by mid-December** – a roughly 5 percentage point increase over their seropositivity at the end of November. As in previous months, estimates of seropositivity due to infection decreased with increasing age in the first two weeks of December: 25–39 years (80%), 40–59 years (74%), and 60+ years (60%).

» **READ MORE**

Data on our Seroprevalence in Canada webpage are updated at least once a month and can be visualized via interactive graphs.

Those looking for population-level data in Excel format can now find download buttons throughout the page (please note there are several tabs).

» **DISCOVER**



Omicron and its ensuing subvariants proved to be more resistant to vaccine-induced immunity and capable of infecting those who are fully vaccinated. Consequently, formulating improved vaccines efficiently and cost effectively remains an important priority. CITF-funded research makes a contribution to these ongoing efforts.

Intranasal administration of protein vaccines shows potential for protection against SARS-CoV-2 infection

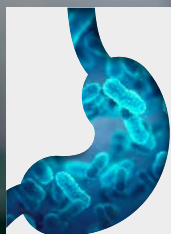
In a CITF-funded study published in *Vaccines*, Dr. Marc-André Langlois (University of Ottawa) found that adjuvanted protein vaccines administered intranasally can elicit strong systemic and mucosal antibody responses against SARS-CoV-2 variants in mice. Though studies in humans are needed to guide the design of new intranasal vaccines, they hold potential to stave off SARS-CoV-2 infection. Intranasal vaccines are set to protect against infection in the upper respiratory tract, the primary entry point for SARS-CoV-2.

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A novel method for developing low-cost proteins for use in SARS-CoV-2 vaccines and assays

A CITF-funded study published in *PLoS One*, led by Drs. Marc-André Langlois and Allyson MacLean (University of Ottawa), demonstrated that agroinfiltration, a method to generate proteins in plants, could be used to produce the receptor binding domain (RBD) of the SARS-CoV-2 spike protein. This study is important because these plant proteins can be used to make protein subunit vaccines and serological and neutralization assays. They are low cost, massively scalable, and rapid to develop.

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The microbiome may play a powerful role in vaccine-induced immunity

In a letter published in *Gut*, Drs. Genelle Healey, Bruce Vallance and CITF-funded researcher Dr. Pascal Lavoie (University of British Columbia) and their team identified a link between the composition of one's gut microbiota and COVID-19 vaccine-induced immunity. The research suggests that those with higher microbial-derived branched-chain fatty acids (produced via microbial protein fermentation) have more trouble developing a strong immune response with vaccine-induced antibodies. On the other hand, those who consume a lot of fibre exhibit a more effective immune response.

» **READ MORE**

The Canadian COVID-19 Emergency Department Rapid Response Network (CCEDRRN), led by Dr. Corinne Hohl (University of British Columbia) aims to evaluate vaccine effectiveness and how long this protection lasts in populations that commonly receive care in emergency departments (ED) across Canada for symptomatic and severe COVID-19. Over the course of their research, Dr. Hohl's team has also found possible predictors for ED readmission.

Pulmonary embolisms can be prevented by screening ED patients with COVID-19 symptoms for blood clots

Studies have shown that patients infected with SARS-CoV-2 are at higher risk of developing a venous thromboembolic disease, including pulmonary embolism. This CITF-funded study, published in the *Canadian Journal of Emergency Medicine*, found that performing a D-dimer diagnostic test on patients who exhibit characteristic COVID-19 symptoms upon admission to the emergency department was very effective in ruling out the risk of pulmonary embolism within 30 days of admission.

» READ MORE

Derivation and validation of a clinical score to risk-stratify COVID-19 patients discharged from the emergency department

Another CITF-funded study, published in *JACEP Open*, concluded that the CCEDRRN COVID-19 discharge score can accurately identify patients at risk of short-term adverse outcomes within 72 hours of emergency department discharge. Of 15,305 eligible patient visits, 535 (3.6%) experienced death or hospital admission within 72 hours of discharge.

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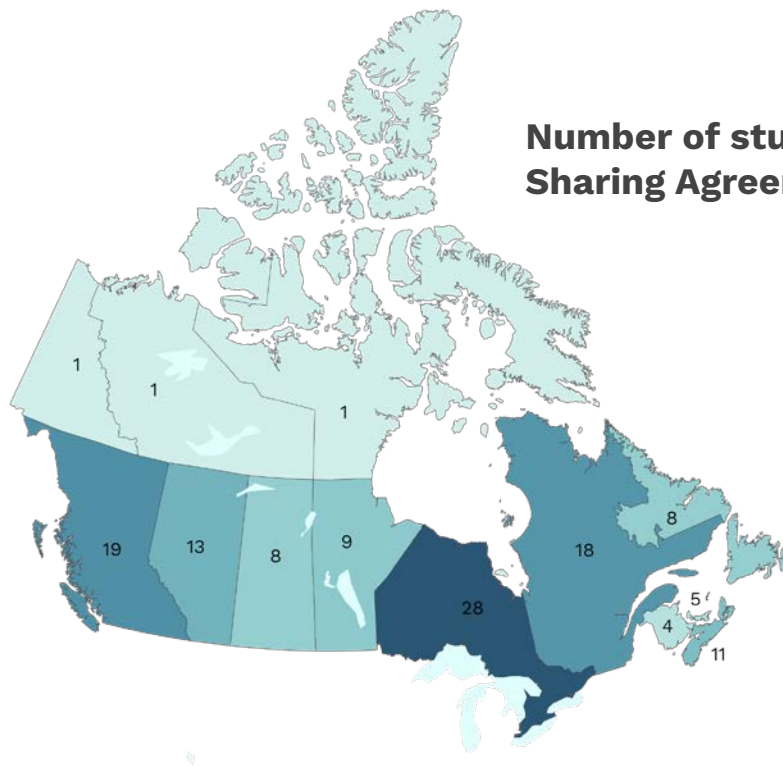
COVID-19 vaccine immunogenicity in people with HIV

A CITF-funded study, published in *AIDS* and led by Drs. Cecilia Costiniuk (McGill University) and Aslam Anis (University of British Columbia), found that vaccine-induced antibodies to SARS-CoV-2 were elicited in over 90% of people living with HIV (PLWH). Of those, most (92%) maintained those antibodies for six months following a second dose of vaccine, although this percentage was less than it was for HIV-negative controls. One month after a third dose, 100% of PLWH had detectable receptor binding domain and spike levels. The results demonstrate the importance for PLWH to keep up with booster doses.

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Thank you to the 41 PIs who have signed DSAs with us

We would like to thank the 41 principal investigators who have signed Data Sharing Agreements (DSAs) for their CITF-funded studies with us so far. Their cooperation and willingness to share data from their CITF-funded work will enable the CITF Databank to include individual-level, de-identified data from hundreds of thousands of participants with a multitude of backgrounds across Canada. Their data, combined with the infrastructure of the CITF Databank, will facilitate further research into SARS-CoV-2, pandemic preparedness, and possibly other fields of study in Canada and around the world for years to come.



Number of studies with Data Sharing Agreements by province

STUDIES WHICH SAMPLED ACROSS CANADA (MULTIPLE PROVINCES)

Dr. Upton Allen

Hospital for Sick Children,
Toward Enhancing COVID-19 Vaccine Confidence among African Canadians: Sustainability of Immune Responses and Safety Profiles and Seroprevalence of SARS-CoV-2 among African Canadians: Clinical and Epidemiological Correlates

Dr. Paul Allison

McGill University, *COVID-19 experience in Canadian dental schools*

Dr. Aslam Anis

University of British Columbia, *COVID-19 Vaccination among People Living with HIV: Immunogenicity, Effectiveness, and Safety*

Dr. Philip Awadalla

Ontario Institute for Cancer Research, *Surveying Prospective Population cohorts for COVID-19 prevalence and outcomes in Canada (SUPPORT-Canada)*

Dr. Sasha Bernatsky

Research Institute of the McGill University Health

Centre, Safety immunogenicity of Covid-19 vaccines in systemic immune mediated inflammatory Diseases (SUCCEED)

Dr. Arianne Buchan

Ottawa Hospital Research Institute, A prospective multi-site observational study of SARS-CoV-2 vaccination immunogenicity in patients with hematologic malignancies

Dr. Nicola Cherry

University of Alberta, The impact of COVID-19 on the health of physicians, nurses and other healthcare workers: An interprovincial cohort study

Dr. Brenda Coleman

Sinai Health, Are healthcare workers at higher risk of COVID-19 than other working adults? and Study of the epidemiology of COVID-19 In teachers and education workers

Dr. Glenwood Goss

Ottawa Hospital Research Institute, Prospective Cohort Study to Examine Immunogenicity of SARS-CoV-2 Vaccination in Cancer Patients with Solid Malignancies

Dr. Michael Grant

Memorial University of Newfoundland, Characterization of Cellular and Humoral Immunity Against SARS-CoV-2 and Characterization of Hybrid Cellular and Humoral Immunity Against SARS-CoV-2 and Evaluation of its Role in Protection from Infection and from Severe Illness

Dr. Brian Grunau

University of British Columbia, COVID-19 Occupational Risks, Seroprevalence and Immunity among Paramedics in Canada (CORSIP Canada)

Dr. Prabhat Jha

Unity Health Toronto, Action to beat Coronavirus Study (Ab-C)

Dr. Nathan Lachowsky

University of Victoria, The COVID-19 Pandemic Among Sexual and Gender Marginalized Populations in Canada: Physical Distancing Impacts, SARS-CoV-2 Seroprevalence, and Health and Wellness Needs

Dr. Mark Loeb

McMaster University, Determinants of Community COVID-19 Transmission: Learning from the Hutterites

Dr. Sreenath Arekunnath Madathil

McGill University, COVID-19 incidence rates among Canadian dentists as they return to work: A cohort study

Dr. Jonathon L. Maguire

Unity Health Toronto, COVID-19 Study of Children and Families: Safe Return to School, Work, and Play (TARGet Kids!)

Dr. Manali Mukherjee

McMaster University, SARS-CoV-2 triggers Autoimmunity: Implications for the pathogenesis of Post-Acute COVID-19 Syndrome (AI-PACS)

Dr. Matthew Oliver

Sunnybrook Research Institute, Determining the safety and effectiveness of COVID-19 vaccination in the chronic kidney disease population

PROVINCE-SPECIFIC STUDIES

British Columbia

Dr. Agatha Jassem

University of British Columbia, The PREVENT-COVID in Seniors Study: PROspEctiVe Evaluation of immuniTy after COVID-19 vaccines in Seniors

Dr. Pascal Lavoie

University of British Columbia, Tracking COVID-19 to Inform Interventions and Help Make our Schools Safer

Dr. M-J Milloy

University of British Columbia, Evaluating the safety and immunogenicity of SARS-CoV-2 vaccines among underserved urban populations with intersecting risk factors for COVID-19 morbidity and mortality: A pooled analysis of three prospective cohort studies in Vancouver, Canada

Dr. Marc Romney

University of British Columbia, Integrating longitudinal

epidemiologic, virologic and immunologic analyses to understand COVID-19 immunity and infection outcomes in long-term care

Dr. Manish Sadarangani

University of British Columbia, SARS-CoV-2 seroprevalence in children and young adults in British Columbia

Alberta
Dr. Xiaoli (Lilly) Pang

University of Alberta, *Early warning and rapid public health response to prevent COVID-19 outbreaks in long-term care facilities (LTCF) by monitoring SARS-CoV-2 RNA in LTCF site-specific sewage samples and assessment of antibodies response in this population*

Saskatchewan
Dr. Maureen Anderson

University of Saskatchewan, *Saskatchewan SARS-CoV-2 Seroprevalence Study*

Manitoba
Dr. Derek Stein

University of Manitoba, *Manitoba COVID-19 Sero-prevalence Study (MCS Study)*

Ontario
Dr. Angela Crawley

Ottawa Hospital Research Institute, *Fine analysis of longitudinal immune responses to SARS-CoV-2 in vaccination: Harnessing the power of Stop The Spread Ottawa to understand immune protection in COVID-19*

Dr. Brian Dixon

University of Waterloo, *Monitoring Waterloo Region hotspots: University of Waterloo Campus*

Dr. Stephen Hwang

Unity Health Toronto, *Ku-gaa-gii pimitizi-win study*

Dr. Keith Jarvi

Sinai Health, *Development of high throughput, inexpensive and scalable testing to detect SARS-CoV-2 antibodies using home blood collection kits and a fully automated ELISA antibody assay*

Dr. Ishac Nazy

McMaster University, *Long-term protective immunity against SARS-CoV-2 virus in COVID-19 patients*

Dr. Amit Oza

University Health Network, *Research Platform to Screen and Protect Individuals that Work Within a Food Production, Healthcare, Research or Clinical Organization (RESPECT)*

Dr. Sharon Straus

Unity Health Toronto, *IPAC+ Evaluating Intervention Impact using Serological and Cellular Assays as Correlates of SARS-CoV-2 Exposure among Long-Term Care Homes (LTCH) Staff, Residents, and Transmission Networks*

Dr. Sharon Walmsley

University Health Network, *Safety and Efficacy of Protective COVID-19 Vaccines*

Dr. Jeffrey L. Wrana

Sinai Health, *Mapping the Emergence and Functional Impact of Novel SARS-CoV-2 Variants*

Quebec
Dr. Denis Boudreau

Université Laval, *Cellular immunity and antibody seroprevalence to SARS-CoV-2: Characterization of three food worker populations*

Dr. Jack Jedwab

Association for Canadian Studies, *COVID-19 Risk and Immunity in Montreal North: A Population-based Study*

Dr. Peter Nugus

McGill University, *COVID-19 in the Orthodox Jewish Community of Montreal: A mixed-methods study of immunity integrating anthropology, epidemiology and immunology*

Dr. Kate Zinszer

Université de Montréal, *ENCORE: Seroprevalence study in Montreal schools and Children, school personnel, and COVID-19: Seroprevalence study in Montréal*

Nova Scotia
Dr. Lisa Barrett

Dalhousie University, *Immunity in LTCF residents at risk of COVID-19 disease and death: Immune biomarkers, immune function, and frailty associated with clinical outcomes in COVID-19 pandemic waves 1 and 2*

WITH DSAs IN PROGRESS

Dr. Angela Cheung

University Health Network,
Canadian COVID-19 Prospective
Cohort Study (CanCOV)

Dr. Juthaporn Cowan

Ottawa Hospital Research Institute,
Vaccine Immunogenicity and Safety
in Immunodeficient patients

Dr. Daniel Grace

University of Toronto, *Engage-
COVID-19: A mixed methods
study of biomedical, behavioural,
and psychosocial aspects of the
COVID-19 pandemic among gay,
bisexual, and other men who have
sex with men in Canada*

Dr. Amy Hsu

Bruyère Research Institute,

*Identification of underlying factors
influencing the immune response
to SARS-CoV-2 among workers and
residents in long-term care homes:
A multi-province study and Vaccine
effectiveness against SARS-CoV-2
variants of concern in long-term
care populations: A multi-province
study*

Dr. Deepali Kumar

University Health Network,
Prospective Evaluation of COVID-19
Vaccine in Transplant Recipients: A
National Strategy

Dr. Parminder Raina

McMaster University, *Canadian
Longitudinal Study on Aging
(CLSA): Platform for studying the
epidemiology of the COVID-19*

*pandemic in aging populations
(CLSA-COVID-19 Study)*

Dr. Donald Vinh

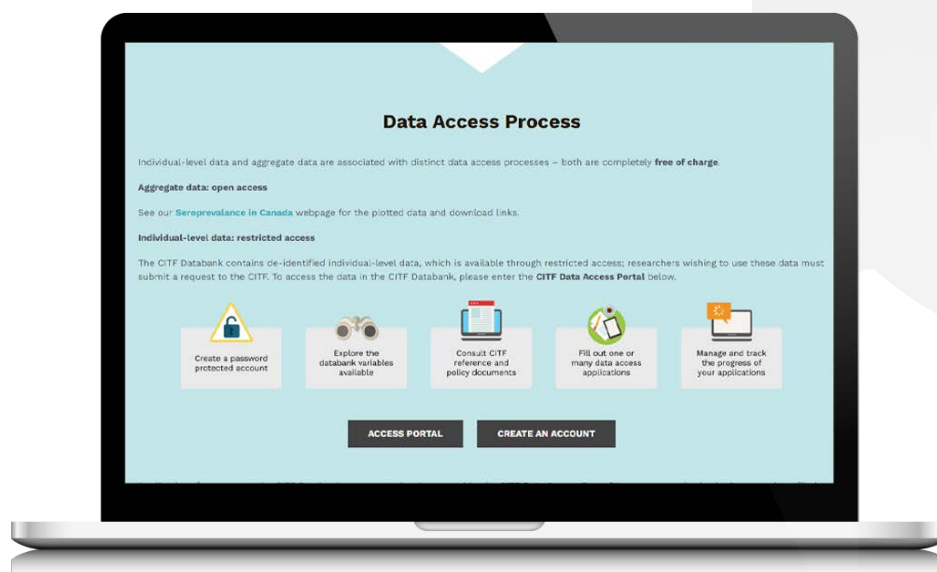
Research Institute of the McGill
University Health Centre, *DISCoVER
(Determining Infection Severity of
CoV-2 in Elderly Residents): Type
I Interferon Responses and their
Bio-Psychosocial Determinants to
Guide Management of SARS-CoV-2
Infection in the Long-Term Care
Facility Elderly*

Dr. Tania Watts

University of Toronto, *Humoral and
cellular responses to SARS-CoV-2
vaccination in pediatric acute
lymphoblastic leukemia patients*

Results from all these studies (and possibly others) will be available in the coming months in the CITF Databank.

» DISCOVER



How social determinants of health affected the COVID-19 pandemic in Canada

Social and economic inequities have contributed to how certain communities in Canada have been disproportionately affected by COVID-19. For the 12th seminar in our *Research Results & Implications* series, CITF-funded experts presented their findings on how these factors – income and material deprivation, employment, household and bedroom density, education, and race/ethnicity – have led to a higher likelihood of becoming infected with SARS-CoV-2 and suffering more severe outcomes (hospitalization and death) from COVID-19. Furthermore, social determinants have had a measurable effect on both access to vaccines and vaccine uptake across the country. The findings clarify the urgent need for policies and programs to redress these inequities and address underlying determinants of risk.

KEY POINTS:

- 1 Data on blood donors from Canadian Blood Services going back to January 2021 show consistently higher infection-acquired seroprevalence among people who declare themselves **racialized** vs. white and among donors living in the most **materially deprived neighbourhoods**.
- 2 A study of South Asians in Peel Region, an Ontario hotspot (22% of provincial cases in the second wave, but only 10% of the population), found **seropositivity was higher** among older males, less educated people, those living in multigenerational households, and those with lower income per household size.
- 3 Seroprevalence due to infection was **3X higher** among those with **high school education or less**, compared to those who had a university degree or higher in Montreal North.
- 4 Ontario hot zone and Montreal North studies showed **healthcare work and teaching** were professions with the highest seroprevalence.



5 New immigrants, the unemployed, and those with lower education were the most **vaccine hesitant**, according to data collected in Peel Region.

7 Community advisory groups are crucial to carrying out effective and efficient COVID-19-related research among Black communities. The most suitable model involves **sustained interaction** between researchers and members of a community.

6 Sickle cell disease (SCD), which predominantly affects Black people, is a known risk factor for severe outcomes from COVID-19, underscoring the importance of vaccine uptake in this population. However, **less than 10% of children with SCD had a third vaccine dose.**

8 **Outreach** through trusted community leaders and community-focused ethnic-language media proved helpful in building relationships with healthcare professionals in the South Asian population of Peel Region.

» PRESENTATION & VIDEO

Recent studies from CITF-affiliated experts have shed light on vaccine effectiveness against the Omicron variant in long-term care (LTC) residents and the protective effects of hybrid immunity. Their latest research, summarized in this section, shows that **older individuals with a history of previous infection are well protected against severe COVID-19 disease for a sustained period of time**, and even for the latest circulating Omicron subvariants. Their research suggests that recommendations for booster doses should include consideration of an individual's history of SARS-CoV-2 infection. Priority should be given to those who have never been infected, which still represented half of the older Canadian population as of last fall.

Hybrid immunity confers greater protection than vaccine-induced immunity alone

Emerging evidence point to an added boost in immunity from infections among vaccinated individuals, including protection from subsequent infection. In a cohort study of 6 million Ontario residents, CITF-funded experts Drs. Jeffrey Kwong and Sharmistha Mishra (University of Toronto) found that a previous infection was associated with a 68% increase in protection against Omicron infection for individuals with two doses of vaccine compared to infection-naïve individuals.

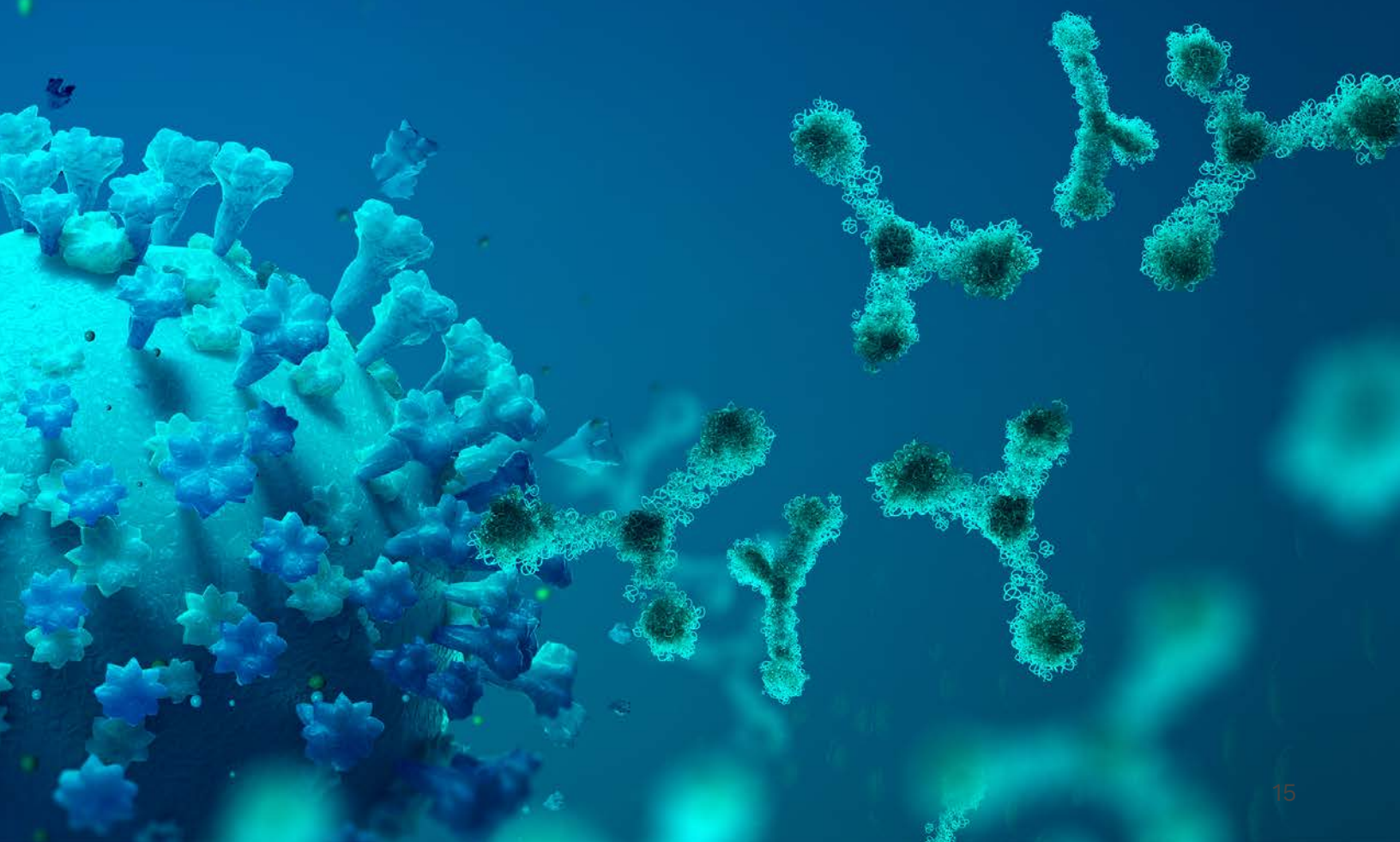
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Omicron infection in long-term care

A study by CITF-affiliated experts Drs. Andrew Costa (McMaster University) and Jeffrey Kwong (University of Toronto) confirmed that the vaccine effectiveness (VE) of a fourth dose of mRNA vaccine was highest within 84 days of the booster (~50% against infection, ~70% against symptomatic infection, and ~80% against hospitalization or death). Its marginal effectiveness (i.e., the effectiveness of a fourth dose compared to a third dose received more than 84 days earlier), was 23% against infection, 36% against symptomatic infection, and 37% against hospitalization/death.

Another study currently in preprint, not yet peer-reviewed, looked at the VE of the fourth dose, while accounting for hybrid immunity. CITF experts Drs. Gaston De Serres (Institut national de santé publique du Québec) and Danuta Skowronski (BC Centre for Disease Control) found that hybrid immunity reduced the risk of hospitalization by at least 90% throughout the entire Omicron era and that the immunity acquired from the infection held the effects of additional vaccine doses stable.

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Seminar Series | Research Results & Implications

COVID-19's youngest victims

COMING IN MARCH

At the beginning of the pandemic, COVID-19 was generally very mild in young children, creating a sense that most were not at risk.

Once Omicron struck, the millions of people infected led to vastly increased numbers of serious cases in children, as well as rare, serious, lingering complications. Furthermore, the rigorous approval process before vaccines were approved for children caused delays in pediatric vaccination. Coupled with poorer vaccine uptake in young children, this has led to gaps in immune protection against COVID-19.

The CITF has funded several studies examining the impact of SARS-CoV-2 on pediatric populations, as well as vaccine efficacy and the durability of immune responses in children.

Join our CITF-funded experts for an informative discussion about the current state of research on COVID-19 and pediatrics in Canada.

covid19immunitytaskforce.ca



The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada.