



COVID-19  
IMMUNITY  
TASK FORCE

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

## Summary report # 8

### The Omicron tsunami

## Background

---

Omicron is the most highly transmissible variant of SARS-CoV-2 that we have faced thus far in the pandemic (1). Though vaccines continue to be highly effective at protecting against serious illness and death, Omicron has proven more capable than previous variants of infecting those who were already vaccinated (2) – known as a breakthrough infection.

Omicron caused an unprecedented rise in infection-acquired seroprevalence across Canada. Between August 2021 and May 15, 2022, the percentage of Canadians with infection-acquired antibodies rose from 2% in the pre-Delta wave to over **40% after 5 months of the Omicron wave.**

For the eighth in our *Research Results and Implications* seminar series, the CITF assembled a panel of experts to address where we stand and where we are headed in the Omicron era.

## Researchers and CITF-funded studies included

Focus	Lead researcher(s) and affiliation	Research population	Location of study
Canada-wide seroprevalence studies	<b>Dr. David Buckeridge</b> Scientific Lead, Data Management and Analysis, CITF Secretariat; McGill University	General	Canada
Global epidemiology of SARS-CoV-2	<b>Harriet Ware</b> SeroTracker, University of Calgary	General	Global
Viral genetic diversity and immune escape potential	<b>Dr. Ciro Piccirillo</b> McGill University	Adult	Immune science
Hybrid immunity	<b>Dr. Michael Grant</b> Memorial University of Newfoundland	Adults	Newfoundland

## **At a glance: key findings from CITF-funded research**

The findings in this summary are preliminary and, in some instances, unpublished; they have not yet been peer-reviewed. Details about these findings are found below.

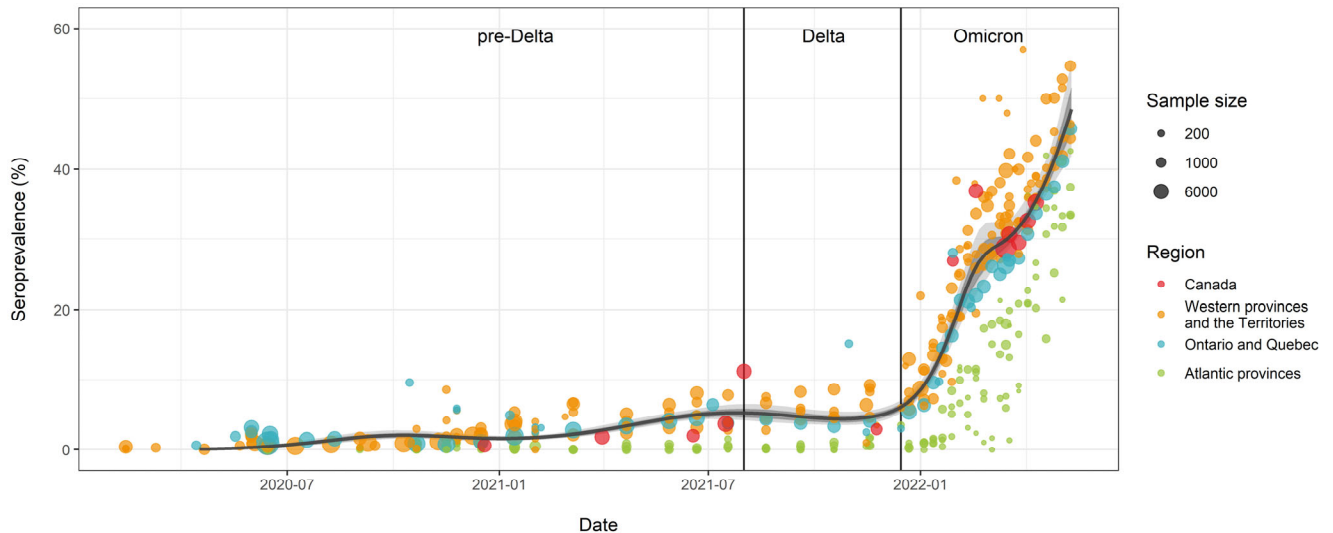
### **Key findings:**

- The idea that Omicron infection will be mild and, therefore, may be taken lightly is a dangerous myth: **tens of thousands of Canadians were hospitalized** during the Omicron wave, many needing intensive care. Moreover, **thousands of Canadians had died by June 2022 due to Omicron**: as many as during the two preceding waves of the COVID-19 pandemic.
- Globally, immunity during the Omicron wave was driven primarily by:
  - infection in Africa;
  - vaccination in the Western Pacific; and
  - a combination of vaccines and infection in high income countries within the Americas and Europe.
- Mutations make **Omicron fundamentally different** than previous variants of SARS-CoV-2 because they enable it to evade immunity, whether from vaccination or infection by earlier variants.
- Widespread Omicron infection conferred **hybrid immunity** (immunity due to a combination of vaccination and infection) to millions of people, which has offered them some protective advantages in the short term. However, an Omicron infection **does not necessarily confer sufficient immunity against re-infection**, nor is it certain to be effective against new emerging variants.
- **Young adults** have been the age group most affected by Omicron.
- **Those residing in more disadvantaged neighbourhoods** have been disproportionately affected by Omicron, revealing fault lines in many aspects of society.
- The **pandemic is not over and COVID-19 continues to pose very real risks**, despite widespread pandemic fatigue and the relaxation of mandated public health measures.
- **With new waves of infection on the horizon**, it is essential that people keep up-to-date on their vaccinations and take common sense measures to protect themselves and their loved ones from COVID-19.

## More in depth

---

### The Omicron wave caused an unprecedented rise in infection-acquired seroprevalence in Canada

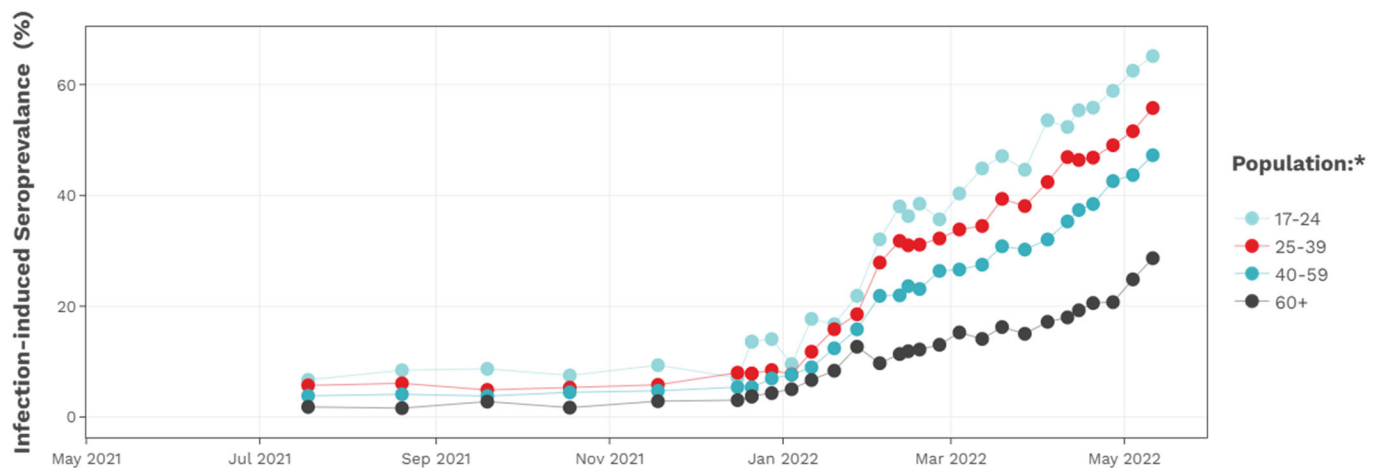


- A compilation of data from blood donors, provincial and territorial surveys, and research cohorts, presented by Dr. David Buckeridge, the Scientific Lead, Data Management and Analysis with the CITF Secretariat, illustrate how **seroprevalence increased in every province and region** in the country between December 15, 2021 and May 15, 2022. The analysis among adults (18 years and above) concluded that:
  - In the second week of May, Western Canada’s estimated seropositivity due to infection in blood donors ranged from 44% in British Columbia to 55% in Alberta.
  - Seropositivity rose to 27% in Quebec in the last week of March and to 46% in Ontario by mid-May.
  - Atlantic Canada retained the lowest seropositivity due to infection in Canada at just over 40%<sup>1</sup>, although the rate of increase in seropositivity due to infection was much higher than in any other jurisdiction during the Omicron era.

---

<sup>1</sup>Fewer samples were collected in the Atlantic Provinces.

## Omicron was notable for the significant rate at which it infected younger people



\*Estimates for age groups 17-24, 25-39, 40-59 and 60+ were provided from Canadian Blood Service

\*Estimates from the 0-17 category were provided from EnCORE, Manitoba Seroprevalence, Saskatchewan Seroprevalence and CHU Ste. Justine.

In data derived largely from blood donors, the **highest levels of seropositivity due to infection were observed in young adults** (aged 17 to 24), with about 65% being seropositive in the second week of May. Rates of infection-acquired seropositivity decreased with increasing age: 25-39 (56%), 40-59 (47%), and 60+ (29%).

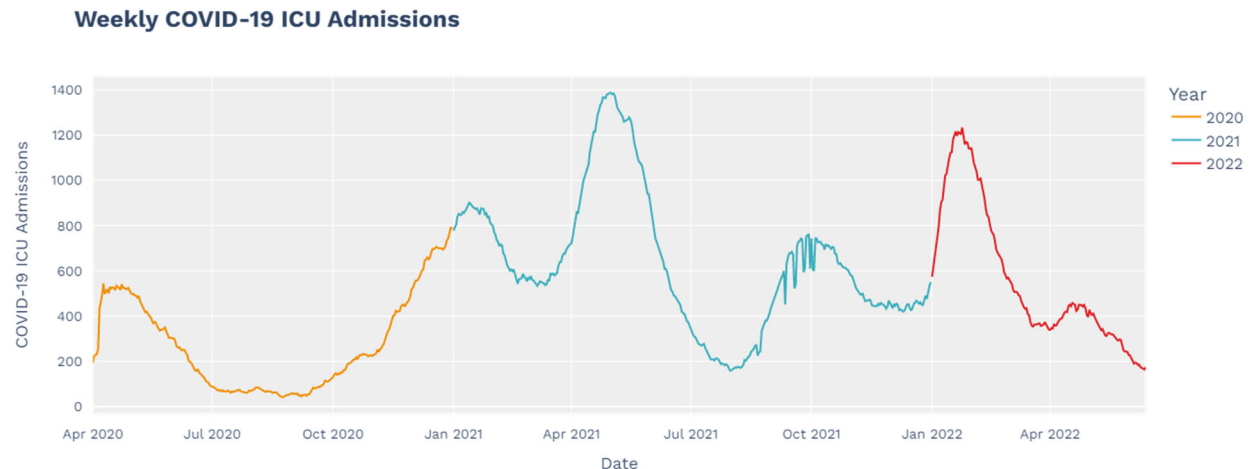
Although **children** are not included in most Canadian serosurveys, residual sera surveys from Manitoba found that 47% of children aged 1-9 and 52% of children and adolescents aged 10-19 were seropositive in March 2022. In Quebec, it was found that between 30-40% of children aged 0-17 were seropositive in the early Omicron era. In the lower mainland of British Columbia, a survey of residual blood including children reported infection rates as high as 60% in mid-February 2022.

A number of explanations have been put forward as to **why younger people have been more susceptible to Omicron**, including:

- Participation in group settings such as school/university (3, 4);
- Greater involvement in broader social networks (3, 5);
- Employment in front-line service jobs: coffee shops, restaurants;
- Closer living situations: group settings, dormitories;
- Lower perceived risk of COVID-19 (the influence of social media has had an impact)(3, 6) ;
- Being more likely to have asymptomatic or mild disease (4), therefore
  - less likely to get tested, and
  - may not test positive with rapid tests.

## Thousands were sent to intensive care units (ICU) and died during Omicron

It is not true that Omicron only brought mild, cold-like symptoms and that getting Omicron wasn't a big deal. Statistics from both the Public Health Agency of Canada and Statistics Canada suggest that, although many – if not most – did get mild symptoms, **tens of thousands were sent to hospital in serious condition and needed to be placed in the intensive care unit** during the Omicron era.



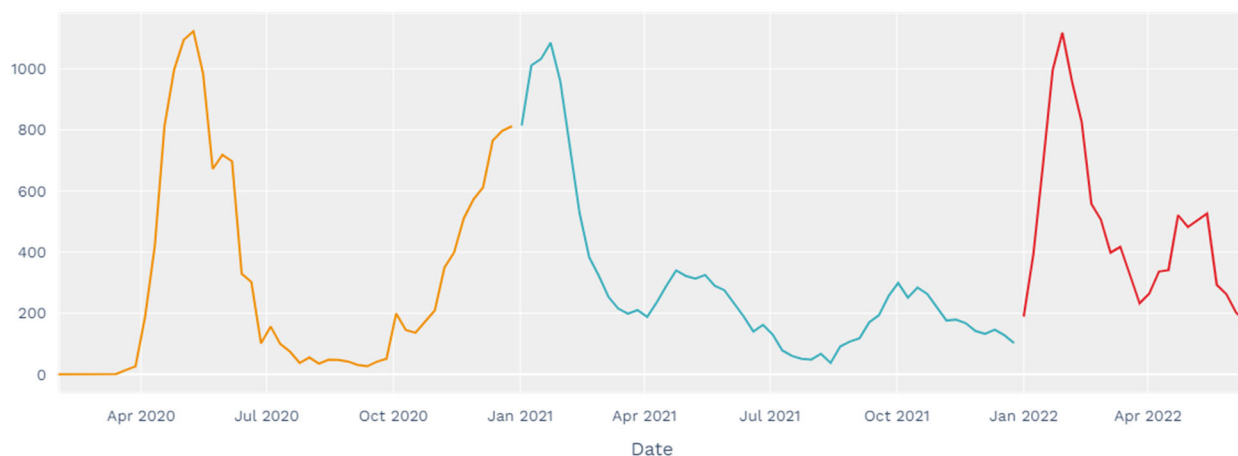
These data show weekly ICU admissions during COVID-19 pandemic. The red spike primarily represents the Omicron era (7).

Furthermore, **thousands of Canadians had died from Omicron by June**: about as many as died in the previous waves of COVID-19, according to data from the [Public Health Agency of Canada](#) (7).

Another truth: **younger Canadians experienced high excess mortality during the first Omicron wave**. According to new data from [Statistics Canada](#) (8), for those under 45 years of age, there were 15.6% more deaths than expected in January 2022. Looking at all age groups combined, there were 4,085 excess deaths, or 13.2% more than expected. There were several reasons cited for this concerning trend:

- Omicron infection itself,
- Delays in other medical procedures,
- Increased substance use – the mental health toll of the pandemic, and
- Other reasons.

## Weekly COVID-19 Related Deaths



These data show all COVID-19 related deaths from April 2020–May 2022. The red spike primarily represents the Omicron era (7).

## Around the world

**Serotracker**, a CITF-supported knowledge hub that tracks and synthesizes SARS-CoV-2 seroprevalence studies worldwide showed that seroprevalence rose during the Omicron era around the world:

- **In Africa, increases in seroprevalence were the result mainly of infection in the context of low vaccine access:** infection-acquired seroprevalence was 63.3% (Nov 2021).
- **In the Western Pacific region, increases in seroprevalence were driven mainly by vaccination:** overall seroprevalence was 94.2% (Feb 2022), while infection-acquired seroprevalence had only reached 4.3% (Nov 2021).
- Among high-income countries **in Europe and the Americas, seroprevalence increases were due to a combination of infection and vaccination:** overall seroprevalence in Europe was 95.9% (Apr 2022), and in the Americas it was 99.8% (Mar 2022).

## How Omicron escapes immunity

**Omicron appears different to the immune system compared to the ancestral SARS-CoV-2 virus** due to 30 mutations in the spike protein, most of which are found in the receptor-binding domain (Dr. Ciro Piccirillo). Antibodies, and probably memory T-cells, do not recognize Omicron variants as well as the original wild-type virus. Omicron is better able to bind to the ACE-2 receptor than its ancestors, which is why it is **more infectious**. But, it has weaker viral fusion, which is why it **generally causes less severe disease (9)**.

Dr. Piccirillo's work identified that:

1. Variants of concern (VOC) are enriched in epitope mutations.
2. When comparing different VOCs, many more mutations (over 30) were observed in the spike region of Omicron.



Further investigation done by his group among individuals with Omicron infection revealed that:

1. Omicron induces weaker humoral response (antibody response).
2. People with Omicron generally had good T-cell responses, including both Helper (CD4<sup>+</sup>) and Killer (CD8<sup>+</sup>) T cells.
3. **Infection with Omicron elicited T cell responses equivalent to those observed in individuals with a 3<sup>rd</sup> vaccine dose.**

## Hybrid immunity

Dr. Michael Grant, from Memorial University of Newfoundland, presented his research showing that **hybrid immunity – a combination of vaccine-induced and infection-acquired antibodies – produces the strongest immune response to Omicron.** His research revealed:

1. An infection boosts antibody responses induced due to two vaccine doses.
2. A moderate and/or severe infection produces a more robust antibody response against the spike protein than an asymptomatic and/or a mild infection.
3. A moderate and/or severe COVID-19 infection after two vaccine doses boosts stable and long-lasting memory T-cells and induces polyfunctional spike specific CD8<sup>+</sup> T cells.<sup>2</sup>
4. Anti-spike antibody levels are boosted by an infection after two vaccine doses, to levels similar to those after three vaccine doses.
5. Omicron infection after two or three vaccine doses induced *de novo* nucleoprotein-specific T cells.
6. Vaccinated individuals infected with Omicron make more antibodies against Wuhan spike protein than against Omicron spike protein.

While this is good news for the vaccinated who happen to become infected, **infection is not a viable strategy to achieve or maintain immunity** for the following reasons (Dr. Hankins):

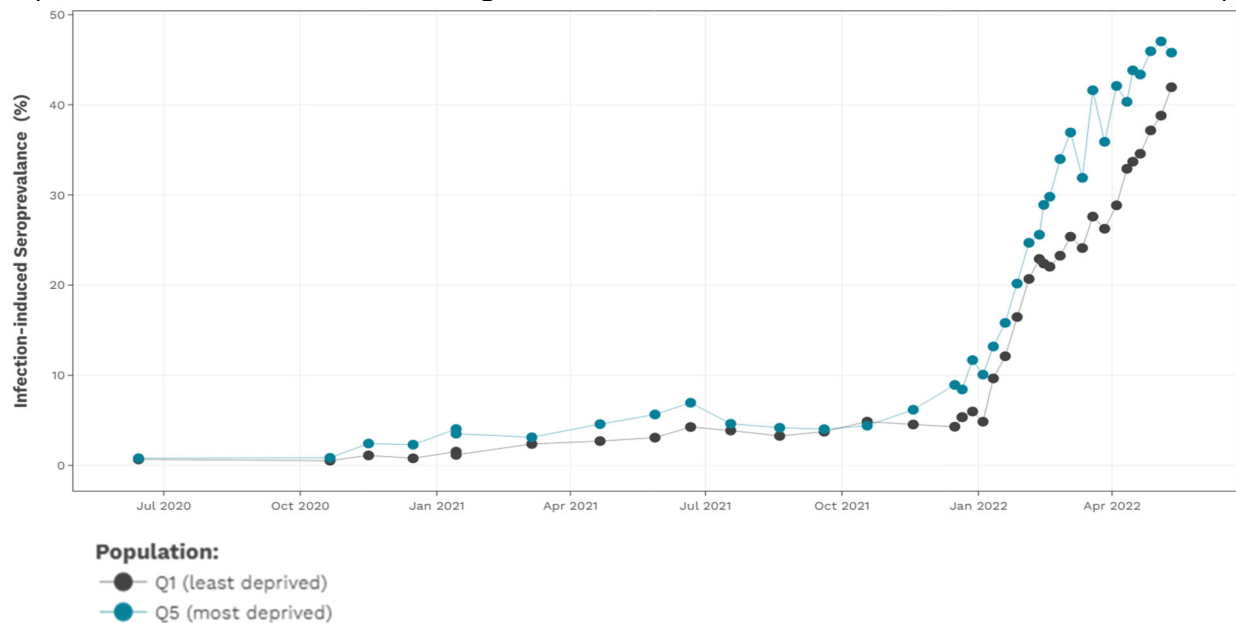
- Continuing risk of severe disease and death;
- Threat of long COVID;
- Spread of infection to others;
- Unlike vaccination, infection is not guaranteed to induce immunity (also shown by Dr. Grant).

---

<sup>2</sup> CD8+ T cells that express multiple functional markers simultaneously.

## COVID-19 has exposed fault lines in many aspects of society

CITF-funded research has consistently shown that those at the bottom of the material deprivation scale have had higher rates of infection than those at the top.



The reasons are multi-faceted, complex, and not easily resolved. They include:

- **High density living environments**, often in multi-generational households (10, 11);
- **Reduced ability to self-isolate** because many low-income earners have jobs that are deemed essential (many in healthcare, grocery shops, etc.), rely more on public transport, and have to place their young children in daycare (12, 13).
- **Fewer healthcare facilities** are accessible in low income neighbourhoods (14) .
- Low income earners have insecure employment and are more likely to be **denied sick leave and other health benefits (15)**.
- Surveys have shown **higher levels of vaccine hesitancy** among those living in lower income areas (13, 16).

## Policy implications

---

### Preparing for the next wave

- **Everybody needs to be encouraged to keep up to date on vaccines**, even if they have been previously infected. The next wave will be caused by a new variant or another sub-variant of Omicron and immunity from the current variant may not be effective against the new one.
- **Public health authorities must continue to engage the public on the dangers of COVID-19**. Despite pandemic fatigue, the danger from COVID-19 is not over and the public needs to be reminded that it still poses a real risk to public health.
- **Encourage Canadians to continue public health measures**, even though they are no longer being mandated by provinces and territories. Canadians should use their common sense to protect themselves and their loved ones from SARS-CoV-2 transmission and infection.
- **Reinforce vaccine confidence** to overcome vaccine hesitancy and expand the adoption of vaccination as the safest and most effective method for protecting the most Canadians.

## References

---

1. VanBlargan LA, Errico JM, Halfmann PJ, Zost SJ, Crowe JE, Purcell LA, et al. An infectious SARS-CoV-2 B. 1.1. 529 Omicron virus escapes neutralization by therapeutic monoclonal antibodies. *Nature medicine*. 2022;28(3):490-5.
2. Eggink D, Andeweg SP, Vennema H, van Maarseveen N, Vermaas K, Vlaemynck B, et al. Increased risk of infection with SARS-CoV-2 Omicron BA. 1 compared with Delta in vaccinated and previously infected individuals, the Netherlands, 22 November 2021 to 19 January 2022. *Eurosurveillance*. 2022;27(4):2101196.
3. Romain B, Schneiderman M, Geliebter A. Prevalence of COVID-19 in adolescents and youth compared with older adults in states experiencing surges. *PLOS ONE*. 2021;16(3):e0242587.
4. Bläckberg A, Fernström N, Sarbrant E, Rasmussen M, Sunnerhagen T. Antibody kinetics and clinical course of COVID-19 a prospective observational study. *PLoS One*. 2021;16(3):e0248918.
5. Mossong J, Hens N, Jit M, Beutels P, Auranen K, Mikolajczyk R, et al. Social contacts and mixing patterns relevant to the spread of infectious diseases. *PLoS medicine*. 2008;5(3):e74.
6. Liu PL. COVID-19 information on social media and preventive behaviors: Managing the pandemic through personal responsibility. *Social Science & Medicine*. 2021;277:113928.

7. COVID-19 epidemiology update 2022 [Available from: <https://health-infobase.canada.ca/covid-19/>].
8. Provisional deaths and excess mortality in Canada dashboard 2022 [Available from: <https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2021028-eng.htm>].
9. Cui Z, Liu P, Wang N, Wang L, Fan K, Zhu Q, et al. Structural and functional characterizations of infectivity and immune evasion of SARS-CoV-2 Omicron. *Cell*. 2022;185(5):860-71.e13.
10. Ghosh AK, Venkatraman S, Soroka O, Reshetnyak E, Rajan M, An A, et al. Association between overcrowded households, multigenerational households, and COVID-19: a cohort study. *Public Health*. 2021;198:273-9.
11. Brousseau N, Morin L, Ouakki M, Savard P, Quach C, Longtin Y, et al. SARS-CoV-2 seroprevalence in health care workers from 10 hospitals in Quebec, Canada: a cross-sectional study. *Cmaj*. 2021;193(49):E1868-e77.
12. Morales DR, Ali SN. COVID-19 and disparities affecting ethnic minorities. *Lancet*. 2021;397(10286):1684-5.
13. Jedwab J. Risk & Immunity Situation of COVID-19 in Montreal-North. 2022.
14. Nash D, McClure G, Mastracci TM, Anand SS. Social deprivation and peripheral artery disease. *Canadian Journal of Cardiology*. 2021.
15. Tai DBG, Shah A, Doubeni CA, Sia IG, Wieland ML. The Disproportionate Impact of COVID-19 on Racial and Ethnic Minorities in the United States. *Clin Infect Dis*. 2021;72(4):703-6.
16. COVID-19 in Canada: A One-year Update on Social and Economic Impacts. 2021.