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PUBLIC HEALTH FUNDING AND COVID-19 OUTCOMES AND VACCINATION

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Disclosures

We do not have anything to disclose

Learning objectives

DESCRIBE

Link between public health unit funding and severe COVID-19 outcomes and vaccination coverage in Ontario

EVALUATE

How public health funding can play a role in achieving health equity

APPLY

OPHID findings to public health funding, pandemic preparedness, and health equity in future emergencies

OPHID STUDY TEAM

Principal Investigators:

- Roman Pabayo (University of Alberta)
- Brendan Smith (Public Health Ontario)

Co-Investigators:

- Laura Anderson (McMaster University)
- Dionne Gesink (University of Toronto)
- Erin Hobin (Public Health Ontario)
- Elaine Hyshka (University of Alberta)
- Scott Leatherdale (University of Waterloo)
- Candace Nykiforuk (University of Alberta)
- Karen Patte (Brock University)
- Sentil Senthilselvan (University of Alberta)
- Arjumand Siddiqi (University of Toronto)
- Kate Storey (University of Alberta)

OPHID Advisory Council:

- alPHa, Boards of Health, public health unit (PHU) Chief Executive Officers, local Medical Officers of Health and Affiliate organizations (e.g., PHU Business Administrators, Public Health Dentistry)

Knowledge Users/Collaborators:

- alPHa, Public Health Ontario, Toronto Public Health, OPHA

Why public health funding matters

Public health's essential role

Preventing disease and injury, improving well-being, and promoting health equity[1]

Underinvestment

"Boom and bust" funding cycles weaken public health infrastructure in Canada and internationally[2,3]

6%

of total health spending in Canada is allocated to public health[5]

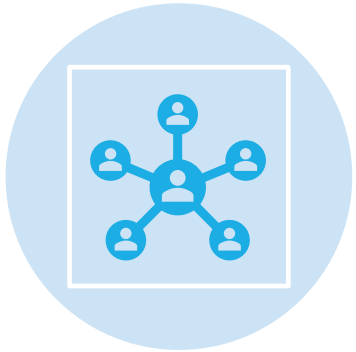
$14 saved in healthcare costs

for every $1 invested over a 10-year period, based on systematic review of public health interventions[4]

Gaps and Opportunities

Build public health system data

Develop and track public health systems indicators



Link public health data to population health and health equity

Measure the quality of public health programs

Ontario’s public health system – a unique opportunity

System	Well-defined, decentralized public health system
Mandate	Delivered through local public health units in line with Ontario’s Public Health Standards
Variability	Services delivered locally according to community needs
Data	Availability of longitudinal public health system, health outcome and equity data

Ontario Public Health Information Database (OPHID) study

Overall goal:

- Build a public health system indicator database through systematic data collection on funding, workforce and program delivery
- Estimate the impacts of funding changes to Ontario's public health system on population health and health equity

Study objectives:

- Advance international evidence on public health systems
- Measure changes over time in Ontario's public health system
- Study the associations between public health systems, population health and health equity

OPHID at a glance

2020
OPHID dataset created

2022
Sexual and mental health

2023
COVID-19 and vaccination

2024
Suicide, drug and alcohol harm

2025
Income inequality and mental health

100%

PHUs captured in OPHID

OPHID Indicators

- Budgeted funding, staffing (full time equivalents and funding)
  - total and per capita public health unit funding
  - funding by program and foundational standards
  - staffing FTE and dollars for FTEs for various positions (e.g., public health nurses)
- Program and services descriptions

Population health and health equity

Data linkages:

- **Cohort**: COMPASS - mental health (focus on adolescents); income inequality
- **Surveillance**: integrated Public Health Information System (iPHIS) - sexual health
- **Administrative**: COVID-19 and vaccination outcomes (ICES)
- **Linked survey data**: deaths due to alcohol, opioid and suicide (Statistics Canada)

Public health funding and COVID-19 hospitalizations and deaths: a time-to-event analysis in Ontario, Canada

Background

- **COVID-19 pandemic** had far reaching health and social consequences and illustrated weaknesses of the public health system in responding to emerging threats
  - Social and racial inequities in COVID-19 outcomes[6] exacerbated existing health and social inequities[7,8]
- Potential mitigating role of public health funding on the health and social impacts of the COVID-19 pandemic is understudied

Objectives

1. Estimate the association between public health unit (PHU) funding and COVID-19 hospitalization or death
2. Examine whether associations differ across:
    - individual-level immigration status
    - neighbourhood-level material resources (SES)
    - neighbourhood-level proportions of racialized and newcomer populations

This work is hypothesis generating, looking for associations that require further unpacking to understand their causes

Data and sample

- **Retrospective population-based cohort study** using linked OPHID and health administrative data among 13,756,277 individuals in Ontario, Canada (March 1, 2020 to December 31, 2022)
    - *Exclusion criteria:* long term care resident (0.7%), no PHU assigned (0.2%), missing PHU funding information (4.1%), or no contact with health care system (3.4%)
- **Health administrative datasets** at ICES captured baseline characteristics and COVID-19 hospitalizations and death
- **PHU indicator data:** OPHID 2019 data

Measures

Outcome: COVID-19 hospitalizations or death

- ***Hospitalizations***: ICD-10 code U071 (COVID-19, virus identified), U073 (multisystem inflammatory syndrome associated with COVID-19)[9], with positive COVID-19 test 14 days or less before/3 days or less after hospitalization date
- ***Deaths***: death from any cause, with positive COVID-19 test 30 days before/7 days after death

Exposure: pre-pandemic 2019 PHU funding per capita

- 2019 approved mandatory programs funding for each PHU divided by 2019 PHU population
- *Transformed*: reflects $10 increase in PHU funding per capita

Covariates

Individual-level:

- age
- sex
- pre-existing chronic conditions

Neighbourhood-level:

- percentage of multigenerational housing,
- multi-unit housing,
- unsuitably crowded housing,
- essential workers, and
- population centre class

PHU-level:

- PHU region

Statistical Analyses

Primary analysis: estimated association between PHU funding per capita and incident COVID-19 hospitalization or death

- Applied **Fine and Gray subdistribution hazard models to account competing risk**
- Fully adjusted models included individual-, neighbourhood-, and PHU-level covariates

Secondary analyses: assessed potential subgroup differences across

1. individual-level immigration status
2. neighbourhood-level SES
3. neighbourhood-level racialized and newcomer population

Results

5% decreased hazard of COVID-19 hospitalization or death per $10 funding increase (95%CI: 0.90-0.99)

Results

5% **decreased hazard** of COVID-19 hospitalization or death per $10 funding increase (95%CI: 0.90-0.99)

Exposure	Modifier	aHR (95% CI)
PHU funding per capita* Immigration status	Canadian born	Ref
	Immigrant (>5 years)	0.98 (0.93-1.03)
	Recent immigrant (≤5 years)	0.92 (0.84-1.01)
PHU funding per capita* Neighbourhood-level SES	Q1 (high SES)	Ref
	Q2	0.95 (0.90-1.00)
	Q3	0.94 (0.90-0.99)
	Q4	0.94 (0.90-0.98)
	Q5 (low SES)	0.94 (0.90-0.99)
PHU funding per capita* Racialized and newcomer population	Q1 (low racialized and newcomer population)	Ref
	Q2	0.95 (0.90-1.00)
	Q3	0.93 (0.88-0.98)
	Q4	0.92 (0.87-0.97)
	Q5 (high racialized and newcomer population)	0.98 (0.93-1.02)

Results are from fully adjusted models

Summary

- Higher levels of pre-pandemic PHU funding per capita was associated with lower rates of COVID-19 hospitalization or death

- PHU funding had a greater impact in reducing COVID-19 hospitalization or death among:

  1. recent immigrants
  2. neighbourhoods with lower SES
  3. neighbourhoods with higher proportions of racialized and newcomer populations

Public health funding, COVID-19 vaccination, and the potential for decreasing health inequities

Background

COVID-19 vaccination

- Variability in public health funding across local public health units
- During the COVID-19 pandemic, such funding variability may influence differences in vaccine administration policies
- In particular, how equity-deserving groups were prioritized

Objectives

1. Determine whether PHU funding was associated with COVID-19 vaccination rates
2. Examine whether associations differ across:
    - individual-level immigration status
    - neighbourhood-level material resources (SES)
    - neighbourhood-level proportions of racialized and newcomer populations

This work is hypothesis generating, looking for associations that require further unpacking to understand their causes

Methods

- **Data sources:** Baseline characteristics, vaccination status, and mortality data were analyzed from administrative datasets at ICES
- Retrospective cohort study with population-level data
- **Data analysis:**
  - Hazard models COVID-19 vaccination status (completed series / completed series + booster)
- Examined interactions between public health funding and:
  - individual-level immigration status
  - neighbourhood-level material resource deprivation
  - neighbourhood-level racialized and newcomer population

Results

Each additional $10 PHU funding per capita was associated with 2% increased completion of COVID-19 primary vaccination series and COVID-19 primary vaccination series + booster

Greater association with greater racialized/newcomer population and among recent immigrants. Small increase in lower SES groups

Models with Controls for Individual + Neighbourhood + PHU factors	
Exposure	**Hazard Ratio (95% CI)**
PHU per capita funding (per 10$ per capita)	1.02 (1.00-1.03)

Exposure	Moderator	Hazard Ratio (95% CI)
PHU per capita funding (per 10$ per capita)	**Immigration status**	
	Canadian born	Ref
	Immigrant (>5 years)	1.02 (1.00-1.05)
	Recent immigrant (≤5 years)	1.06 (1.01-1.11)
PHU per capita funding (per 10$ per capita)	**Material resources**	
	Q1 (most material resourced)	Ref
	Q2	1.02 (1.00-1.03)
	Q3	1.02 (1.00-1.03)
	Q4	1.01 (1.00-1.03)
	Q5 (least material resourced)	1.02 (1.00-1.03)
PHU per capita funding (per 10$ per capita)	**Racialized and newcomer population**	
	Q1 (least racialized and newcomer population)	Ref
	Q2	1.01 (0.99-1.02)
	Q3	1.01 (1.00-1.03)
	Q4	1.03 (1.01-1.05)
	Q5 (most racialized and newcomer population)	1.04 (1.01-1.07)

Results are from fully adjusted models

Summary

- Higher levels of pre-pandemic PHU funding per capita was associated with higher rates of COVID-19 vaccination

- PHU funding had a greater impact in increasing COVID-19 vaccination among:

  1. recent immigrants
  2. neighbourhoods with lower SES
  3. neighbourhoods with higher proportions of racialized and newcomer populations

Limitations and strengths

Limitations:

- Inability to measure new or pandemic-specific funding during study timeframe (due to inconsistent reporting across PHUs)
- Missing funding information from 3 PHUs, impacts generalizability (PHUs in study cover 96% of Ontario population)
- Aggregate public health funding does not consider how funding is allocated or quality of resulting programs
- Residual confounding

Strengths:

- Large population-based cohort study
- Decentralized delivery of public health in Ontario: advantageous to examine natural variation in public health systems
- OPHID Advisory Council

Equity-informed strategies to promote COVID-19 vaccination uptake undertaken by public health units in Ontario, Canada

Background

Strategies to strengthen COVID-19 vaccine delivery systems and ensure equitable access to the vaccines

- COVID-19 vaccines were prioritized to high-risk populations (e.g., elderly, immunocompromised, healthcare workers)
- The Ontario vaccination effort provides an opportunity to study the challenges of integrating health equity-informed vaccination actions

Objective

1. Describe local public health strategies to promote COVID-19 vaccination equity in Ontario, Canada between 2020-2023

Methods

- COVID-19 health equity programs survey was administered to measure impacts of PHU programming
- OPHID Advisory Council, including 10 public health leaders, supported the recruitment and activities and advice on survey methods
- Questions regarding health equity in:
  1. COVID-19 testing and providing information
  2. Health equity in COVID-19 vaccinations
- 25 Public health units agreed to participate (response rate=73.5%)
- Data Analysis:
  - Qualitative analysis of survey data on public health's COVID-19 equity-driven vaccination strategies in 2023
  - Descriptive statistics and Inductive content analysis

Results

Descriptive:

- Over 80% of participating PHUs reported prioritizing health equity through:
  - providing information on vaccination
  - community engagement
  - improving physical accessibility to COVID-19 vaccines
- A lower, 40% prioritized health equity in data collection

Themes:

- Equity-based decision-making process: Defining priority populations with data-driven and health equity-oriented processes
- Equity informed actions: Promoting vaccination through health equity-informed strategies
- Indigenous health: Prioritizing Indigenous health and sovereignty in vaccination efforts
- Recommendations and proposed solutions: address health equity-related barriers to COVID-19 vaccination

Discussion

- **First Canadian studies** linking public health funding to COVID-19 health outcomes
- Higher pre-pandemic PHU funding associated with improved COVID-19 outcomes
- Funding impact was greater for reducing inequities across racial and SES groups
- Higher-funded PHUs may have had greater capacity for pandemic and equity-specific responses[11,12]
- Qualitative analysis revealed strong equity emphasis, with variation across Ontario PHUs
  - Stronger PHU guidance needed on effective measures to reduce health inequities

OPHID study: next steps

- Build capacity for using public health systems data in public health planning
- Focus on trends in public health workforce capacity
- Generate evidence on the value of public health, demonstrating the systems role in improving population health and achieving health equity
- Exploring ways to optimize knowledge mobilization and knowledge translation
- Establishing similar public health indicator databases in other provinces

OPHID study findings

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Thank you!

Questions?

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