July 25, 2024

Re: Discontinuation of Wastewater Surveillance in Ontario

Dear Premier Ford, Minister Khanjin, Minster Jones and Heather Jeffrey,

We are writing to express our concern that the plan to reduce wastewater surveillance in Ontario will deprive immunocompromised (IC) people of an essential tool to protect themselves from COVID-19 infections. Wastewater monitoring provides community-level data that IC people can use to assess the prevalence of COVID-19 and other infectious diseases in their communities which, in turn, allows them to assess their risks and protect themselves accordingly. Ending Ontario funding for this important tool will have direct negative consequences for the IC population in Ontario.

Note: The IC community is made up of people with many different medical conditions and diseases, including but not limited to, cancer, solid organ transplant recipients, auto-immune diseases such as lupus and rheumatoid arthritis, diabetes, primary immunodeficiency, HIV, among others.

We understand that Ontario intends to facilitate a handoff to the Public Health Agency of Canada (PHAC), however, we have major concerns about this because PHAC will not be offering the same regional precision as the current system that covers all 34 Public Health Units (59 sites currently vs 8 planned). In view of the significant impact on Ontarians who are IC, we ask that both provincial and federal-level governments collaborate to ensure that this critical surveillance program continues without interruption.

A recent study conducted by Broadstreet Health Economics & Outcomes Research demonstrated that IC people are at increased risk of severe consequences from COVID-19:

- Although the IC subgroup of Ontarians represented less than 1% of the total population, they accounted for approximately 10% of all COVID-19 hospitalizations
- IC patients experienced significantly greater clinical burden during hospitalization, associated with greater healthcare resource use and costs

- Each IC patient incurred >$5K more per hospitalization, $2.7K more 30 days post-discharge, and $10.7K more 180 days post-discharge compared to a non-IC patients with similar baseline risk factors (e.g., age, sex, vaccination status, SARS CoV 2 strains circulating at time of admission)

IC patients experienced more severe COVID-19 outcomes in hospital and post-discharge in comparison to non-IC patients, resulting in greater costs associated with the care of IC patients in hospital and post-discharge. Even for those who are not hospitalized, the risks are high and the outcomes can be significant, long-lasting, and costly to the health system. Rather than reduce the availability of wastewater surveillance data, Ontario should be taking advantage of wastewater surveillance by promoting its use by IC people and others who are vulnerable to severe consequences from COVID-19.

Below are examples of the importance of wastewater surveillance to our community members and their concern about losing broad visibility:

- **Robert Pitter, Living with Chronic Lymphocytic Leukemia:** *When the viral levels in wastewater are shown to be low, I can safely relax precautionary measures such as distancing, avoidance, isolation, and masking. When viral levels trend upward, I gradually reinstate these measures.*
In the absence of this information on viral levels, the only ways to avoid infection is the permanent use of undesirable measures such as social isolation and masking. The lack of timely information about rates of infection only adds to the mental health stresses of being immunocompromised.

- **Yuan Lew, Living with Lung Cancer:** *I am disappointed with the announcement of the shutdown of several wastewater sites and the robust system we've established over the years. I use it to schedule appointments and contractor work around the house, meet up with friends at patio restaurants, and plan vacations. Without the ON system, I am not sure when to plan these!*

- **Derek Clark, Double Lung Transplant Recipient:** *"I use wastewater surveillance information to conduct my individual risk assessment and to make informed health decisions about my daily activities, social visits and business meetings. It is vital that Ontario maintains, monitors and shares this data as it is a crucial public health tool that helps to protect vulnerable*

populations from harmful infections that can lead to severe complications. For virus tracking, wastewater is liquid gold and now is not the time to flush it away."

- **Beverly G., Auto-immune Conditions & Cancer:** *Since the beginning of the pandemic, I felt the government and health leaders took the health of all very seriously. This gave me a sense of comfort and security.*
Having access to wastewater surveillance is critical to me being able to assess how risky it might be to schedule some medical appointments (even though they're all important) and do basic things like grocery shopping or getting a haircut. If numbers are low enough, I feel better about going to a patio for a coffee or meal with friends or family, activities essential to my mental health. Losing that visibility will force me to stop doing these things which will be detrimental to my overall wellbeing.

It is imperative that Ontario's Wastewater Surveillance Initiative be maintained at the current level of surveillance to protect the immunocompromised community and manage/reduce healthcare costs related to immunocompromised people becoming infected with COVID-19.

The Canadian Immunocompromised Advocacy Network (CIAN) invites you and your colleagues to participate in a discussion to share further insights about the IC community and the importance of wastewater surveillance. Should you wish to arrange a time, please contact Michelle Burleigh, Co-Chair of CIAN, at the email below or by phone at (416) 276-8366, who will coordinate a time.

Sincerely,

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In Partnership with:

Canadian Immunocompromised Advocacy Network

Characterizing the clinical and economic burden of COVID-19 among individuals with immunocompromising conditions in Ontario, Canada: A matched, population-based observational study

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Introduction

- COVID-19 continues to be associated with substantial burden, particularly among immunocompromised (IC) patients[1,2]
- IC individuals are more likely to experience suboptimal immune responses to vaccines, and thus experience more severe COVID-19 related outcomes

Objective

This study aimed to describe and compare the burden of illness, resource utilization, and healthcare costs during and following COVID-19 hospitalizations among IC and non-IC patients in Canada

Methods

Figure 1: Study cohort diagram

All individuals captured within Ontario health administrative databases[a] between 15/01/20 – 31/03/23
(n= 17,723,871 [224,083 IC])

All individuals with a COVID-19 hospitalization[b]
(n= 115,451)

All eligible IC[c] patients (n= 101,547) → All eligible non-IC patients (n= 9,283)

Excluded patients (4.6%)
- Does not reside in Ontario (0.1%)
- Ineligible for public insurance at index (0.1%)
- Older than 105 at index (0.01%)
- <12 years at index (3.8%)
- Death prior to January 15, 2020 or index date (0.01%)

Unmatched non-IC cohort (n=64,420) → 63.4%

Matched 1:up to 4 on age, sex, COVID-19 wave of hospital admission

IC cohort (n= 9,283)

Non-IC cohort (n= 37,127)

[a]Data housed and linked at ICES
[b]Only initial COVID-19 hospitalizations were considered for each patient
[c]IC status was determined at index hospitalization, using data prior to and including the index hospitalization, and included those with ≥1 of: solid organ or stem cell transplant, hematological malignancy, rheumatoid arthritis, multiple sclerosis, or primary immunodeficiency

Outcomes & Statistical Methods

- Clinical burden, healthcare resource use (HCRU), and costs were assessed during index COVID-19 hospitalization and post-discharge (within 30- and 180-day periods post discharge) and compared between IC and non-IC patients
- Relative risks, relative rates and 95% confidence intervals (CIs) of clinical outcomes were estimated using log-binomial and modified Poisson regression
- Relative and absolute mean (95% CI) differences in costs were estimated using gamma regression
  - Models were adjusted for neighborhood deprivation, long-term care residency, baseline comorbidities (i.e., Charlson comorbidity index [CCI], frailty), and COVID-19 vaccination status

Results

Cohort Characteristics

- 9,283 eligible IC patients hospitalized with COVID-19 (mean age 68.7 years; 52.1% female) were matched to 37,127 non-IC patients (Figure 1)
- In comparison to non-IC patients, IC patients were more likely to:
  - Have more comorbidities, according to hospitalization records from the past 2 years
  - Live in neighbourhoods with lower degrees of material deprivation
  - Have a Hospital Frailty Risk Score[3] >15
  - Have received a complete COVID-19 vaccination regimen

Table 1: Baseline patient characteristics

Variable	IC (n=9,283)	Non-IC (n=37,127)
Age [mean(SD)]	68.7 (15.7)	68.7 (15.7)
Sex, F [n(%)]	4,834 (52.1)	19,335 (52.1)
COVID-19 wave of hospitalization [n(%)]		
Wave 1 (15/01/20-31/08/20)	329 (3.5)	1,314 (3.5)
Wave 2 (1/09/20-28/02/21)	814 (8.8)	3,254 (8.8)
Wave 3 (01/03/21-31/07/21)	847 (9.1)	3,388 (9.1)
Wave 4 (01/08/21-14/12/21)	293 (3.2)	1,172 (3.2)
Wave 5 (15/12/21-28/02/22)	1,942 (20.9)	7,767 (20.9)
Wave 6 (01/03/22-18/06/22)	1,527 (16.4)	6,108 (16.5)
Wave 7 (19/06/22-31/03/23)	3,531 (38.0)	14,124 (38.0)
CCI		
Mean (SD)[a]	2.5 (2.0)	2.1 (2.1)
Material deprivation[b]		
1 (least deprived)	1,581 (17.0)	5,530 (14.9)
5 (most deprived)	2,081 (22.4)	9,159 (24.7)
LTC resident [n(%)][c]	793 (8.5)	3,598 (9.7)
Frailty score > 15 [n(%)][d]	1,391 (15.0)	3,537 (9.5)
Vaccination status [n(%)]		
Unvaccinated	2,517 (27.1)	12,876 (34.7)
Partially vaccinated	428 (4.6)	1,643 (4.4)
Fully vaccinated[e]	6,338 (68.3)	22,608 (60.9)
Fully vaccinated + booster	4,715 (50.8)	15,302 (41.2)
IC conditions [n(%)]		
Rheumatoid arthritis	3,926 (42.3)	-
Haematological malignancy	2,435 (20.2)	-
Solid organ transplant	1,751 (18.9)	-
Multiple sclerosis	907 (9.8)	-
Primary immunodeficiency	461 (5.0)	-
Allogeneic/autologous BMT	381 (4.1)	-

Abbreviations: BMT, bone marrow transplant; CCI, Charlson Comorbidity Index; IC, immunocompromised; LTC, long-term care; non-IC, non-immunocompromised; SD, standard deviation.
[a]Data housed as having received any of the following: 1) one dose of Janssen, or 2) two doses of a health Canada authorized vaccine, or 3) one dose of a non-Health Canada authorized vaccine and one dose of a Health Canada authorized vaccine, or 4) three or more doses of a vaccine (Health Canada authorized or not). [c] p=0.08

References: 1. Public Health Agency of Canada (2022). Canadian COVID-19 vaccination uptake report. 2. Government of Canada (2023). COVID-19 Epidemiology update: Current situation. 3. Gilbert et al. (2018). Lancet 391(10132):1775-1782
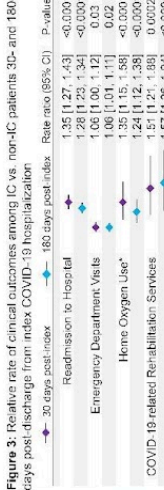
Clinical outcomes during and post index hospitalization

- In comparison to non-IC patients, IC patients were at significantly greater risk of the following, after adjusting for baseline patient characteristics (Figure 2):
  - ICU admission (**+6%**)
    - Receipt of any ventilation (**+27%**)
    - Receipt of invasive ventilation, including ECMO (**+24%**)
  - In-hospital mortality (**+34%**)
- Within 30-days post-discharge, IC patients experienced significantly greater adjusted rates of (Figure 4):
  - All-cause readmission to hospital (**+35%**)
  - Emergency department visits (**+6%**)
  - Home oxygen use (**+31%**)
  - COVID-19-related rehabilitation services (**+51%**)
- Within 180-days post-discharge, the rates of HCRU among IC patients remained significantly higher than HCRU rates among non-IC patients; the rate of hospital readmissions decreased slightly over time (Figure 3)

Figure 2: Relative risk of clinical outcomes among IC vs. non-IC patients during index COVID-19 hospitalization
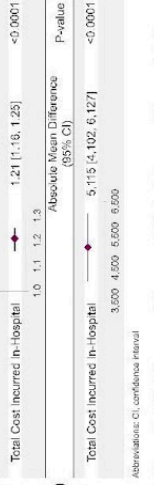
	Risk ratio (95% CI)	P-value
ICU Admission	1.06 [1.01, 1.12]	0.01
Receipt of Any Ventilation	1.27 [1.19, 1.36]	<0.0001
Receipt of Invasive Ventilation or ECMO	1.24 [1.16, 1.33]	<0.0001
Receipt of Non-Invasive Ventilation	1.10 [0.87, 1.40]	0.43
Mortality in Hospital	1.34 [1.27, 1.41]	<0.0001

Abbreviations: CI, confidence interval; ECMO, extracorporeal membrane oxygenation; ICU, intensive care unit
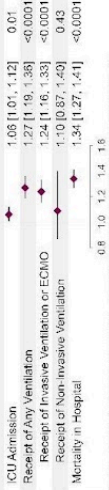
Figure 3: Relative rate of clinical outcomes among IC vs. non-IC patients 30- and 180-days post-discharge from index COVID-19 hospitalization

	Rate ratio (95% CI)	P-value
30 days post-index		
Readmission to Hospital	1.35 [1.27, 1.43]	<0.0001
Emergency Department Visits	1.06 [1.00, 1.12]	0.03
Home Oxygen Use[*]	1.06 [1.01, 1.11]	0.02
COVID-19-related Rehabilitation Services	1.51 [1.21, 1.88]	0.0002
180 days post-index		
	1.28 [1.23, 1.34]	<0.0001
	1.35 [1.15, 1.58]	<0.0001
	1.24 [1.12, 1.38]	<0.0001
	1.57 [1.26, 1.94]	<0.0001

Abbreviations: CI, confidence interval; COVID-19, coronavirus-19; [*]only a risk ratio was calculated for home oxygen use due to this being a binary measure.
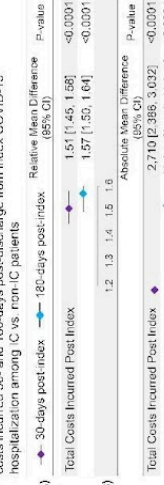
Costs during and post index hospitalization

- The mean (SD) cost of an index COVID-19 hospitalization was $25,496 ($42,520) for an IC patient and $21,983 ($38,504) for a non-IC patient.
- Total costs incurred during index COVID-19 hospitalization were **21% higher** in the IC cohort relative to the non-IC cohort, after adjusting for patient characteristics (Figure 4A)
  - The absolute mean difference in cost per IC versus non-IC patient per index COVID-19 hospitalization was **$5,115** (Figure 4B)
- Total adjusted costs incurred 30- and 180-days post-discharge were **51% and 57% higher** in the IC cohort versus the non-IC cohort, respectively, after adjusting for patient characteristics (Figure 5A)
  - The absolute mean difference in HCRU costs per IC versus non-IC patient were $2,719 30-days post-discharge, and $10,657 180-days post-discharge (Figure 5B)

Figure 4: A) Relative mean difference and **B)** absolute mean differences in total costs incurred during index COVID-19 hospitalization among IC vs. non-IC patients

A)
	Relative Mean Difference (95% CI)	P-value
Total Cost Incurred In-Hospital	1.21 [1.16, 1.25]	<0.0001

B)
	Absolute Mean Difference (95% CI)	P-value
Total Cost Incurred In-Hospital	5,115 [4,102, 6,127]	<0.0001

Abbreviations: CI, confidence interval

Figure 5: A) Relative mean difference and **B)** absolute mean difference in total costs incurred 30- and 180-days post-discharge from index COVID-19 hospitalization among IC vs. non-IC patients

A)
	Relative Mean Difference (95% CI)	P-value
Total Costs Incurred Post Index	1.51 [1.45, 1.58]	<0.0001
Total Costs Incurred Post Index	1.57 [1.50, 1.64]	<0.0001

B)
	Absolute Mean Difference (95% CI)	P-value
Total Costs Incurred Post Index	2,710 [2,386, 3,032]	<0.0001
Total Costs Incurred Post Index	10,657 [9,459, 11,864]	<0.0001

Abbreviations: CI, confidence interval

Discussion

- Between January 2020 and March 2023, 9,283 patients with IC from a total of 224,083 patients with COVID-19 were hospitalized with COVID-19 in Ontario.
  - Although the IC subgroup represented 1% of the total population, they accounted for approximately 10% of all COVID-19 hospitalizations
  - IC patients experienced significantly greater clinical burden during hospitalization, associated with greater healthcare resource use and costs
  - Each IC patient incurred $5K more per hospitalization, $2.7K more 30-days post-discharge, and $10.7K more 180-days post-discharge compared to a non-IC patient with similar baseline risk factors (e.g., age, sex, vaccination status, SARS-CoV-2 strains circulating at time of admission)
- **Strengths:** This study used population-based data capturing all COVID-19 hospitalizations from a population of >17 million residents in Canada
- **Limitations:** Unmeasured confounding between IC and non-IC cohorts remain, given the lack of complete prescription data for younger patients and lack of in-hospital prescription data in the databases used, the use of additional prophylactic treatments for COVID-19 (e.g., remdesivir) were not adjusted for. IC patients may have been more likely to receive these treatments, which may lead to underestimation of risk of outcomes among the IC cohort.

Conclusions

- IC patients experienced more severe COVID-19 outcomes in hospital and post-discharge in comparison to non-IC patients, resulting in greater costs associated with the care of IC patients in hospital and post-discharge
- COVID-19 mitigating policies and prophylactic treatments are needed to continue to protect IC populations