# Investigating the Impacts of COVID-19 on the Shelter Vulnerable Population

## Storytelling through Modelling
### Progress and Next Steps

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# Acknowledgements

*"We acknowledge that our University is located on Treaty 6 Territory and the Homeland of the Métis. We pay our respect to the First Nations and Métis ancestors of this place and reaffirm our relationship with one another."*

# COVID-19 and Homelessness

- The homeless population have a unique pattern of movement, social structure and are at a disadvantage to access regular resources compared to the general population

- COVID-19, and the response measure to it precipitated the perfect storm for perpetuating homelessness and shifting people who may have been at a tipping point to fall into homelessness

- How did COVID-19 change the tipping point?

"the situation of an individual, family or community without stable, safe, permanent, appropriate housing, or the immediate prospect, means and ability of acquiring it." Canadian Observatory on Homelessness (2017)

# Models and Storytelling

- The data readily available about homelessness numbers are 'snapshots' and estimates

- There is a need to develop open communication with individuals who have experienced homelessness to get a fuller story and fill in the gaps in the data

- Many of these individuals are innate storytellers and can give a rich picture of what their day to day life looks like

- How do we dialogue about models with people with lived experience?
    - Causal Loop Diagrams
    - Agent Based Modeling

# Lesson Learned: Trust is Key

- Research done with Ginetta Salvalaggio to evaluate and improve Addiction Recovery and Community Health (ARCH)
- Worked with a community Elder

Trust and fostering relationships was key in being able to successfully roll out interventions

- How do we quantify this?
- How does trust impact COVID-19 and prevention measures?
    - Willingness for vaccines
    - Willingness to accept testing
    - Destigmatization

# Lesson Learned: Listening to the Community

- Research done by Wade McDonald and Yellow Quill First Nation Elders

- Developed a storytelling module for Anylogic that allowed the community to engage in the outputs of the model in a way that was meaningful to them

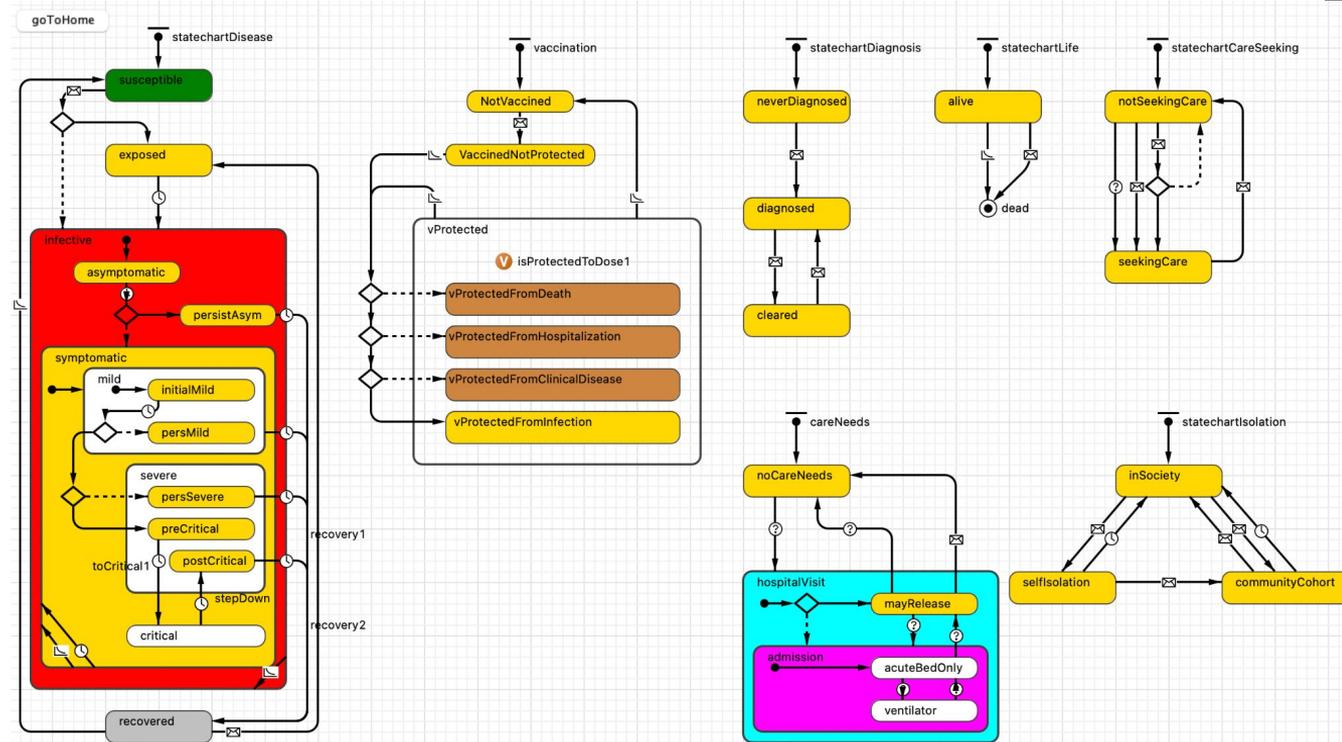- The model was geographical and related the problem directly to the land



Image from Wade McDonald's Model on Water Futures and Holistic Human Health Effects

# COVID-19 in the Homelessness ABM

Built on a foundation of a COVID-19 ABM model that has been developed by other students in our lab

The model was developed at the onset of COVID-19 and has been continuously developed

It is used for COVID-19 decision making in saskatchewan and in Australia
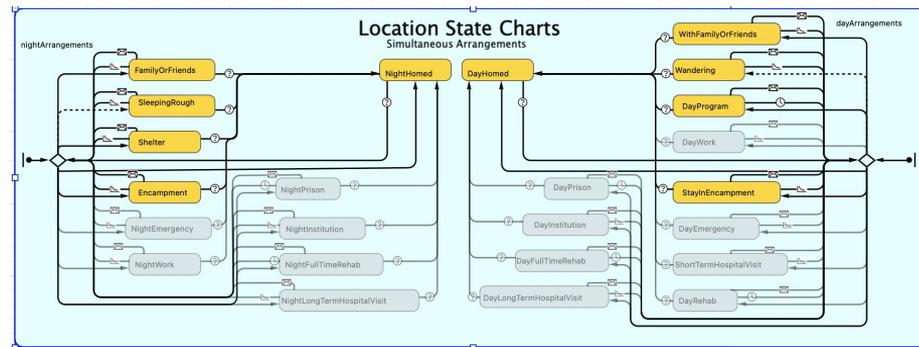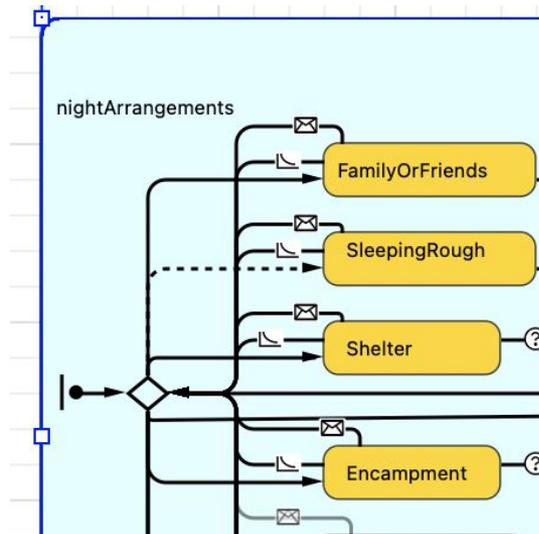
# What gaps we wanted our model to fill

1. Depicting the homeless population and how they flow between different locations
    a. This includes how the networks might change from and are impact by COVID-19 spread
    b. Develop a framework that allows us to consciously prepare for the next pandemic for this population
2. Chronic Homelessness  vs. Episodic Homelessness
3. Substance use and Mental health
    a. Drawing insight from a model that is already built for polysubstance use
4. How we can represent trust vulnerable people have in the system and those around them
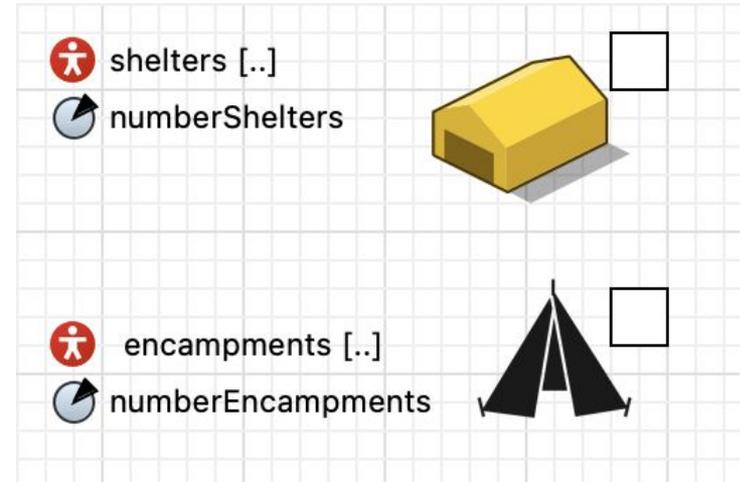5. The stages of interpreted risk of becoming homeless

# Agents in the model - People

- We model the homeless population as agents
- Characteristics:
    - Age, Sex, Ethnicity
    - Has Pets
    - Has Children
    - Has Partner
    - Visible Minority
    - A Member of the LGBTQIA2S+ Community
- Track their movement during the day and night
- A changing trust score as they interact with the system
- Changing Support System
- Their uptake on mandates and safety precautions related to COVID-19

# Agents in the model - Locations



- Encampments
- Shelters
- Sleeping Rough
- With Family or Friends
- Each Location has 'Amenities' and 'Rules'
  - Allows pairs of people
  - Allows pets
  - Space for overnight substance use
  - Safe consumption site
  - Provides clean needles
  - Provides Medical Services
  - Has Day Program
  - Women Only
  - Must be suber
  - Substances Prohibited
  - Provides Hygiene Services
  - Allows Children
- Each location also has different COVID-19 transmission rates based on being indoors and crowding levels



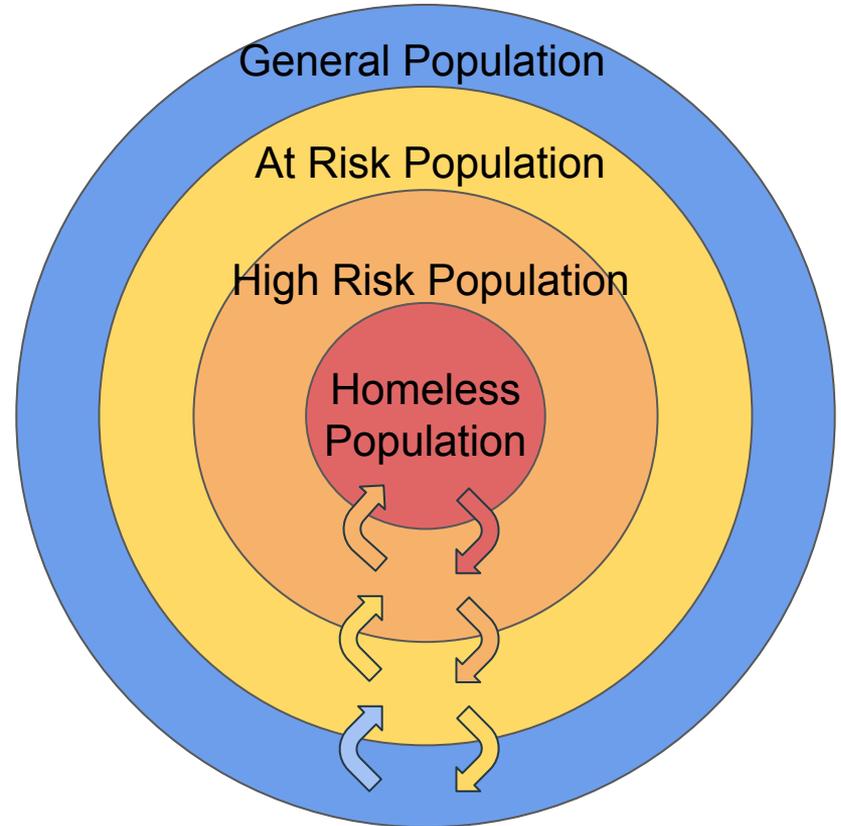| COVID-19 Preventions | Characteristics | Support Systems |
| --- | --- | --- |
| hasSanitationStations | allowsPets | accessToHygenicServices |
| hasMasks | spaceForOvernightSubstanceUse | providesMedicalServices |
| hasRapidTests | allowsPairsOfPeople | hasDayProgram |
| sanitizesAfterUse | substancesProhibited | hasFirstAidTreatment |
| prohibitsInfected | isInside | hasBedBugTreatment |
| | womenOnly | hasFrostbiteTreatment |
| | allowsChildren | providesUnusedNeedles |
| | substanceUseProhibitted | hasSafeSubstanceUse |
| | mustBeSober | hasMentalHealthAssistance |

# Flow and Networks

- There is the interactions that happen between individuals when they are in their overnight location and interactions that happen at their day locations

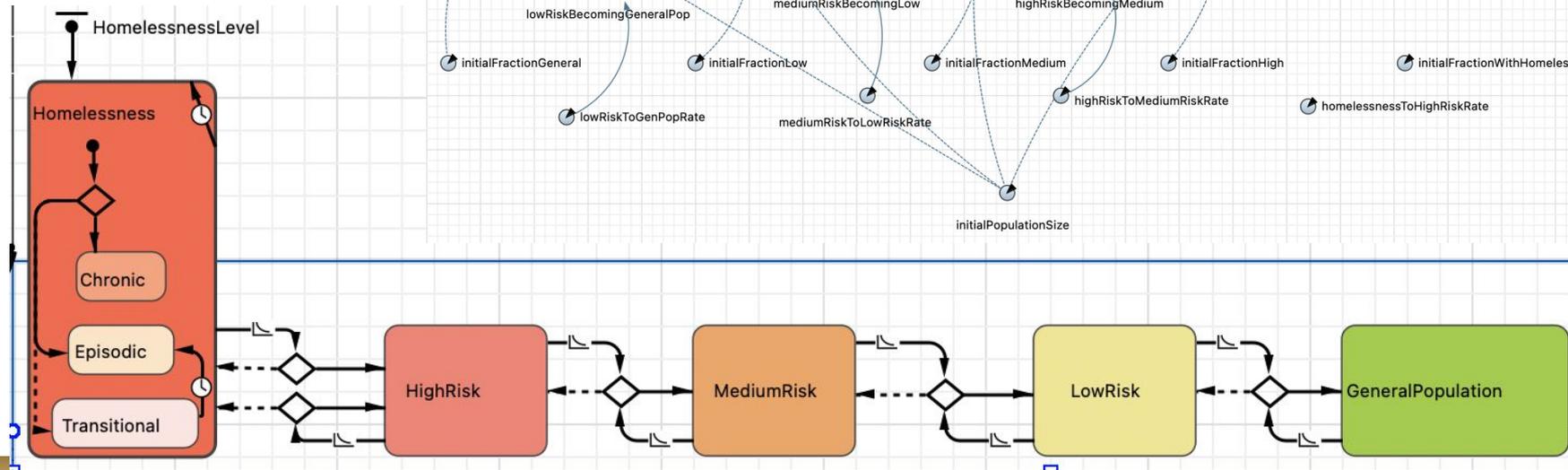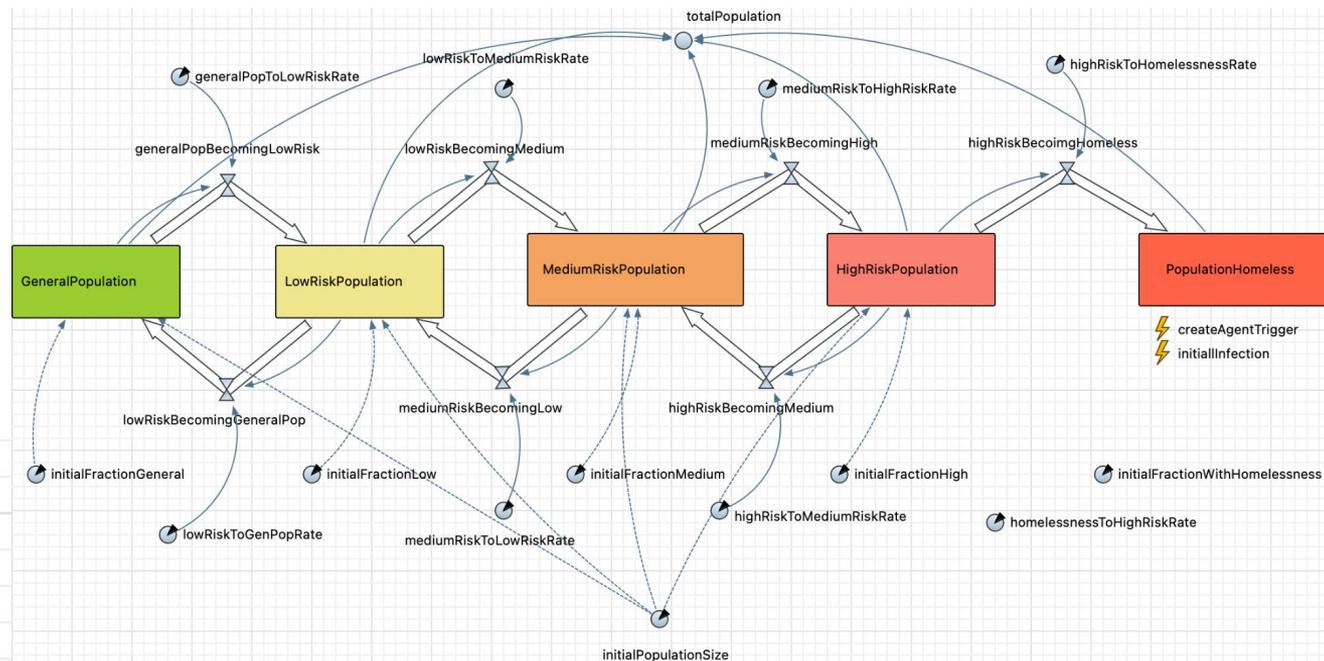- They are interrupted by interventions and changes in environment

# Risk Level

- Most literature takes a '3 ring' approach

- High risk population adds a finer granularity

- Look at the homeless population at different severities of homelessness

# How we are working on representing it in the model

# Interventions we are interested in modelling - What can we learn?

- The 'Basics'
    - Impacts of masking
    - Impacts of Ventilation
    - Vaccination
    - Testing measures
- Further Downstream
    - When there are restrictions in place and friends and family homes can no longer be used, what does that look like?
    - Limiting mixing between various homeless shelters
    - Simulating waste water testing at the shelters to prompt more regular swabbing
    - Offering Day programs that are attractive to the community to develop trust but that also provide testing
- Further Still
    - If there is an increase in homelessness due to pandemic restrictions or job loss, what happens to people in the current system structure?
        - What emergency procedures help support these influxes
    - Community Cohorting: providing a place to go for the duration of their illness

# Next Steps

- Getting feedback from PWLE on the risk levels and how people might transition through them
- Working with our partners who have access to shelter data not public accessible to fill in some of the data gaps
- Model and produce detailed outcomes to report back to our contributors on the interventions and scenarios

Homelessness and Vulnerable Population Group Model Building Event - in the early planning stages

- This event will bring together PWLE, experts in the field and modellers
- Goal is to create Causal Loop Diagrams to explore core problems and depict the causal pathways related to this project
- One of the best ways to tap into lived experience and sense of involvement

Thank you!

# Who are we talking about?

In Canada

-   Estimated 235,00 people experienced Homelessness of some form in 2014

"the situation of an individual, family or community without stable, safe, permanent, appropriate housing, or the immediate prospect, means and ability of acquiring it." Canadian Observatory on Homelessness (2017)

Snapshot of April 28, 2022 in Saskatoon

Experiencing Homelessness: 550

Experiencing Chronic Homelessness: 59% (w/o a permanent address for >6 months)

Unsheltered Homeless: 31

Hidden Homeless: 30

Identifying as Indigenous: 90%

# Why ABMs?

- Seeking to intervene at points in and change behavior on dynamics **across networks**
- Important for people to be able to **move between locations**
    - Impact of localized environment and how each contribute to spread of infection differently
- The need to capture **heterogeneity**
    - Different interventions could apply to only a subset of the population
- The **individual level histories** for the purpose of storytelling
- Wish to characterize **learning by and/or memory** of people based on experience, or **strong history dependence** in people
    - Trust and past experience of each person is important to know how they will interact with others and elements in the system

# Okay... But what ARE they?

One or more populations composed of individual agents, each associated with:
- Parameters – discrete (e.g., Gender, Ethnicity), continuous (e.g., birthweight, income, latitude, longitudinal) or relational (e.g., mother, service dog)
- State (continuous or discrete) e.g., age, smoking status, networks, preferences
- Actions
- Rules for evolving state
- Means of interaction with other agents via one or more environments (e.g. spatial & topological context)

ABMs are "upwards facing" (crudely, "bottom up") dynamic models in the sense that we specify behaviour involving situated agent evolution & interaction, and study how that induces overall behaviour (temporal, spatial, topological) of the system