



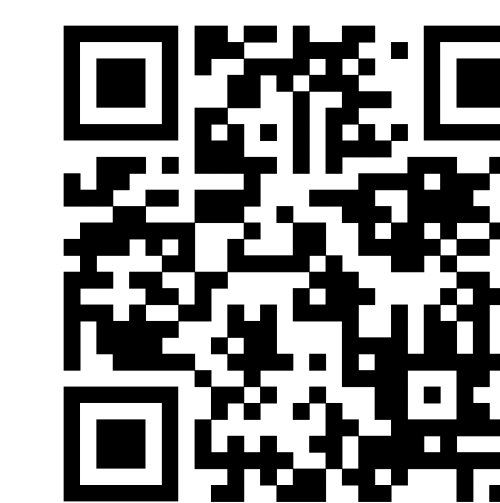
Statistics
Canada

Statistique
Canada

Creating an open-source tool to model opioid overdoses and deaths

Noah Bolohan (1), Dr. Deirdre Hennessy (1), Dr. Hawre Jalal (2)

1 - Health Analysis Division, Statistics Canada, 2 - University of Ottawa



Scan me to read more about
this project!

I. BACKGROUND & MOTIVATION

Canada has seen an increasing number of opioid-related harms and deaths between January 2016 and June 2023, with an estimated:

- 39,435 opioid-related hospitalizations
- 40,462 apparent opioid toxicity deaths

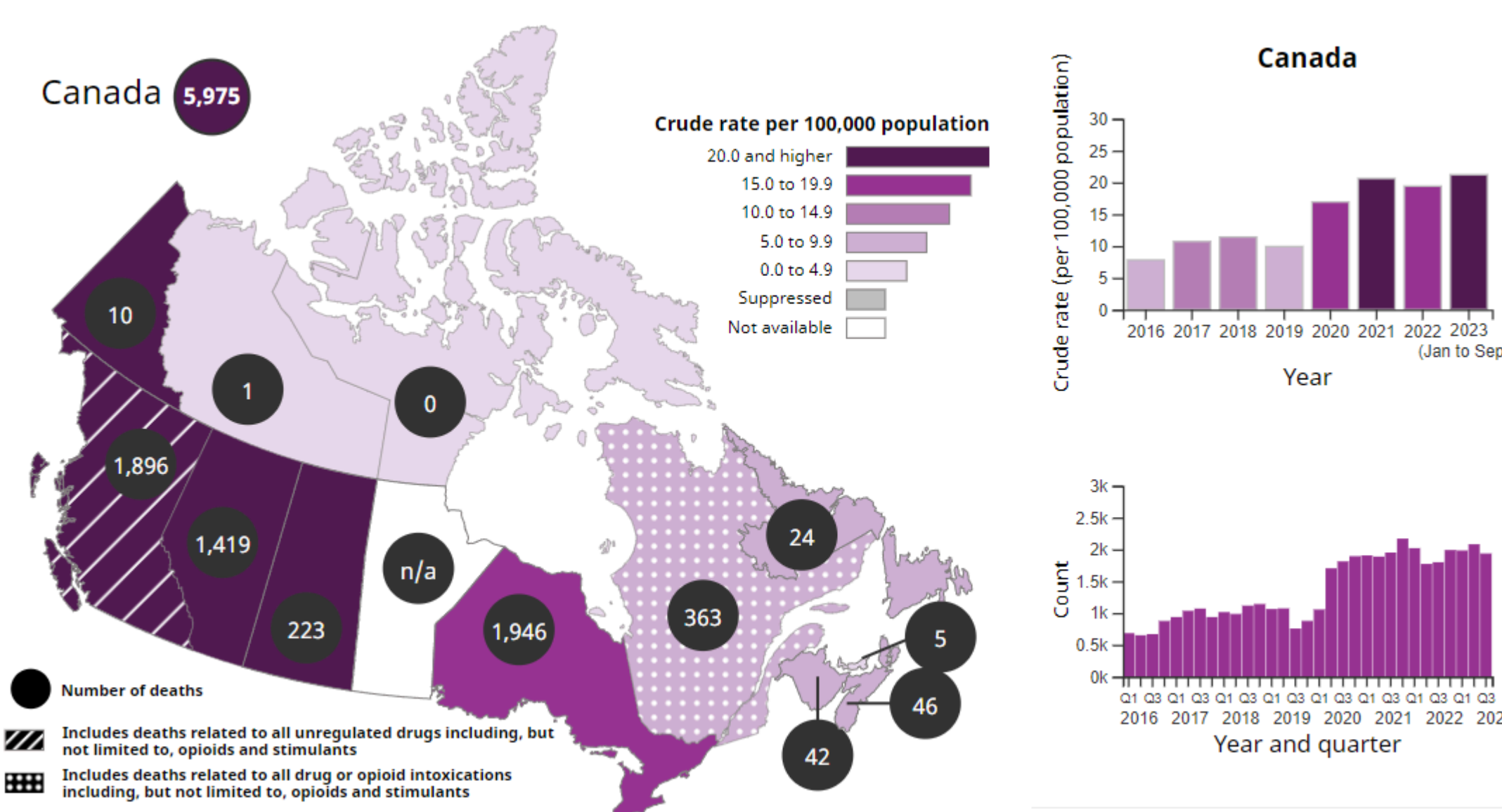


Figure 1: Opioid- and Stimulant-related Harms in Canada¹

This work is motivated by the following:

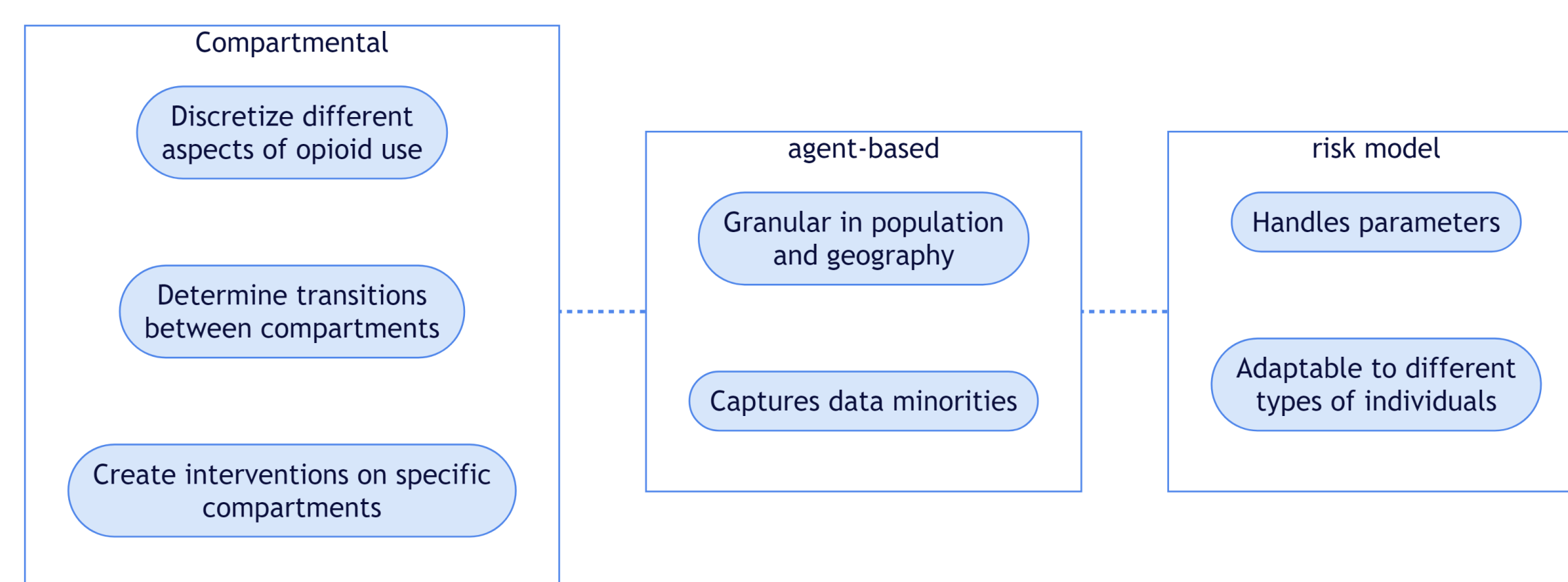
- Previously, Statistics Canada have been involved in modelling health outcomes only at the national or provincial level
- COVID-19 and the opioid crisis have demonstrated a necessity for policy-making and prevention efforts in smaller geographic areas, as well as shed light on the gap in modeling capacity and knowledge within the Federal Government

We are developing an open-source modelling tool aimed towards analyzing the impact of opioid use policies and interventions at the public health unit level in Canada.

II. METHODS

We are developing a compartmental agent-based risk model which will simulate the frequency and outcomes of opioid use in a synthetic population. With this approach, we aim to achieve the following:

- Simulate counterfactual scenarios of policies and interventions
- Assess impacts of these scenarios on a synthetic population
- Produce outputs at lower-level geographies, e.g., the public health unit
- Support policy makers and researchers with an easy-to-use tool
- Adapt an open-science approach, e.g., make the tool publicly available and free to use



¹Federal, provincial, and territorial Special Advisory Committee on the Epidemic of Opioid Overdoses. Opioid- and Stimulant-related Harms in Canada. Ottawa: Public Health Agency of Canada; March 2024. <https://health-infobase.canada.ca/substance-related-harms/opioids-stimulants/>

III. THE MODEL

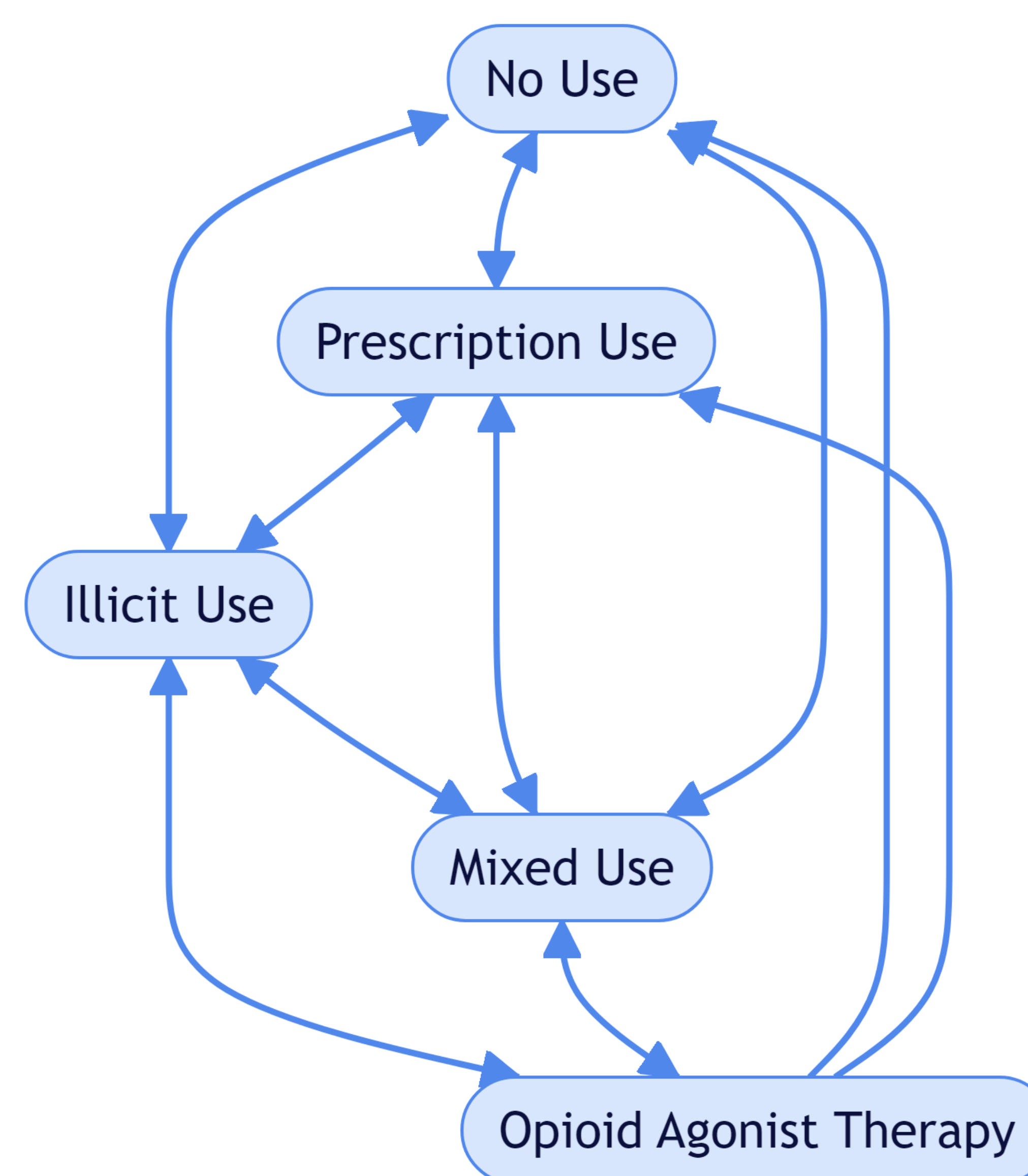
The model simulates opioid use and outcomes over a number of days, weeks or months for a synthetic population representative of a public health unit. The synthetic population is derived from the following:

- Statistics Canada data, including local population characteristics
- Population profile is represented as a set of probability distributions
- Individual characteristics, e.g., socio-demographic, socio-economic, geographic, and health conditions

IV. OPIOID USE STATE

These states compartmentalize the ways in which a model individual may use opioids. Directed arrows represent possible transitions between use states, with transition rates dependant on any of the following:

- An individual's personal characteristics
- Location of opioid use
- Events that have occurred for the individual or in the world
- Interventions or policies that have been applied to the simulation
- Transition multipliers specific to the health care system of the public health unit



V. LOCATIONS

These states include the location in which the agent is currently using opioids:

1. Housing status
2. Hospital
3. Prison
4. Safe site
5. Other

VI. EVENTS

Certain events may have an impact on opioid-related outcomes, on a personal or global level:

1. Supply contamination
2. Injuries
3. Social assistance cheques
4. Overdoses

VII. SCENARIO DEVELOPMENT

A key feature of a modeling approach is the ability to simulate counterfactual ('what-if') scenarios. For example:

- What if there are more take-home naloxone kits available in the community?
- What if there was an increased number of supervised safe consumption sites?

Our model can be adapted to include a number of policies or interventions related to opioid use and outcomes in order to explore different scenarios and their impact on the community. The model includes the following:

i Take-home naloxone kit availability
Determines the number of naloxone kits available to take home at each moment in time.

i Opioid prescription alteration
Affects the rate at which opioid prescriptions are administered

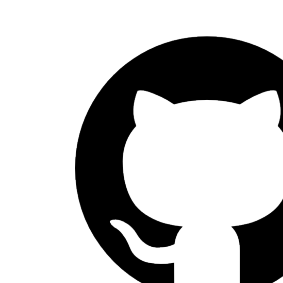
i OAT prescription alteration
Affects the rate at which Opioid Agonist Therapy (OAT) is prescribed.

i Point-of-contact interventions
This intervention represents a broad class of interventions which may occur when an opioid-using actor comes into contact with the public health system. For example, visits to the hospital, emergency room/department, prison, or supervised safe consumption sites.

VIII. IMPLEMENTATION

The implementation of the model will follow an open-science approach for research and dissemination:

- Written completely in Python
- Accompanied by Dash/Plotly user interface
- Pre-packaged datasets tailored for public use



IX. ACKNOWLEDGEMENTS

I would like to acknowledge CAHSPR for granting me the opportunity to share this project, as well as Statistics Canada and Dr. Hawre Jalal for supporting this work as well as sharing invaluable insight and guidance.

This poster is made in Quarto, using a typst poster template made by Christophe Dervieux of Posit. The methods and opioid use state diagrams are made using the Mermaid Diagramming and charting tool.