

# Mapping Neighbourhood Vulnerability to COVID-19

---

Dr. Valorie Crooks & Leah Rosenkrantz

Department of Geography, Simon Fraser University


With: Dr. Nadine Schuurman, Dr. Melissa Giesbrecht,  
Jessica Tate, Kristie Nicol, Paul Burgener





**World Health Organization (WHO)**  @WHO · Jan 4, 2020



[#China](#) has reported to WHO a cluster of [#pneumonia](#) cases —with no deaths— in Wuhan, Hubei Province  . Investigations are underway to identify the cause of this illness.



85



1K



770



**World Health Organization (WHO)**  @WHO · Jan 4, 2020



WHO is closely monitoring this event and will share more details as we have them.

WHO is working across the 3 levels (country office, regional office, HQ) to track the situation. [#pneumonia](#) [#China](#)

# As a health geographer

“...when a health concern like COVID-19 and mitigation efforts impact and involve fundamental societal structures, almost all areas of society and social life, and most humans and the human experience, then more so than ever it becomes an issue for not only the health sciences but for the social sciences as well.”

Global Perspectives on Health Geography

Gavin J. Andrews · Valorie A. Crooks  
Jamie Pearce · Jane P. Messina *Editors*

## COVID-19 and Similar Futures

Pandemic Geographies

## The 'Ah ha!' moment

*Human geographic* considerations in BC, including rurality, community, culture and population movement with a view to prevent transmission and mitigating effects.



MICHAEL SMITH FOUNDATION  
FOR HEALTH RESEARCH

BC's health research funding agency





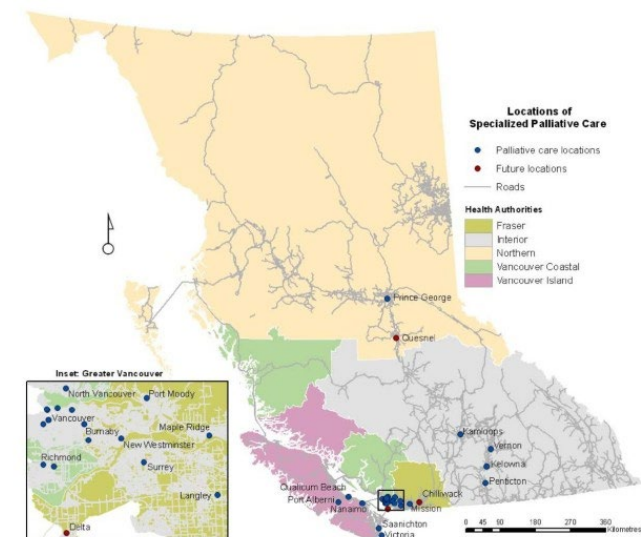
Research article | [Open Access](#) | Published: 04 March 2020

## Where to enhance rural palliative care? Developing a spatial model to identify suitable communities most in need of service enhancement

[Nadine Schuurman](#) , [Michael E. Martin](#), [Valorie A. Crooks](#) & [Ellen Randall](#)

*BMC Health Services Research* **20**, Article number: 168 (2020) | [Cite this article](#)

495 Accesses | 3 Altmetric | [Metrics](#)



# What we're building on



# Goal

- to produce a series of maps that will identify *specific* locations in BC at risk of experiencing high rates of COVID-19 infection, of inadequate spatio-temporal access to ICU care, and of being vulnerable to the secondary effects of pandemic that can be used to support informed decision-making

# Objectives



---

- create and run a set of new vulnerability index models (referred to as CORVIX models) that can facilitate informed public health and health services decision-making about COVID-19 by generating maps as a key **decision-support tool**;
- **refine** the CORVIX models using new information as it becomes available,
- dialogue with end-users to **obtain feedback** on how the models can be improved and to assist with interpreting the results to support decision-making



# COVID-19 Risks in British Columbia's Neighbourhoods

Mapping Risk & Vulnerability Across the Province

CORVIX1

---



# The process



# Where we started

- Age
- Sex
- Ethnicity
- Socio-economic status
- Educational attainment
- Smoking
- Household crowding
- Housing type
- Employment type
- Air pollution exposure
- Wildfire smoke
- Population density
- Food insecurity
- International entry points
- Tourist destinations
- Long term care facilities
- Prisons
- Food processing plants
- Large-scale agriculture



A critical  
moment

# Developing the model

- Our lightbulb moment led us to define vulnerability according to the following equation:

***Vulnerability*** = *relative infection risk + relative exposure risk*



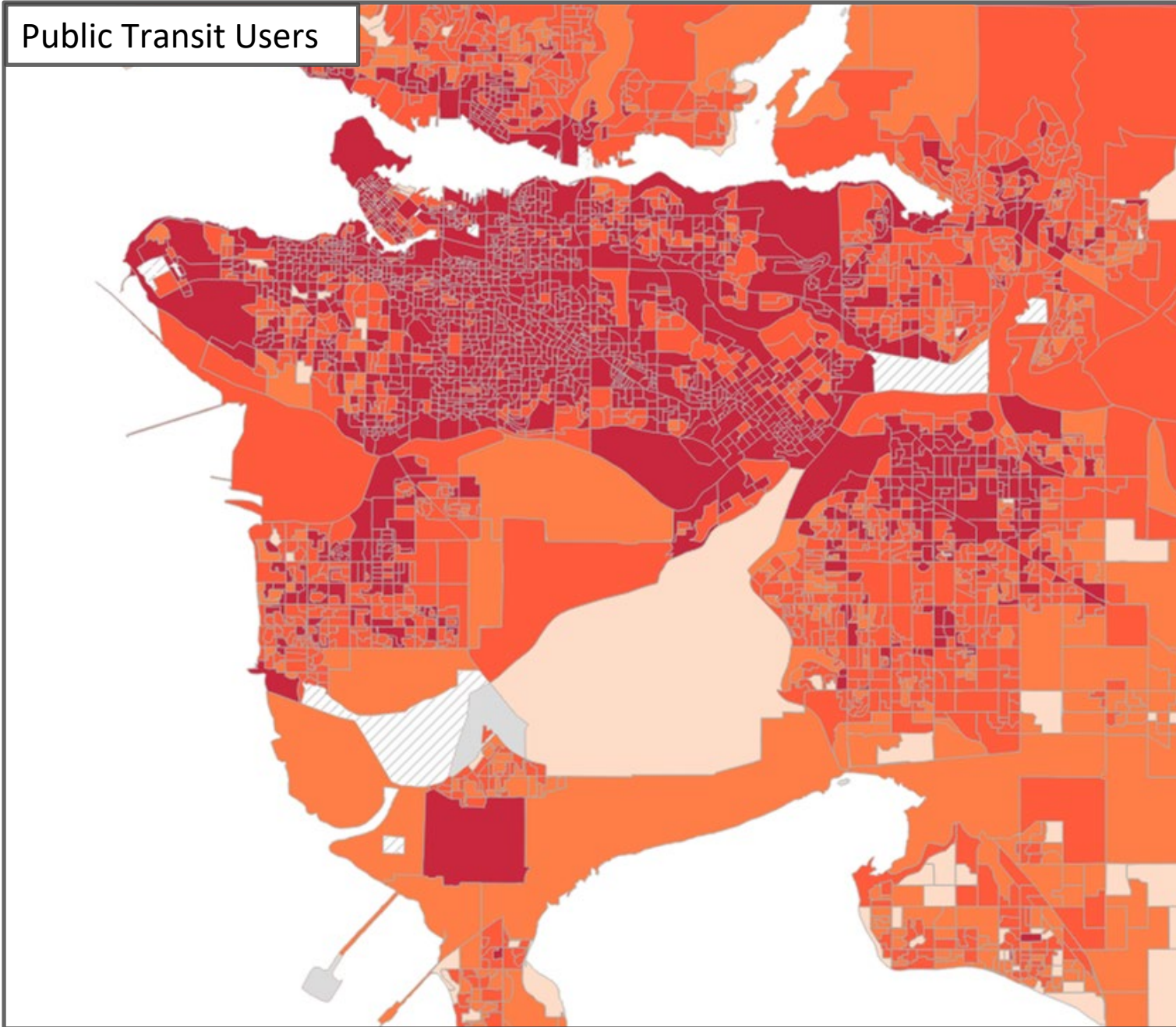
# Relative infection risk index

## **Indicators:**

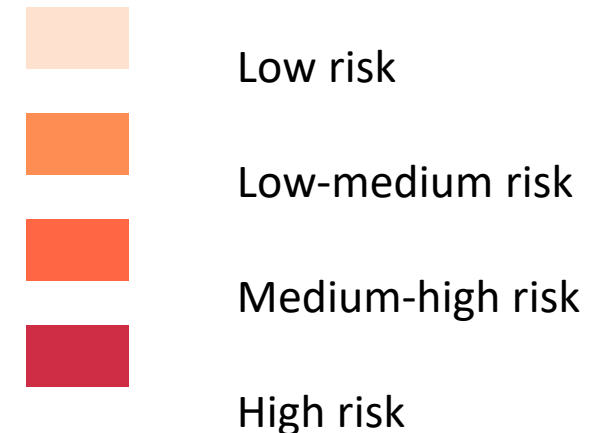
1. Living in a large household
2. Living in a crowded household
3. Not knowing English
4. Working outside the home
5. Being employed in a high-risk industry
6. Being a public-transit user
7. Being socioeconomically disadvantaged



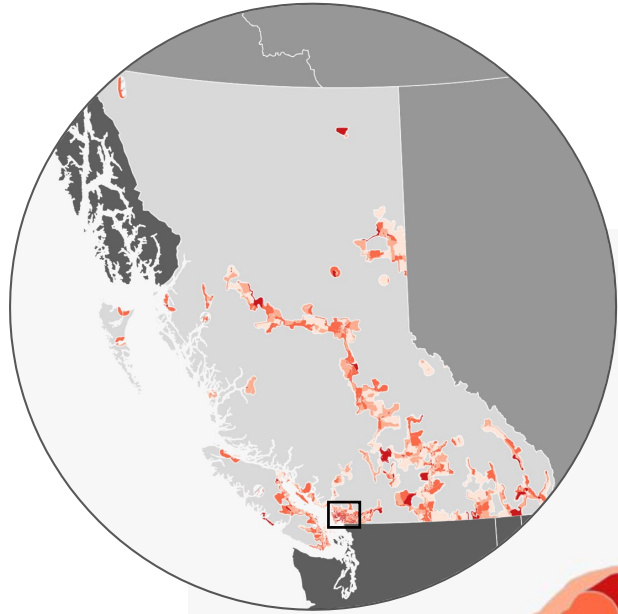
## Public Transit Users



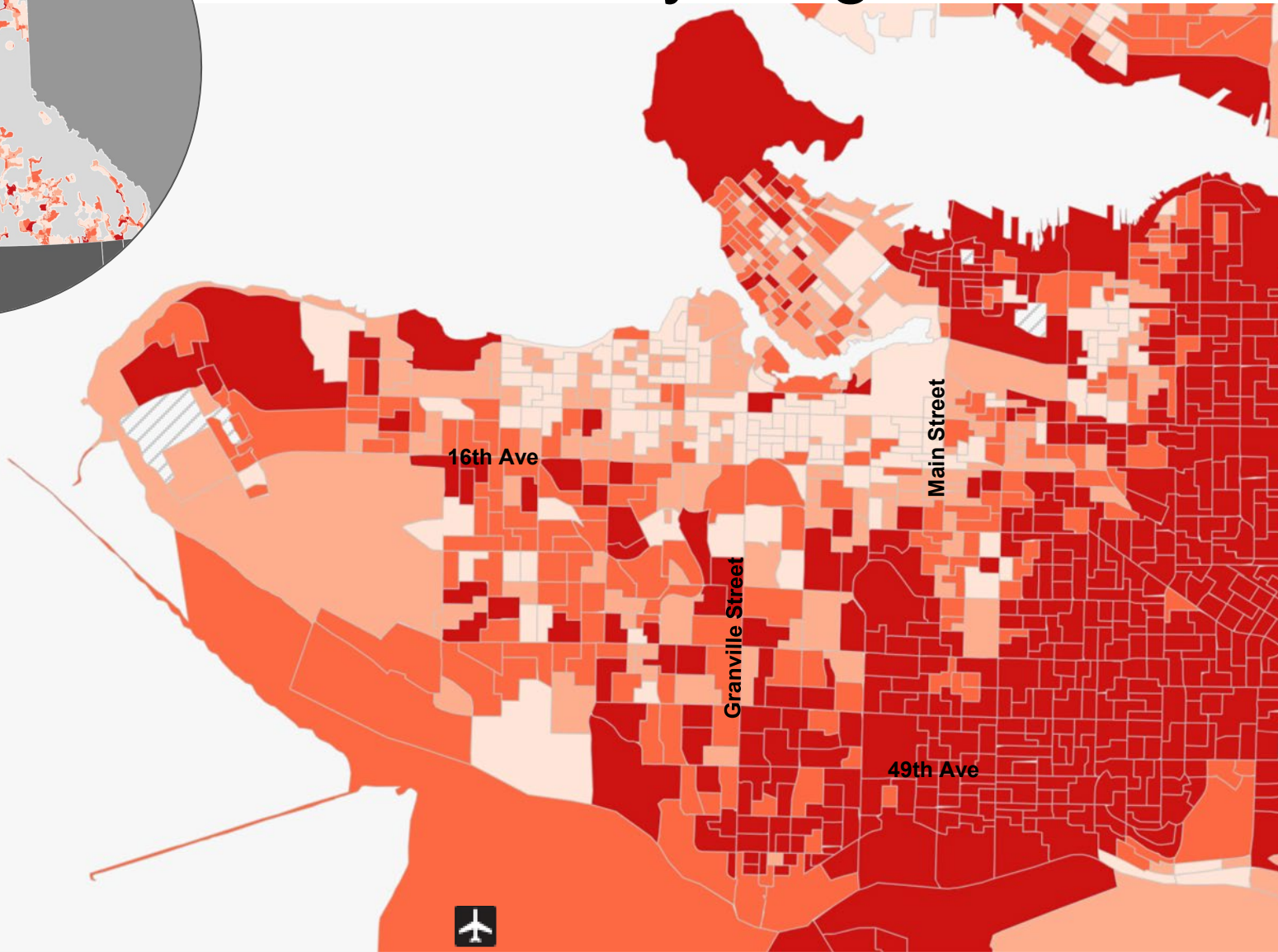
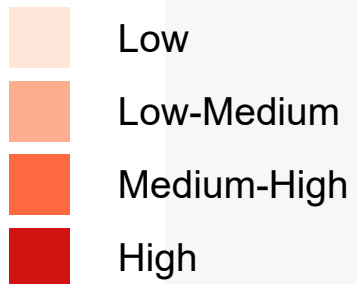
*\*\* As a reminder, our indicators are based off a 'business as usual approach' so even though it has been found that public transportation is safe given certain precautions like mask wearing and physical distancing, our models assume a status quo of constant ridership and normal pre-pandemic behaviors (i.e., no mandatory masking/physical distancing).*



# Relative Infection Risk for SARS-CoV-2 by Neighbourhood



## Relative Risk



## Indicators

- Living in a large household
- Living in a crowded household
- Not knowing English
- Not working from home
- Being a public transit user
- Being employed in a high-risk industry
- Socioeconomic Deprivation (VANDIX)

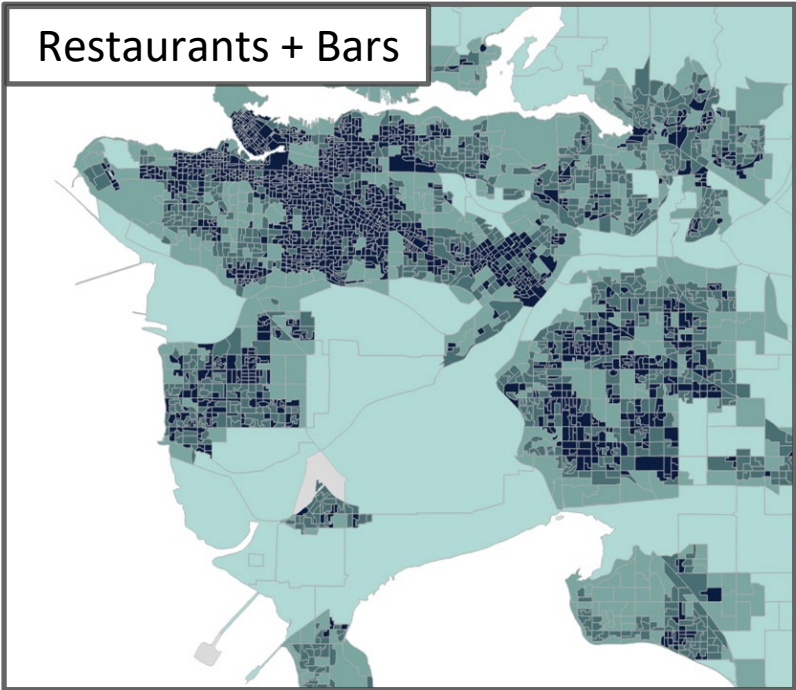
# Relative exposure risk index

## Indicators:

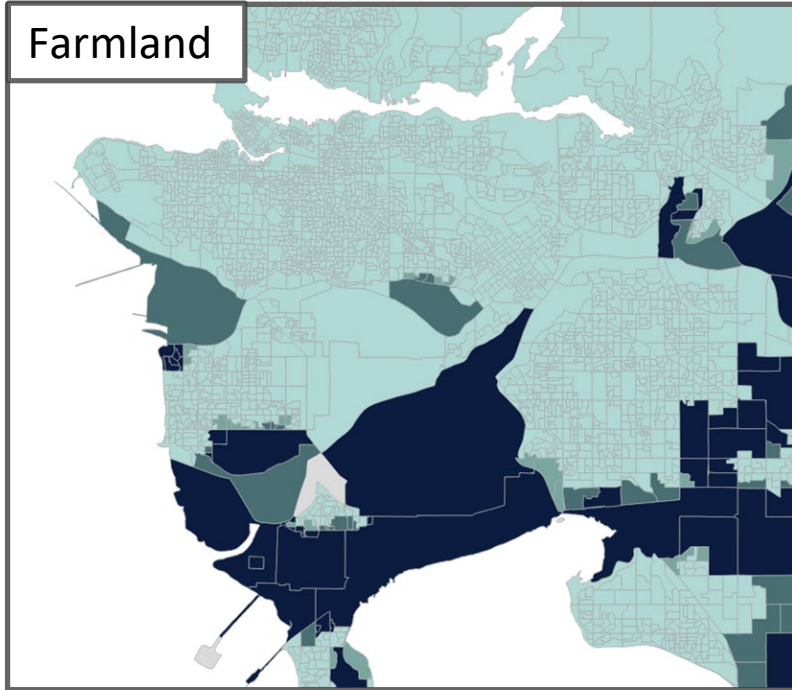
1. Density of bars and restaurants
2. Percentage of farmland
3. Presence of major mines
4. Density of long-term care beds
5. Density of schools
6. Presence of universities with residences
7. Density of homeless shelters
8. Density of daycares
9. Density of food processing sites
10. Density of places of worship
11. Presence of prisons
12. International connectivity



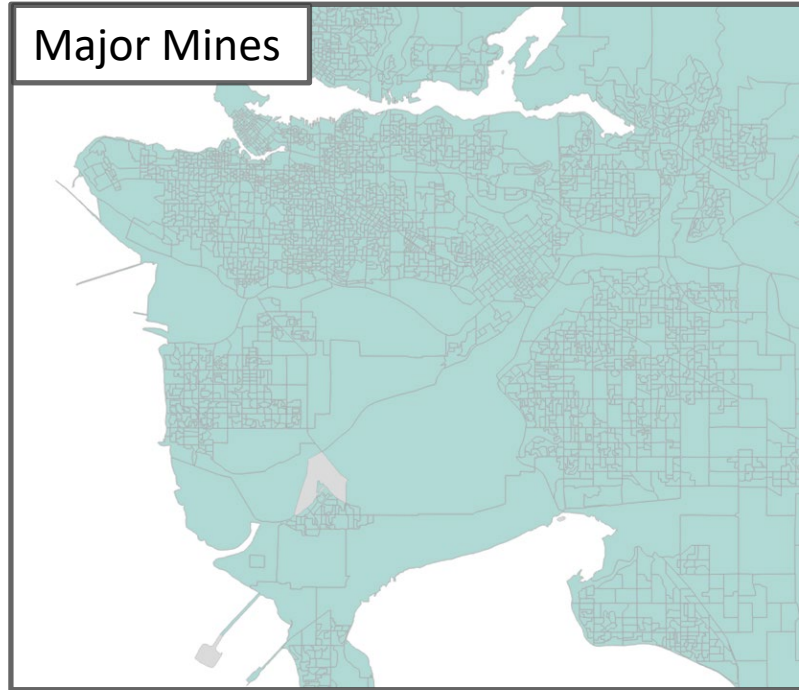
Restaurants + Bars



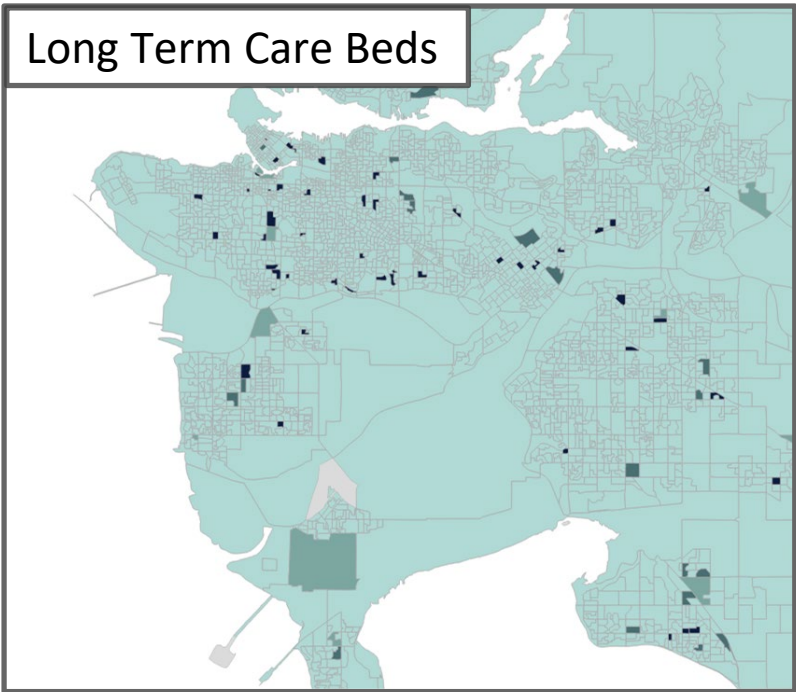
Farmland



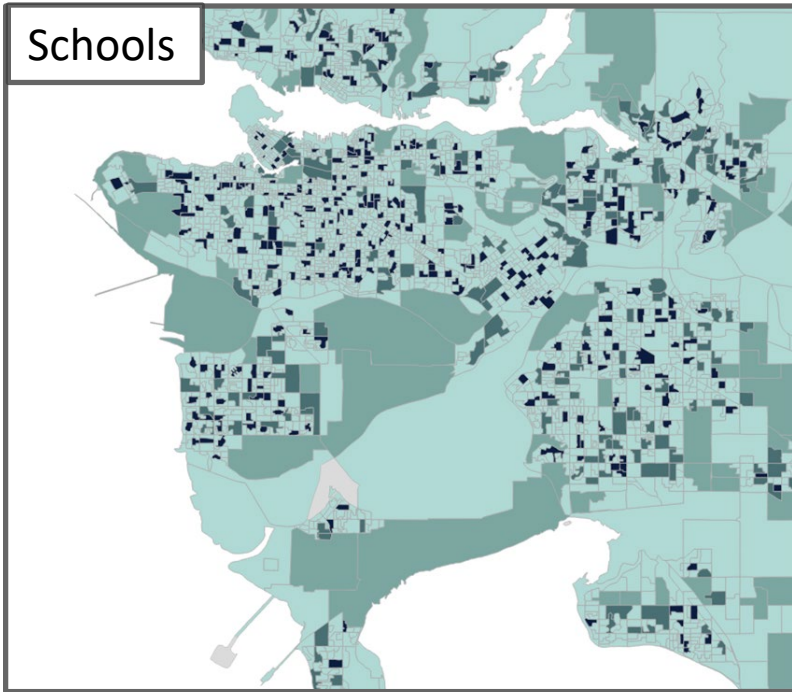
Major Mines



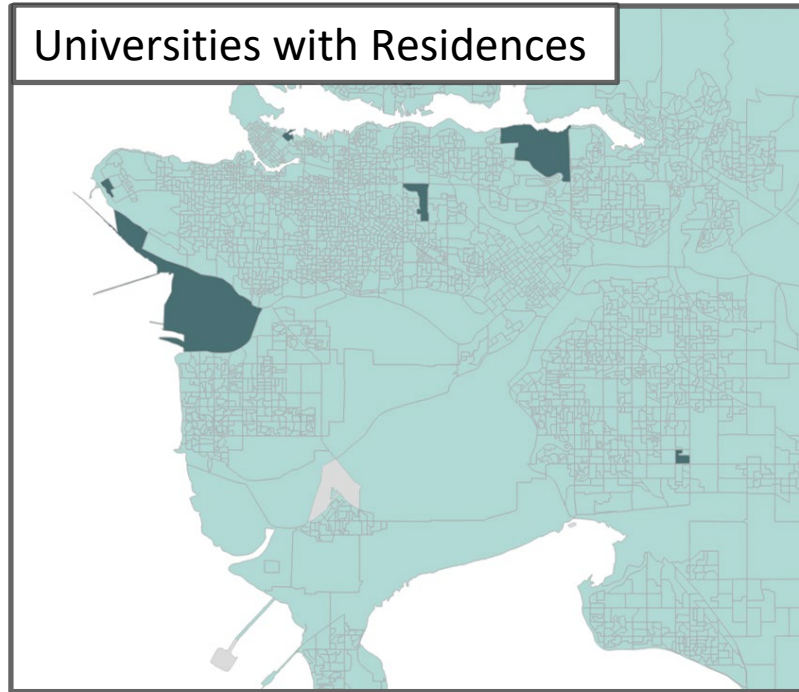
Long Term Care Beds



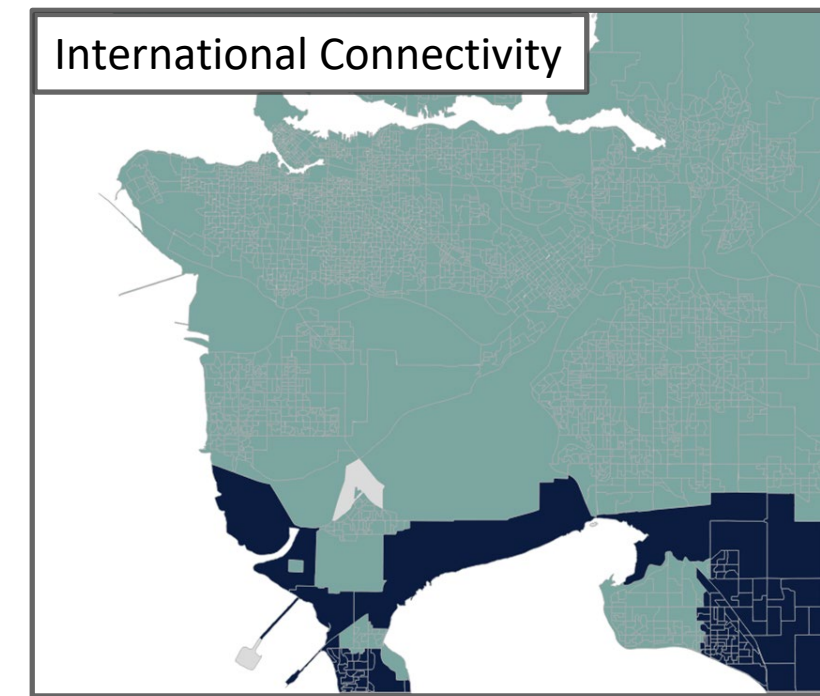
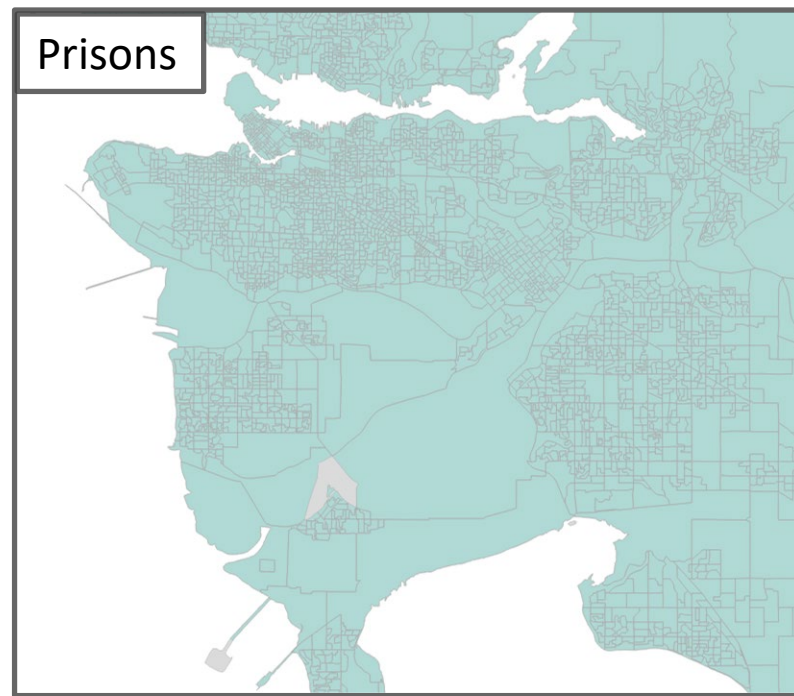
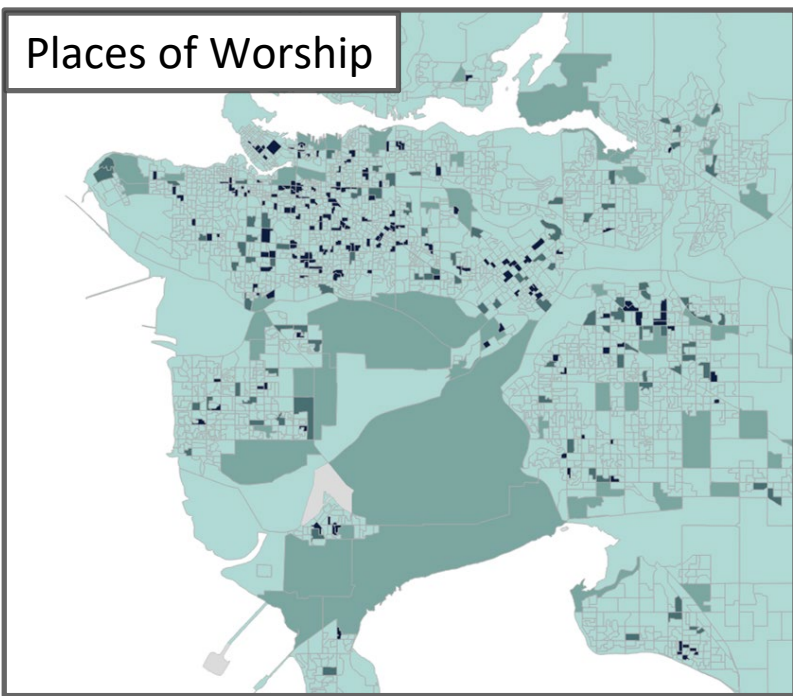
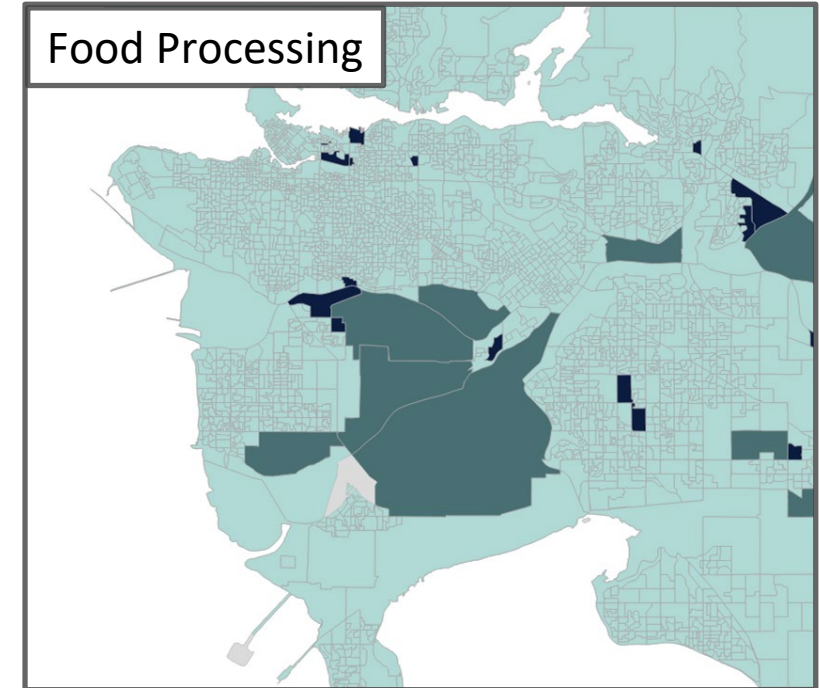
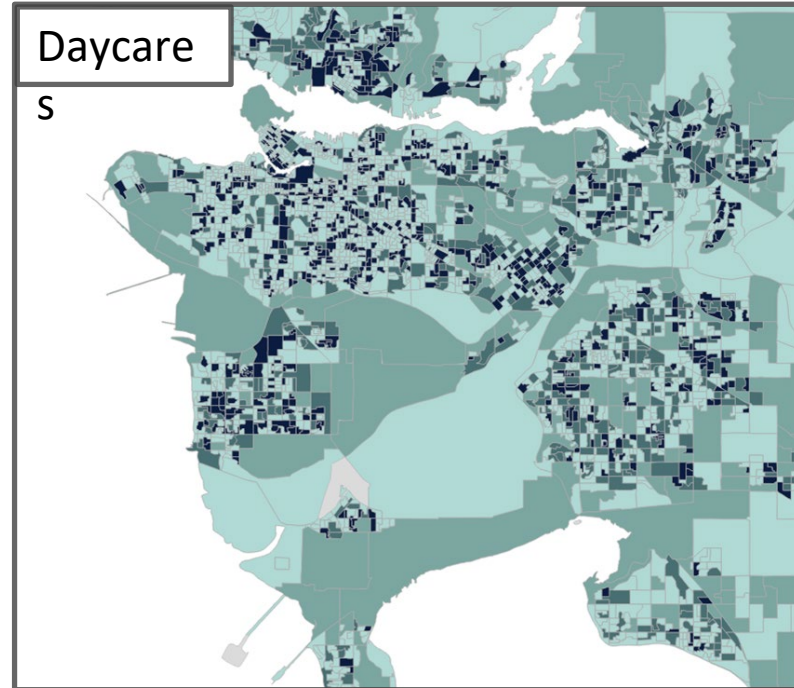
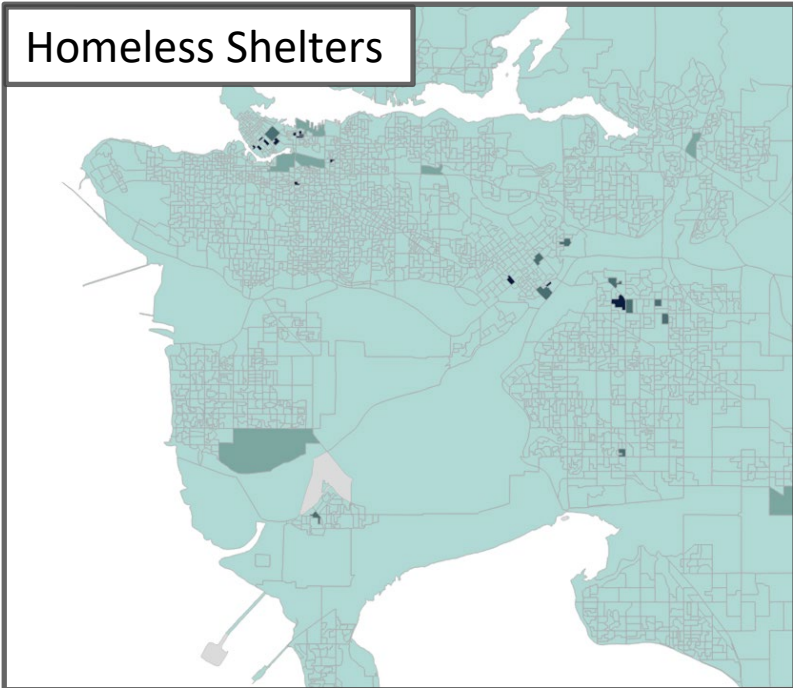
Schools



Universities with Residences

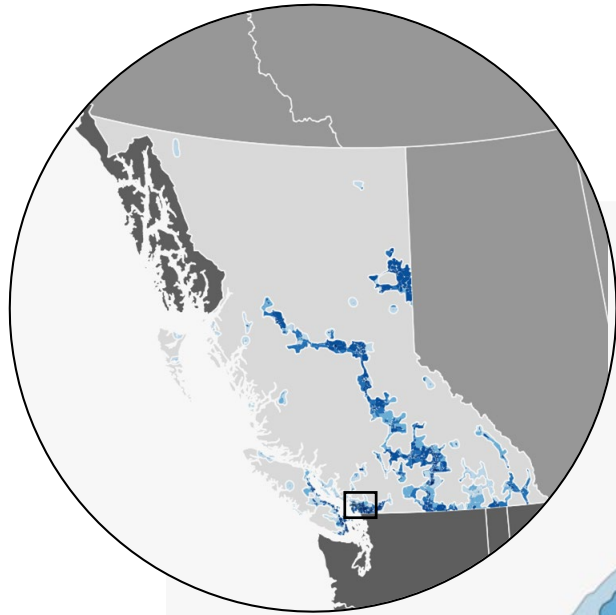




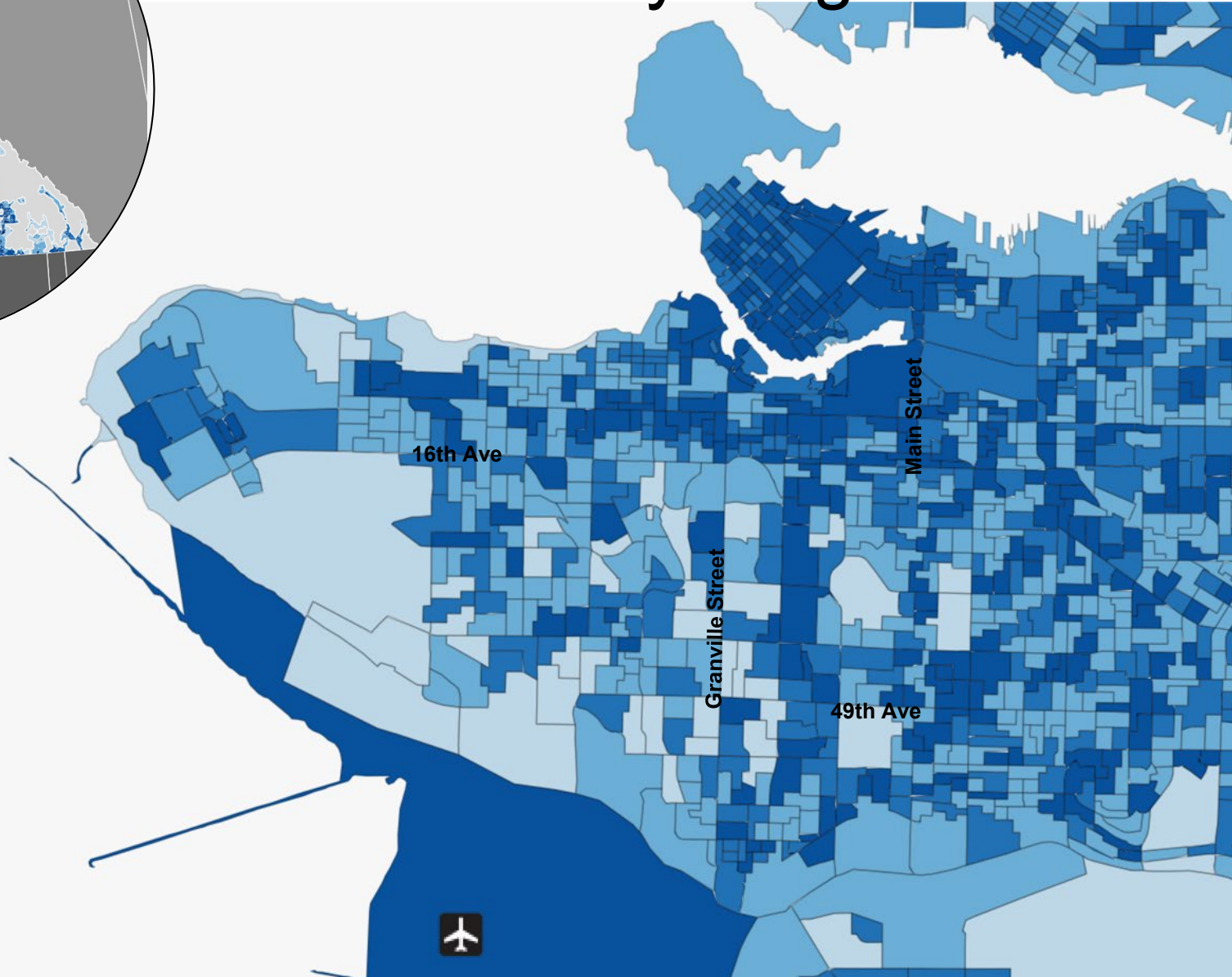
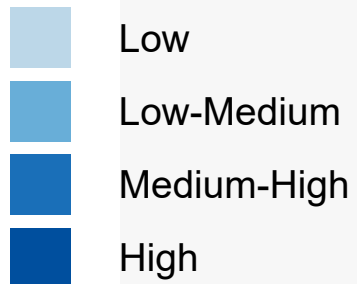




# Relative Exposure Risk to SARS-CoV-2 by Neighbourhood



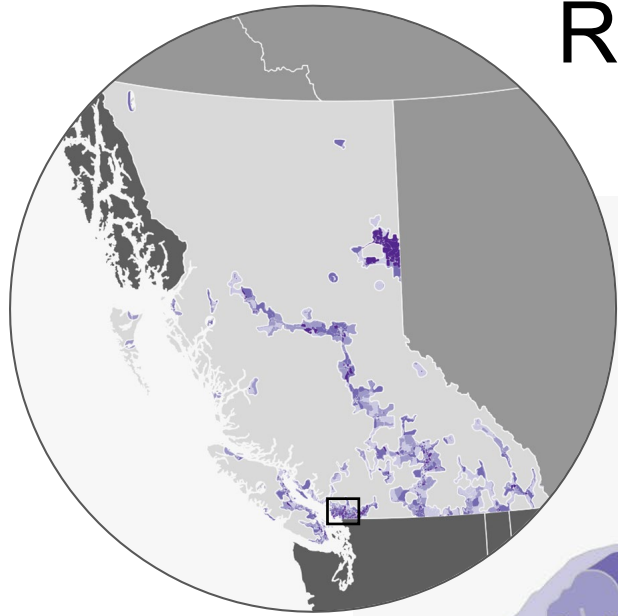
## Relative Risk



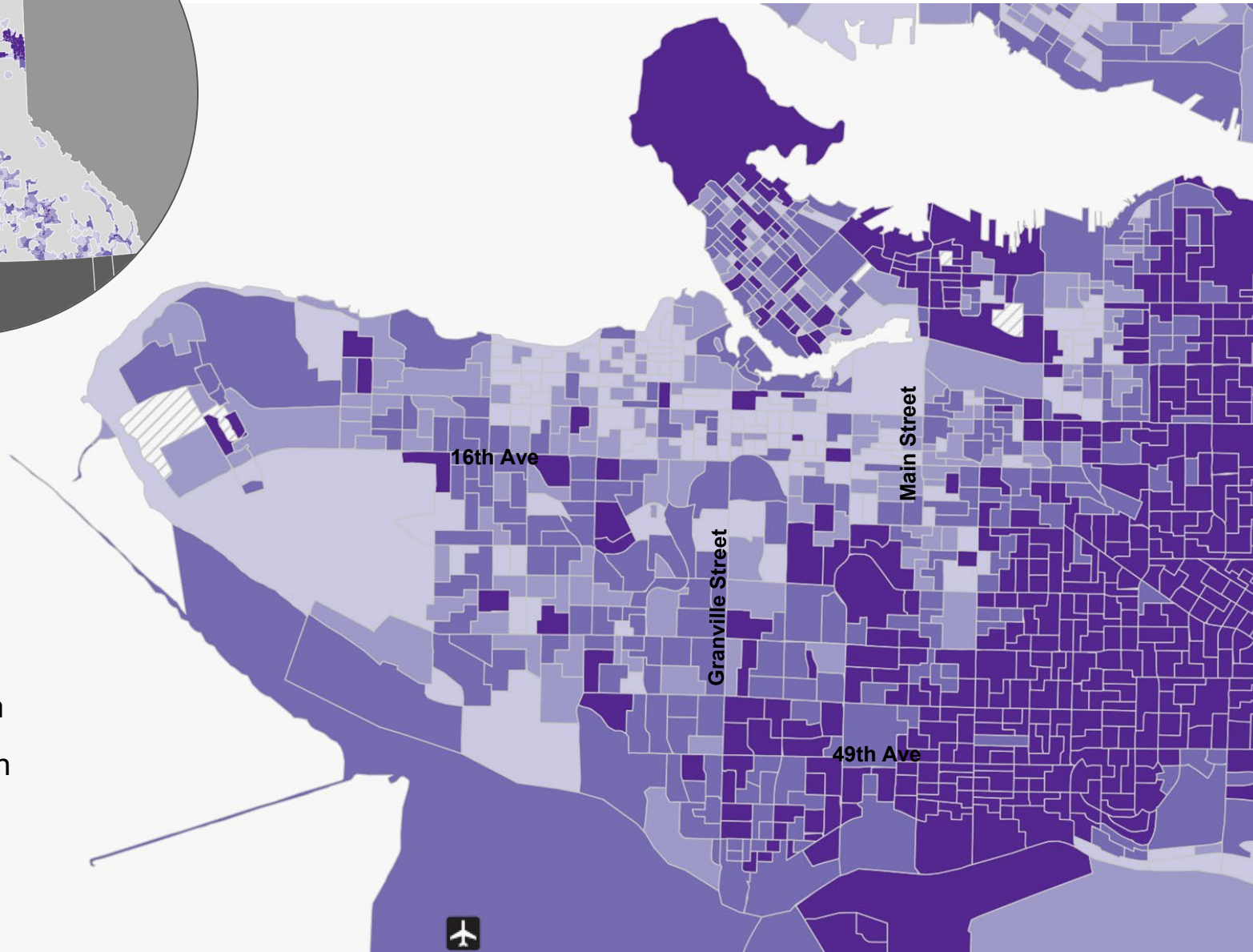
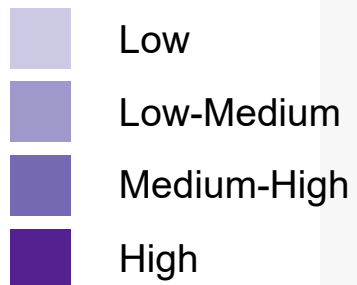
## Indicators

- Density of bars and restaurants
- Percentage of farmland
- Density of food processing sites
- Presence of major mines
- Density of long-term care beds
- Density of Daycares & schools
- Presence of universities with residences
- Density of homeless shelters
- Density of places of worship
- Presence of prisons
- Tourism destinations
- Density of tourist sites
- International connectivity score

# Relative vulnerability to SARS-CoV-2 outcomes by neighbourhood



## Relative Risk



**RELATIVE  
VULNERABILITY  
Y=**

**Relative  
Infection Risk  
+  
Relative  
Exposure Risk**

# Feedback from interview participants

Underscored the need to have an interactive map website

Informed our thinking about what guidance we needed to give people when looking at these maps

Shaped our thinking about what we were trying to show and why

Pushed us to refine our variables



# Guidance on interpretation

- All models have limitations and our maps/CORVIX1 model should be used in combination with other information sources
- The variables we have included are limited to those for which data are available through Statistics Canada or that is publicly available, and we also use 'dissemination areas' to depict neighbourhoods
- Our models should not be used to attribute blame for transmission to specific people or places in particular neighbourhoods
- Our models use a 'business as usual' approach to the variables, and so we do not factor in pandemic measures



Living in a crowded household

Living with a large household

Not knowing English

Working outside the home

Being employed in a high risk  
industry

Being a public transit user

Socioeconomically  
Disadvantaged

**RELATIVE PERSONAL  
RISK TO COVID-19 BY  
NEIGHBOURHOOD**

Low risk

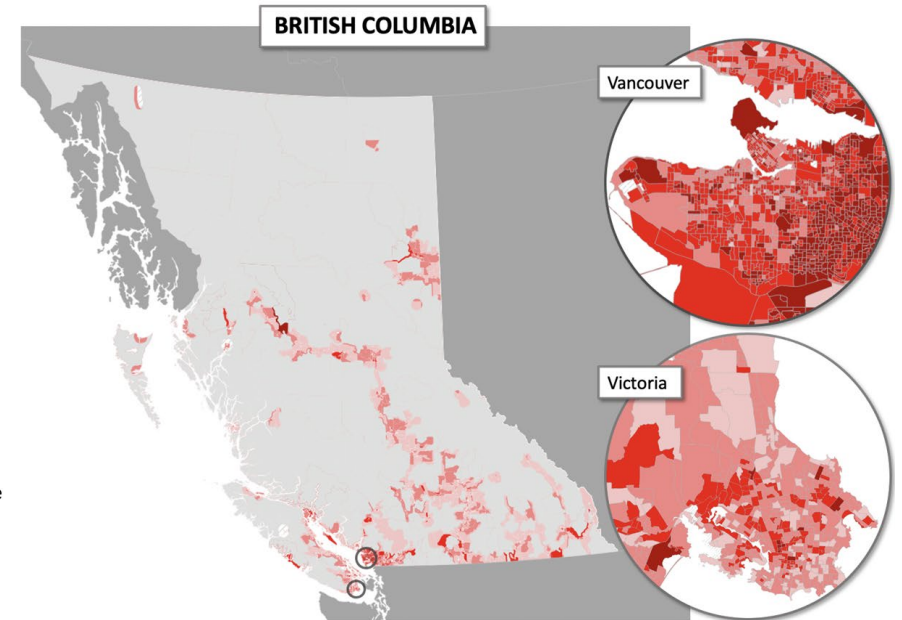
Low-medium risk

Medium-high risk

High risk

Population ecumene

No data





Presence of university with residences

Density of places of worship

Density of tourism destinations

Presence of prisons

Presence of major mines

International connectivity score

\* Population density is used as a proxy for density of bars and restaurants.

\*Density of bars and restaurants

Percentage of farmland

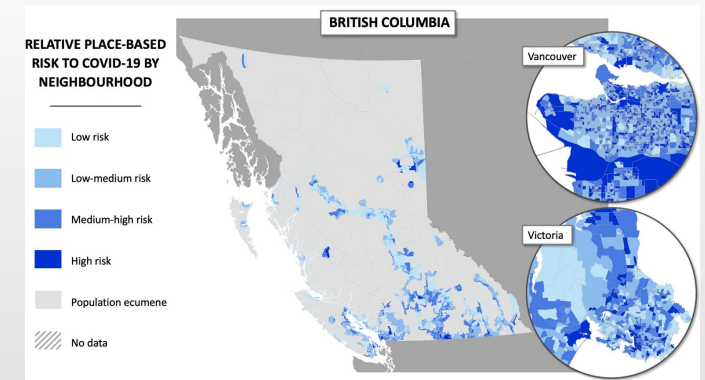
Density of food processing sites

Density of long-term care beds

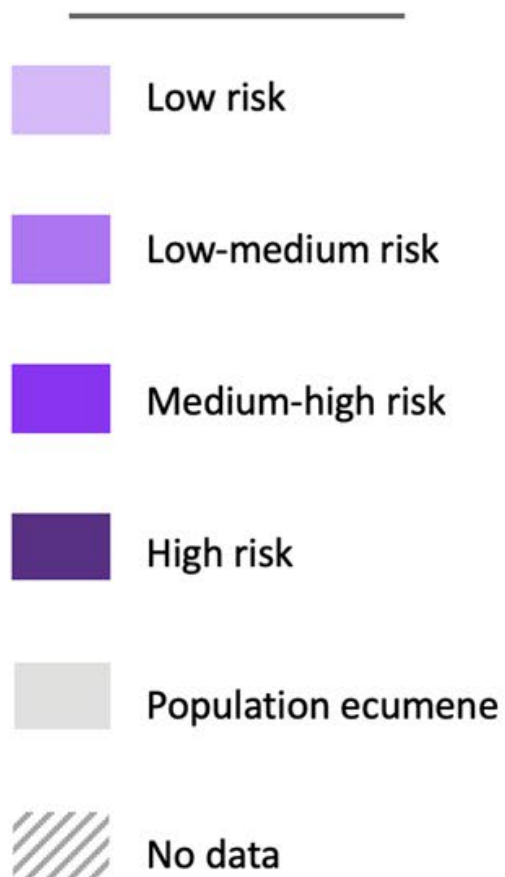
Density of homeless shelters

Density of daycares

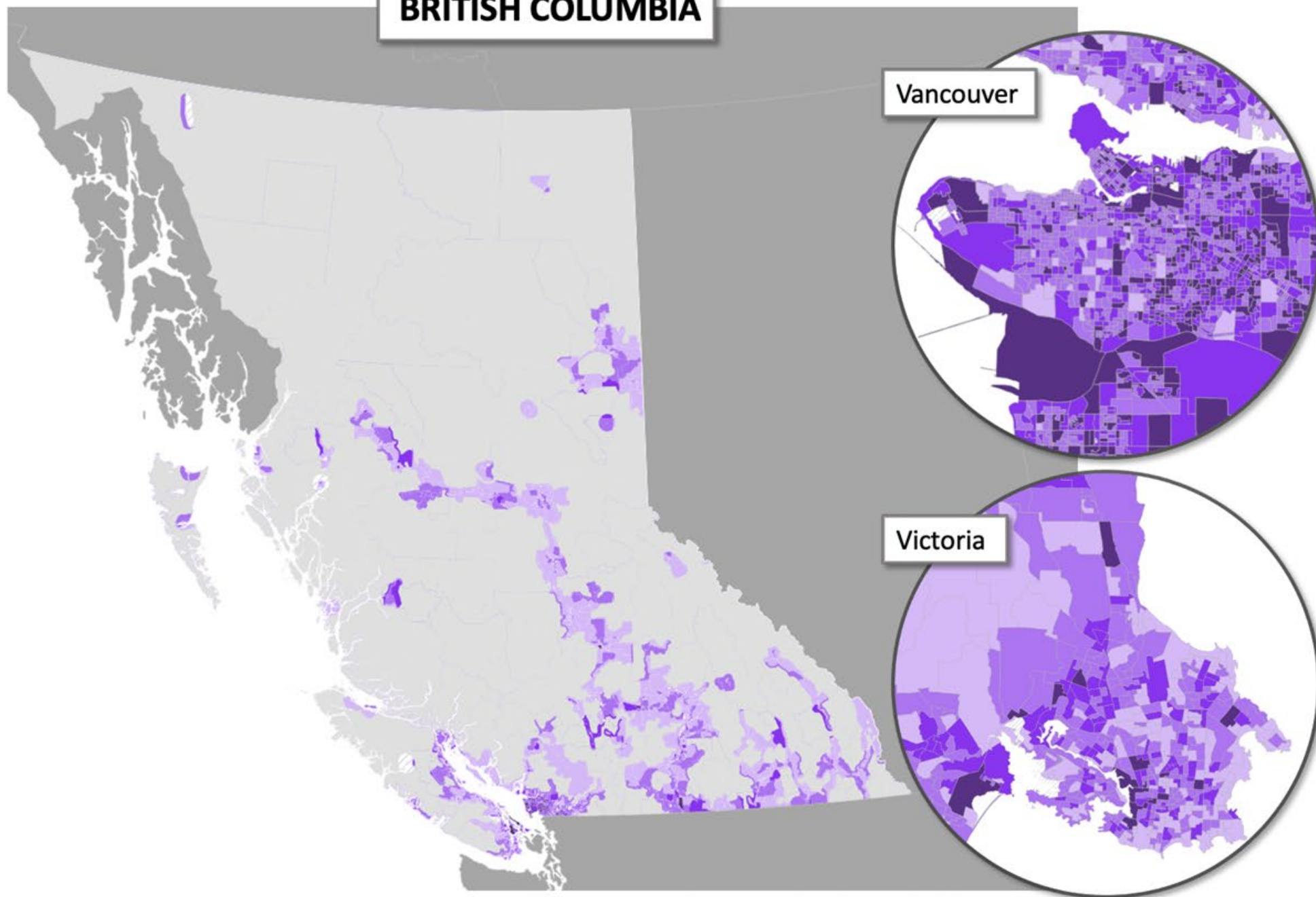
Density of schools



# RELATIVE OVERALL VULNERABILITY TO COVID-19 BY NEIGHBOURHOOD



## BRITISH COLUMBIA



# This map shows which Tri-City neighbourhoods are most at risk to COVID-19

The maps are meant to help people understand why it's important to stay close to home

Dec 29, 2020 3:58 PM By: [Stefan Labbé](#)



Global News Hour at 6 BC  
Mapping B.C. neighbourhoods vulnerable to COVID-19 outbreaks



News / Local News

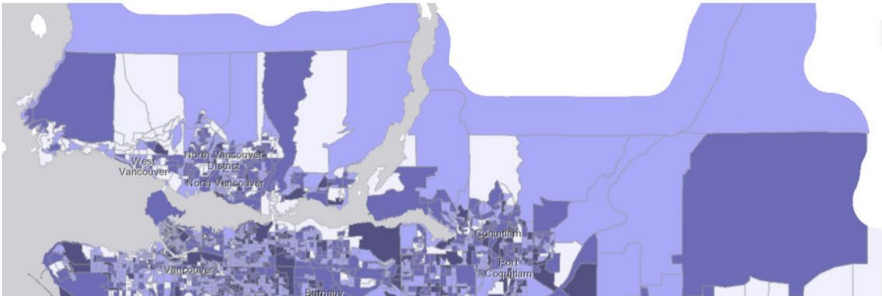


## These maps help identify B.C. neighbourhoods facing higher COVID-19 risks

*Researchers from Simon Fraser University mapped neighbourhoods across B.C. to help identify communities facing higher risks of COVID-19 outbreaks.*

Nathan Griffiths  
Dec 31, 2020 • December 31, 2020 • 2 minute read

### Overall Vulnerability to Risks







# Mapping the COVID-19 pandemic's secondary health impacts

Exploring contributing factors across British Columbia's neighbourhoods

## Our Map

Text describing map

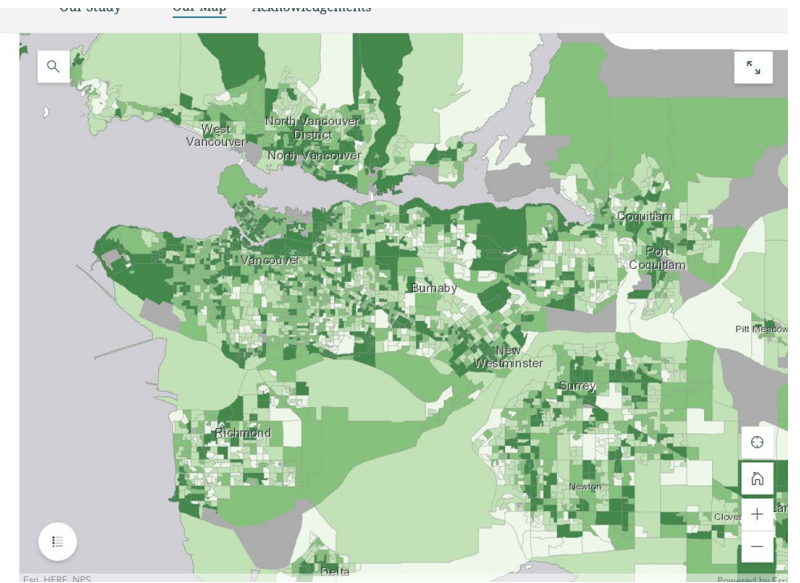
Housing Insecurity

Job Insecurity

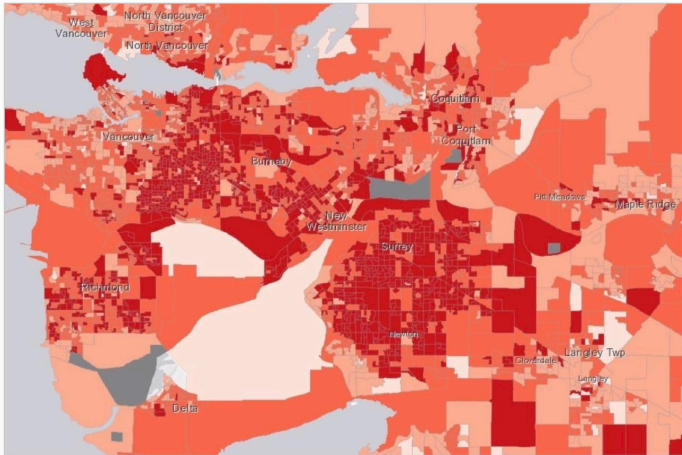
Occupational Burnout

Loneliness / Isolation

Educational Disruption







A map from a Simon Fraser University research team shows which neighbourhoods are most at risk of personal risks in a post-pandemic recovery map.

# SFU maps show post-pandemic recovery risks throughout the province

Project lead says there are connections to hotspots, but risks aren't limited to those areas

British Columbia · Analysis

## Why B.C.'s summer of renewal likely won't look the same for everyone



Risk tolerance and mental health will play a big role in people's behaviours, experts say

[Justin McElroy](#) · CBC News · Posted: May 22, 2021 10:00 AM PT | Last Updated: May 22, 2021



News / Local News

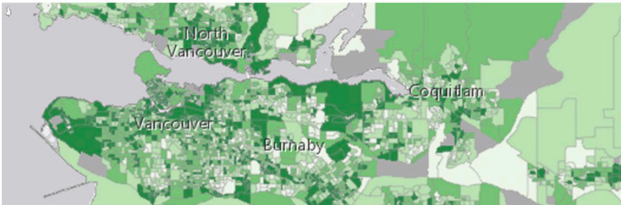


## COVID-19: SFU researchers map secondary health effects of COVID-19

*Researchers at Simon Fraser University have created an interactive map of the longer-term impacts of COVID-19 on British Columbians*

Kevin Griffin

May 19, 2021 · May 19, 2021 · 3 minute read · [Join the conversation](#)





## Follow this work

---

- Twitter: [@valoriemoons](#)
- Online: [pandemicgeographies.ca](#)
- Email: [moons@sfu.ca](mailto:moons@sfu.ca)