

SABCoM - Spatial Agent-Based COVID-19 Model*

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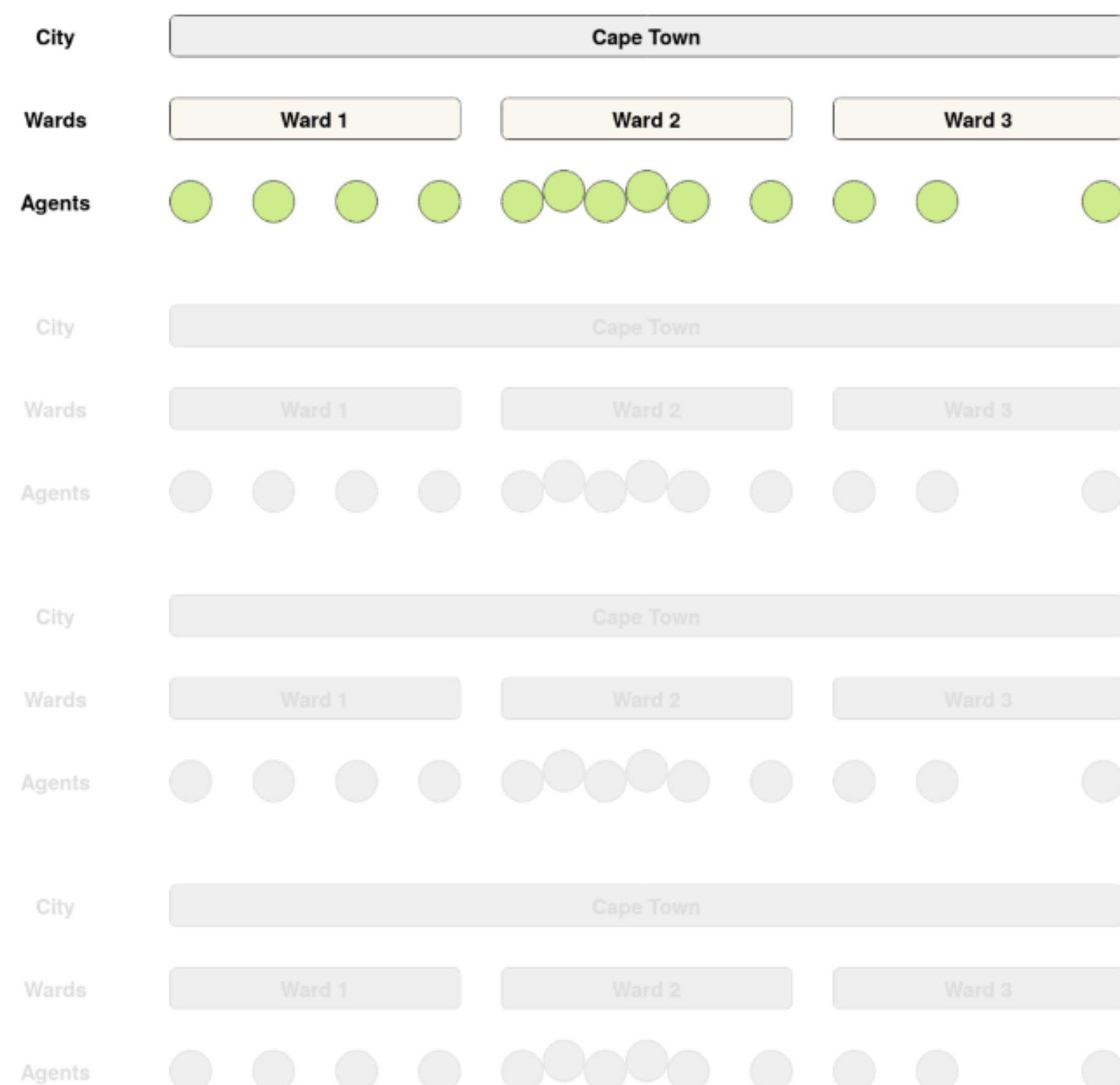
An aerial photograph showing a stark contrast between two types of residential areas. On the left, a suburban neighborhood with large, well-maintained houses, green lawns, and trees. On the right, a densely packed informal settlement with small, makeshift structures and a dirt road. A paved road runs vertically between the two areas, symbolizing social and economic heterogeneity.

**A heterogeneous society requires
heterogenous agent models**

SABCoM Model Overview

Contagion happens between agents

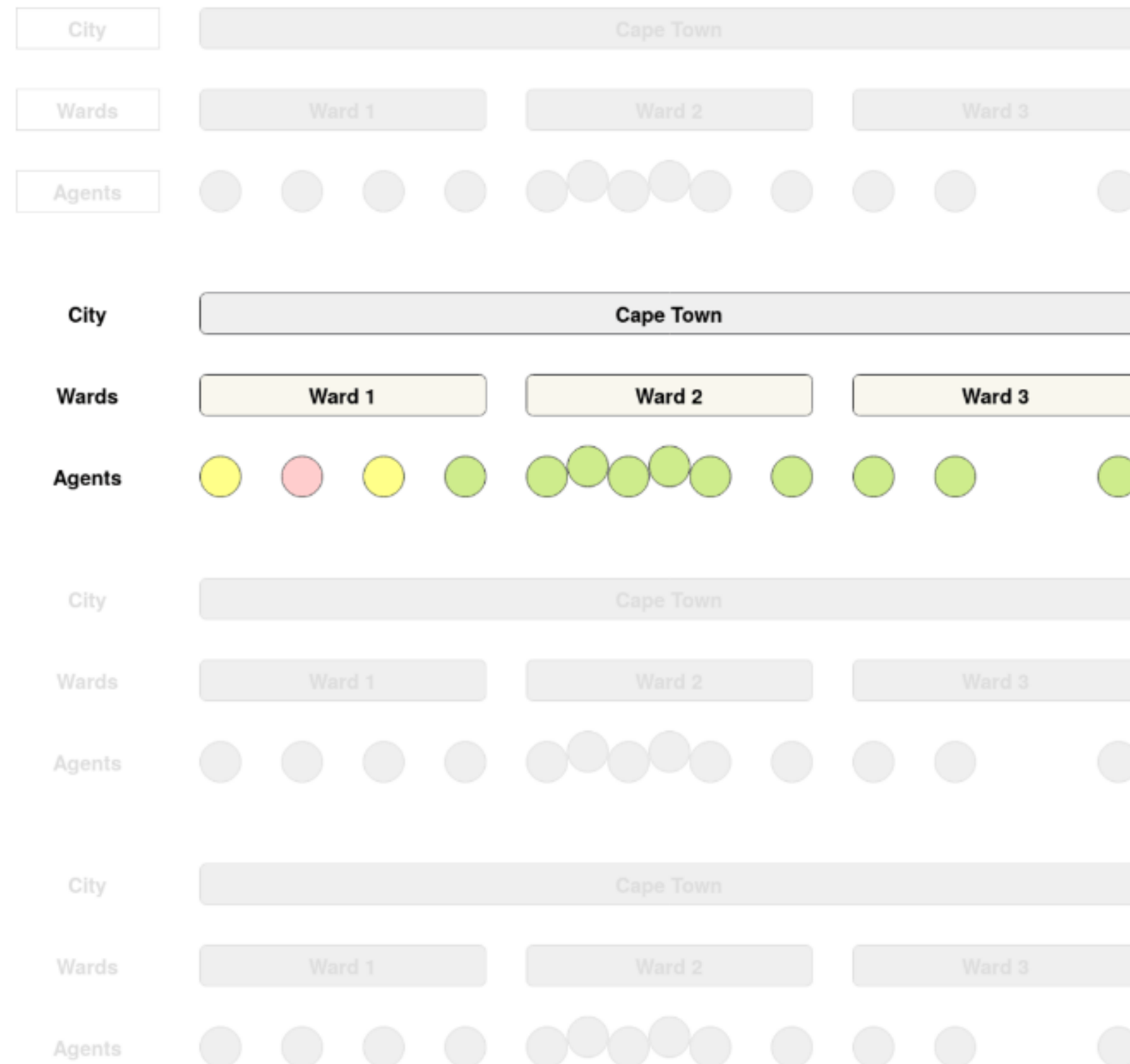
Agents live in- and travel between wards



Step 0: All agents are healthy

Contagion happens between agents

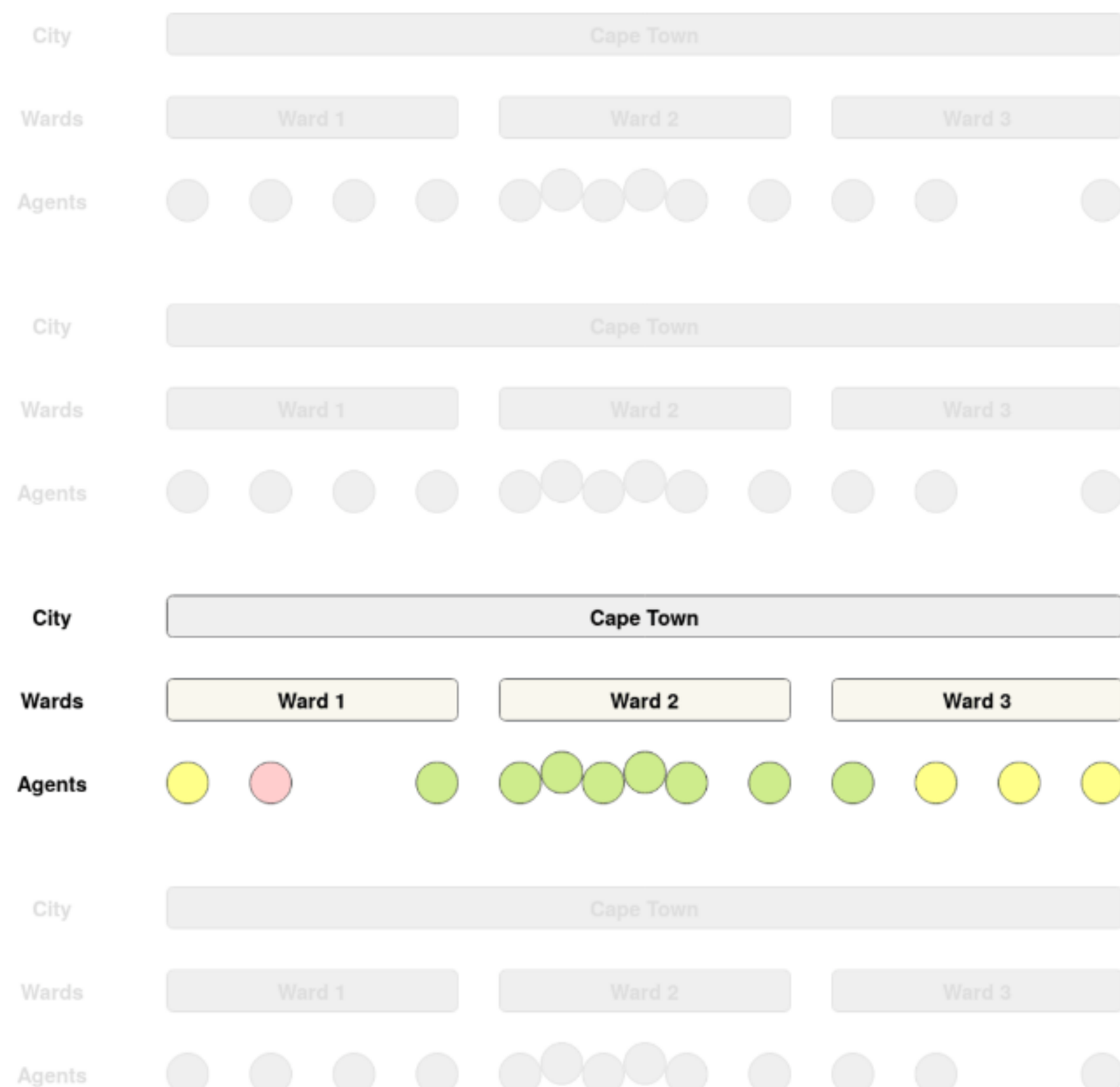
Agents live in- and travel between wards



Step 1: Some agents become infected

Contagion happens between agents

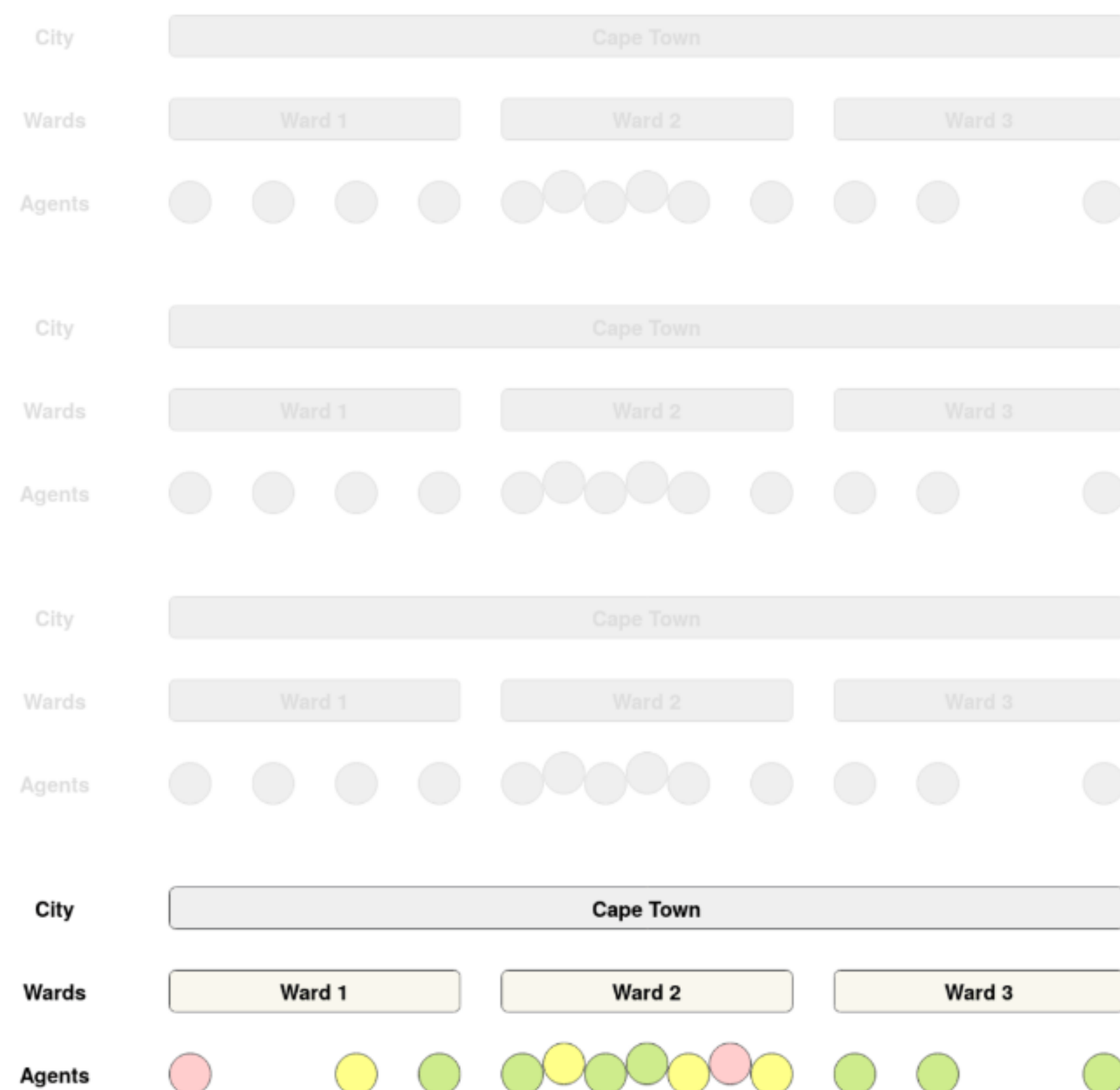
Agents live in- and travel between wards



Step 2: Agents travel

Contagion happens between agents

Agents live in- and travel between wards



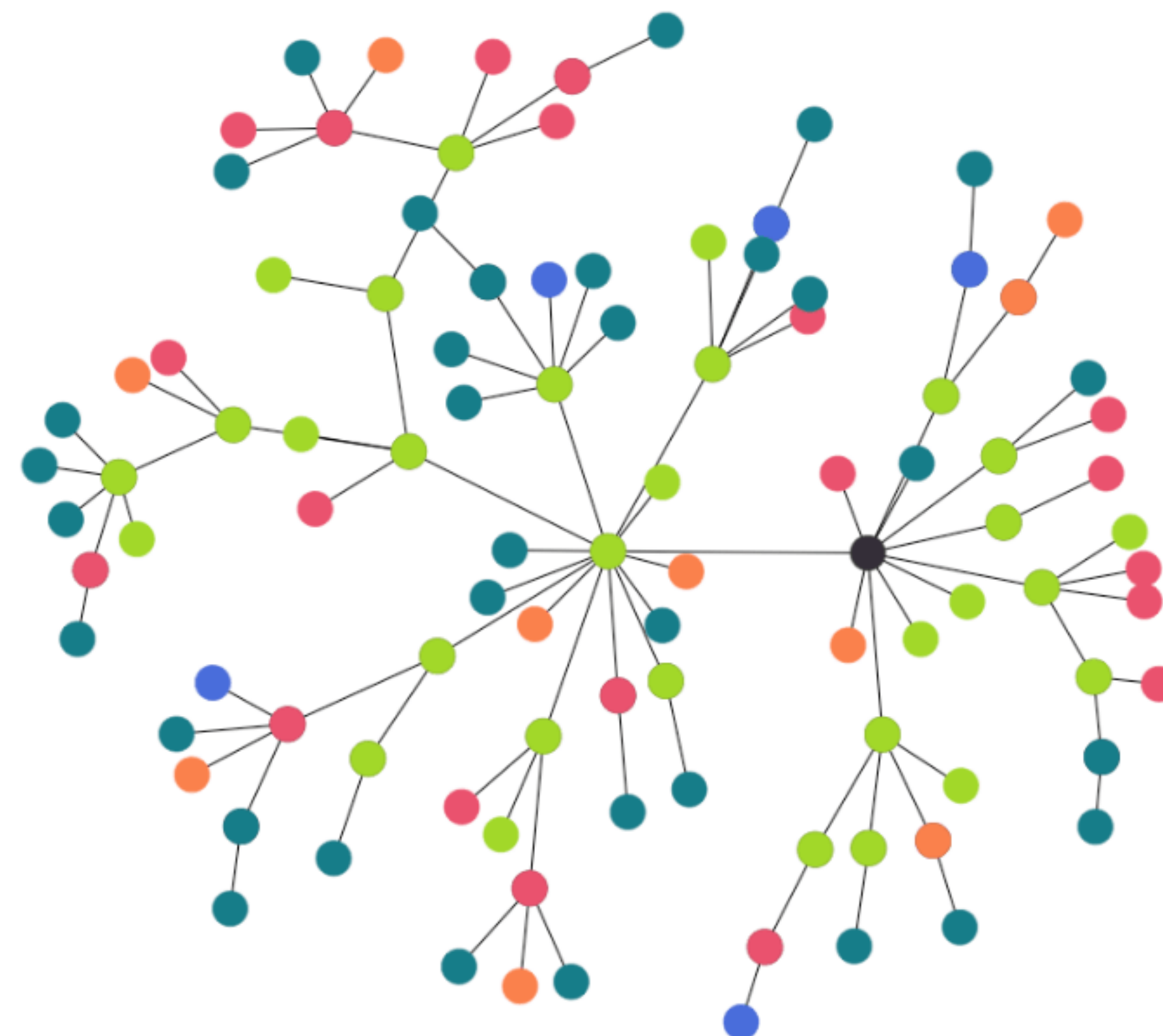
Step 2: Agents travel

Contagion happens between agents

Agents live in- and travel between wards

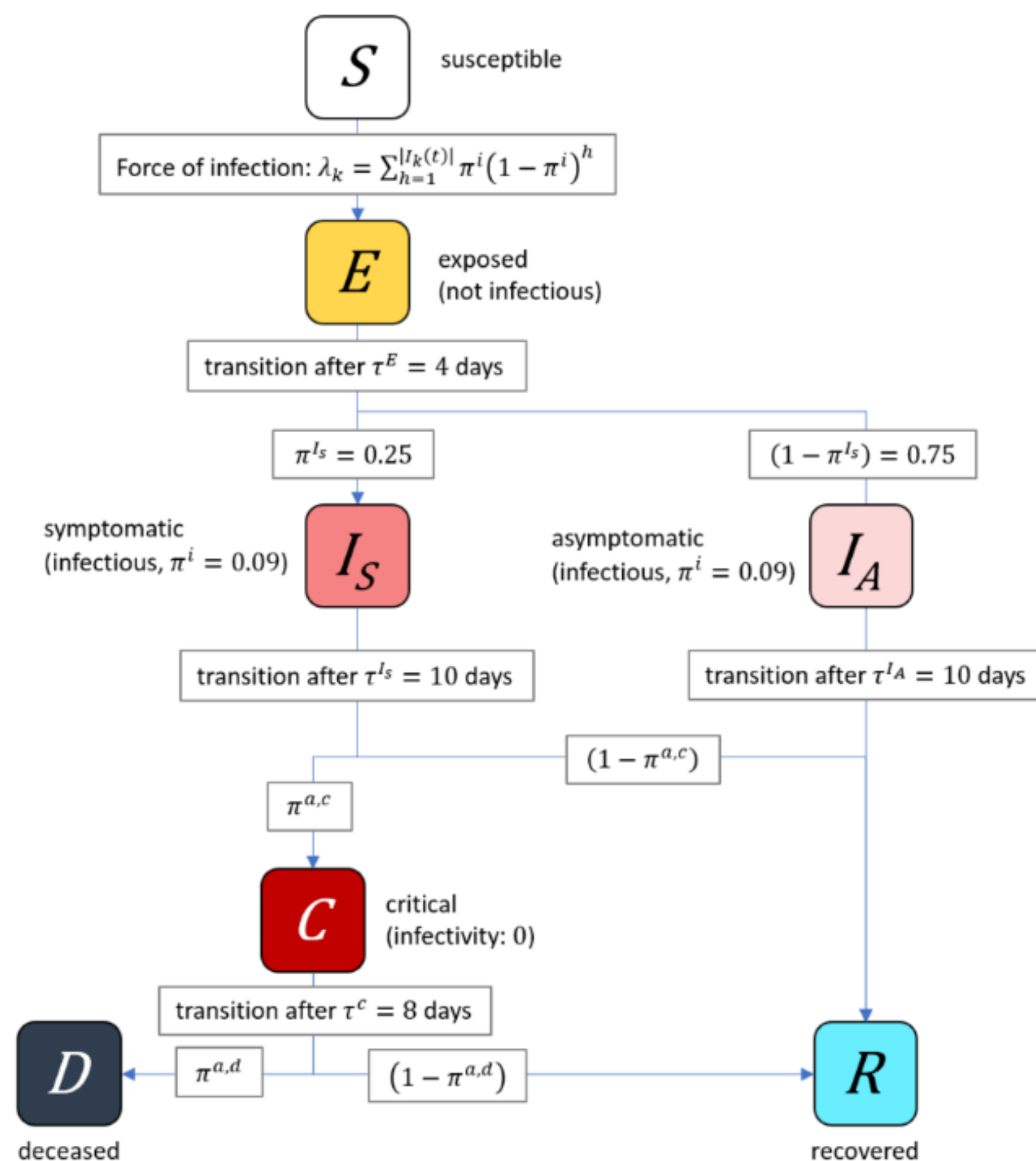


Agents **interact** within a (social) network

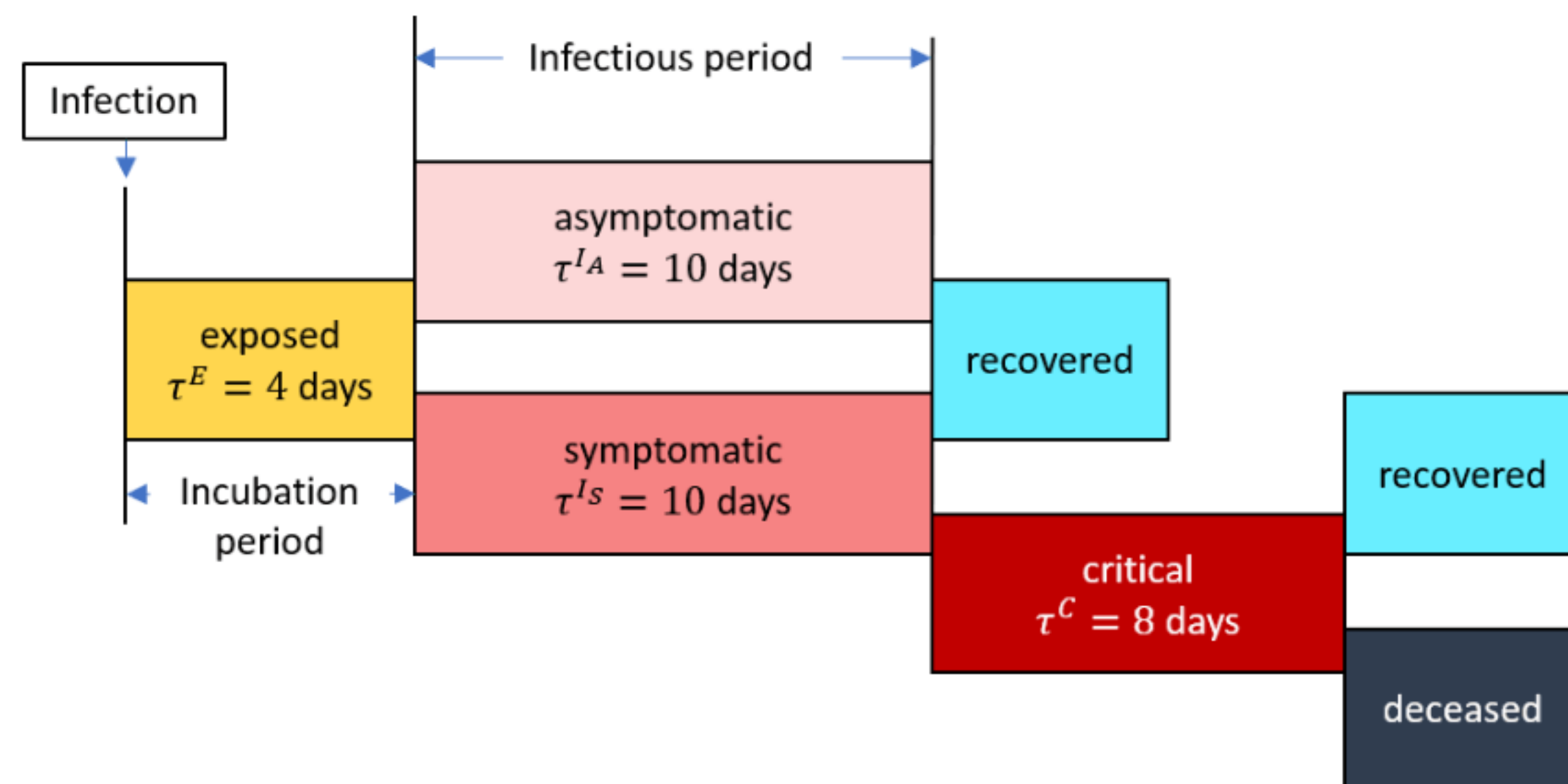


● Asymptomatic ● Critical ● Recovered
 ● Symptomatic ● Susceptible ● Died

Basic dynamics follows SEIR model



Schematic and transition probabilities



Basic timeline and agents' states



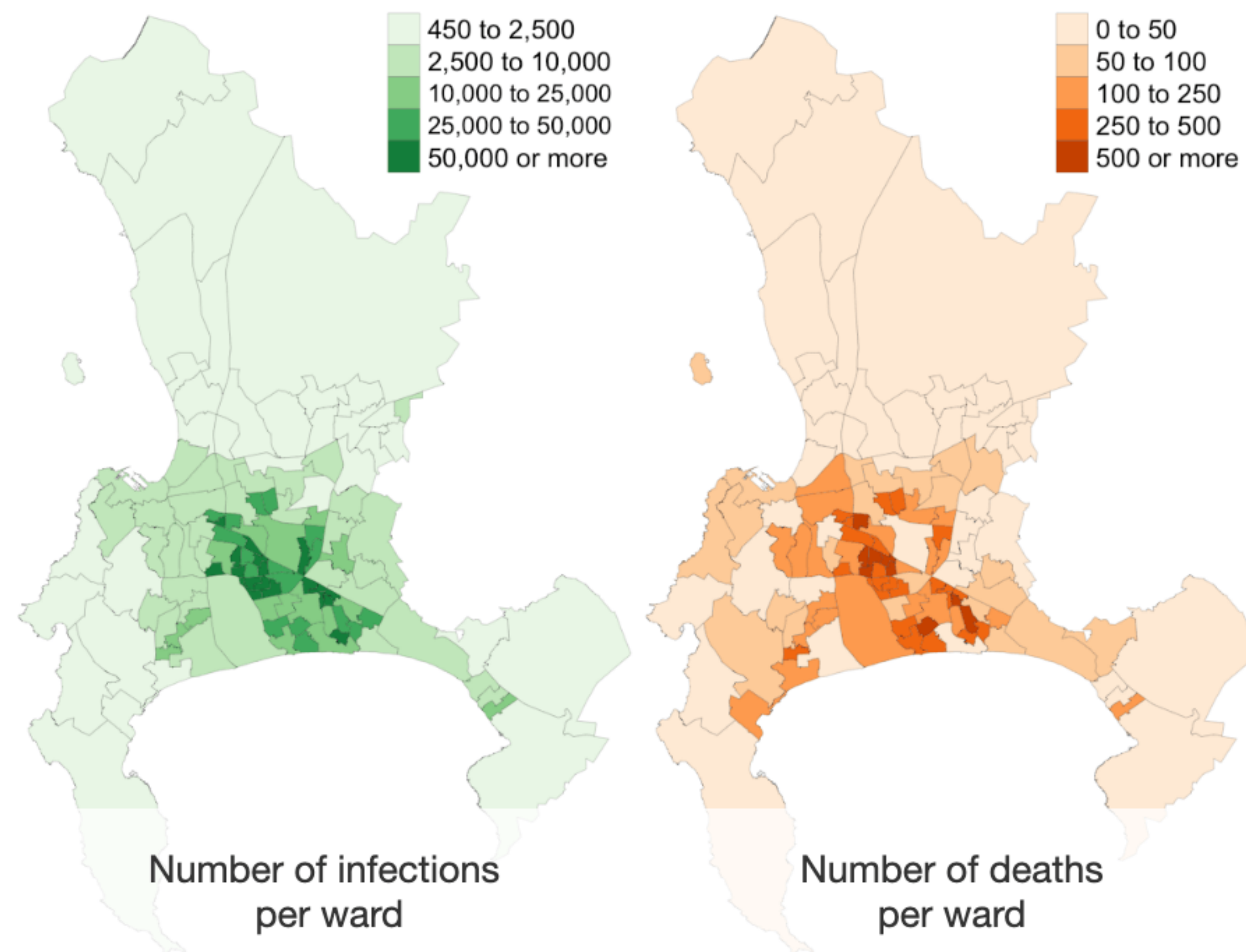
Our baseline calibration for Cape Town

Baseline calibration for Cape Town

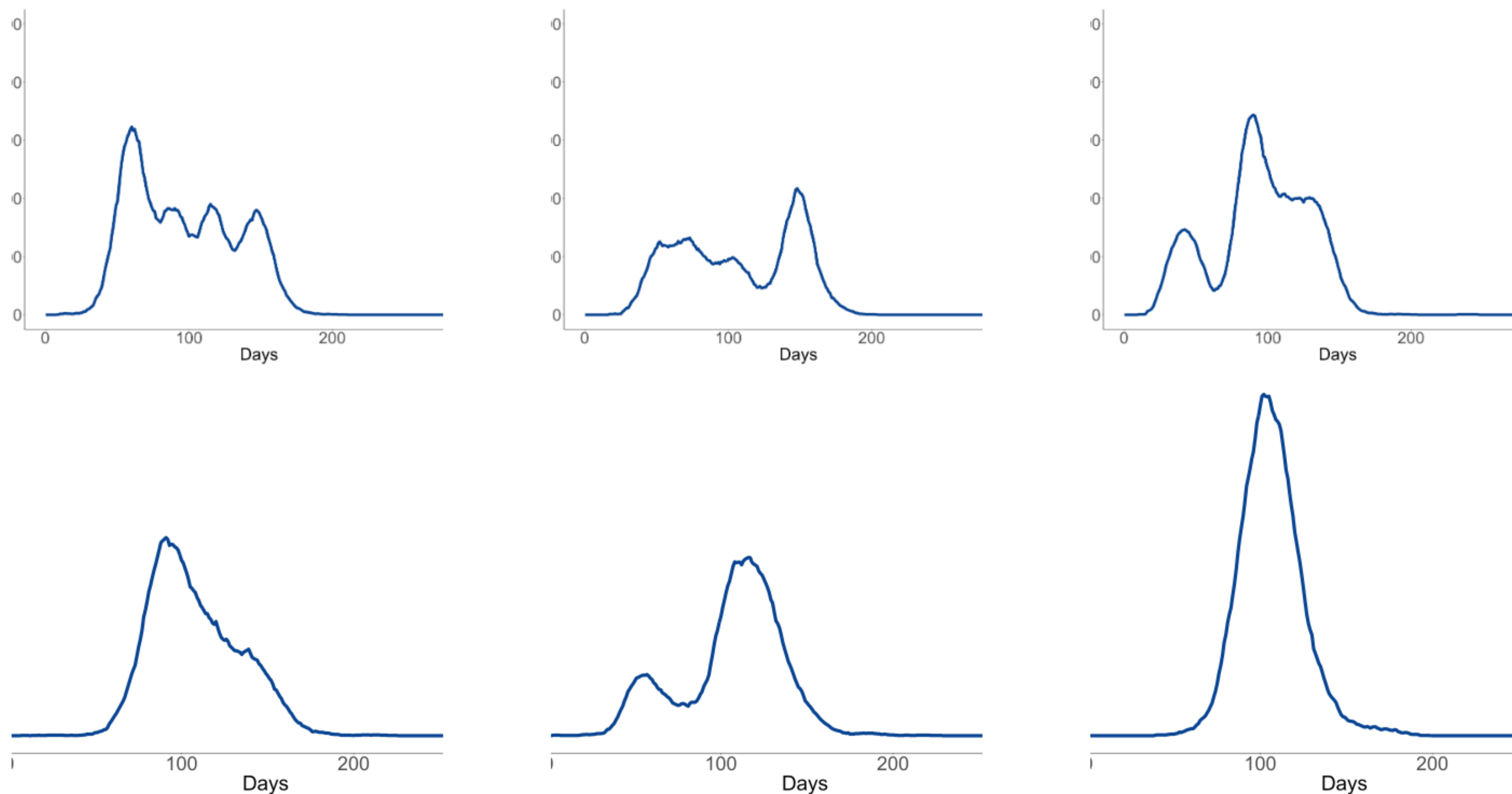
Using best available data and parameters

We **calibrate** our model using:

- Pathogen parameters (using best available estimates from literature)
- Simulation parameters (#agents, #simulations, etc.)
- 2011 Census (per ward)
- 2013 National Household Travel Survey (to be updated)
- WC DoH data for e.g. initial infections and ICU beds
- Policy parameters (lockdown levels, alternative policies)



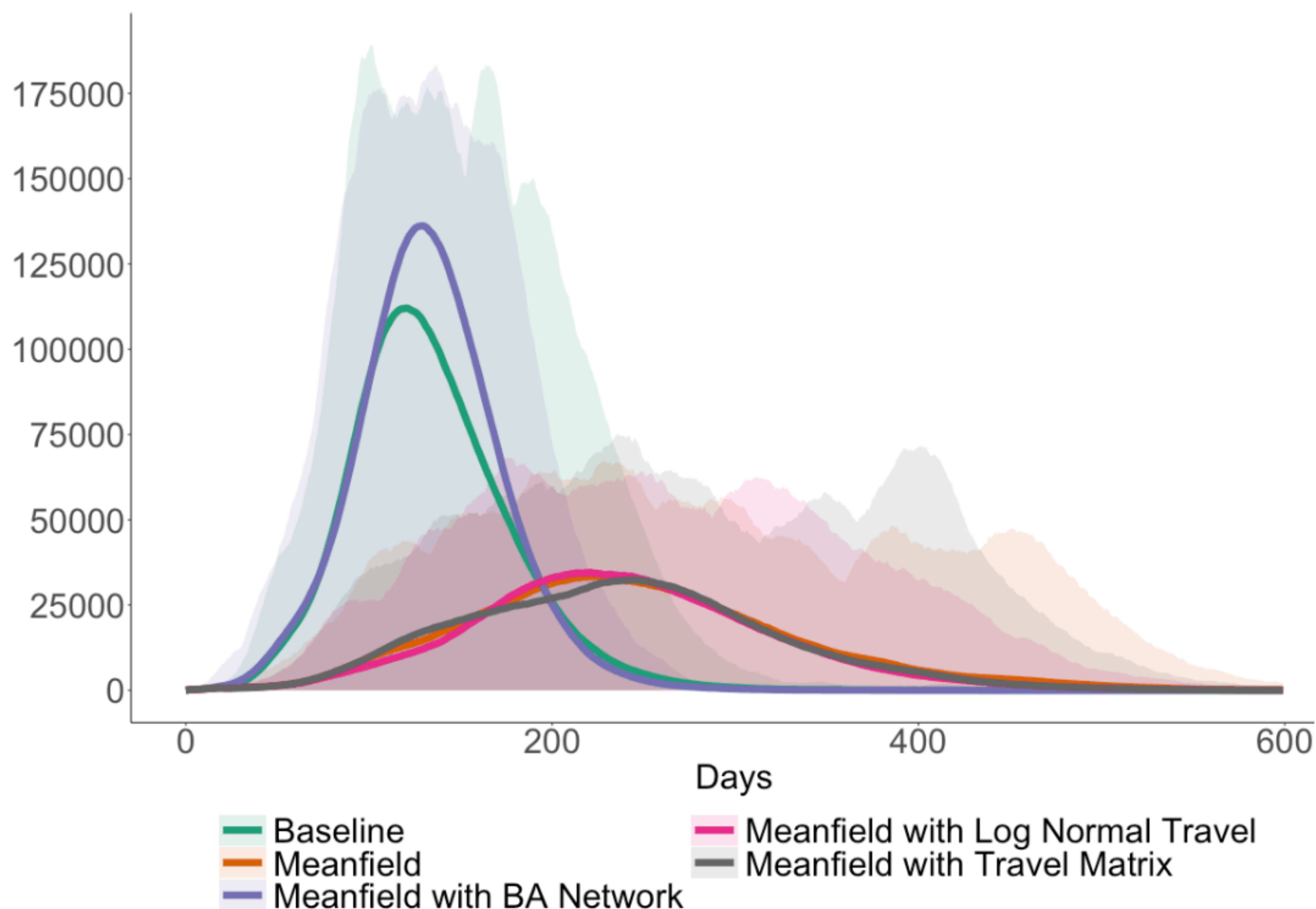
The model produces ward-level predictions



of infections per day for different wards

Insights from bottom up aggregation

Interactions within ward are key during lockdown

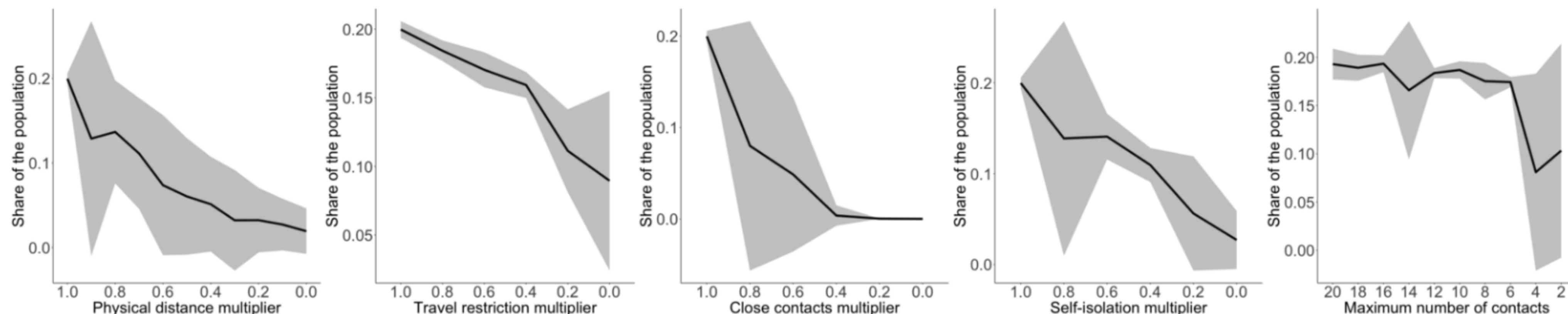




Lessons for Policy Makers 1: A lockdown is not without alternatives

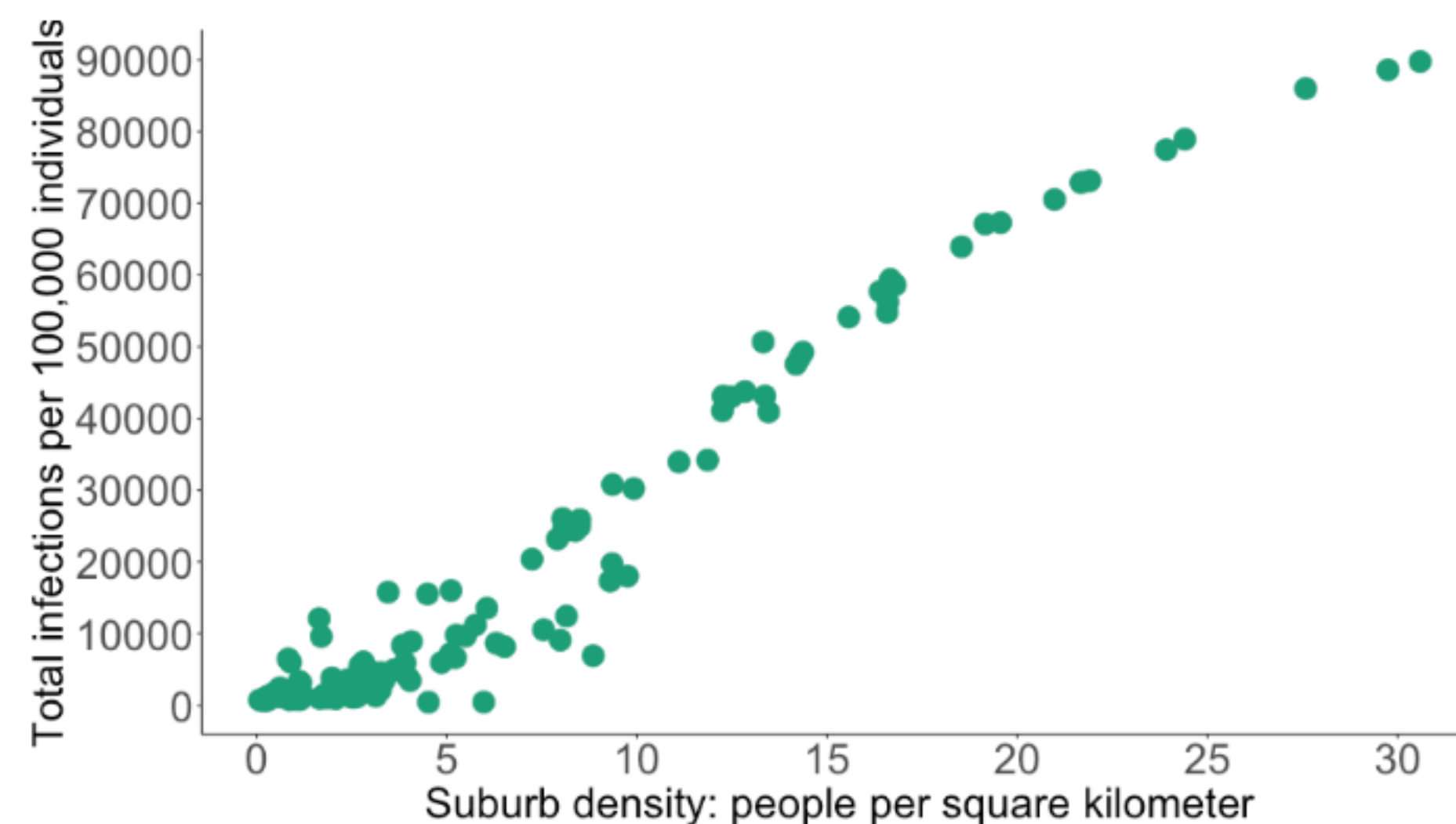
SABCoM allows detailed study of policies

Lockdown alternatives exist, but must be done right



Lesson 1: Some policy parameters are more important than others (e.g. close contacts vs. max contacts)

Lesson 2: Some parameter changes are more important than others (e.g. close contact reduction is very efficient > 0.8 ; but not < 0.4)





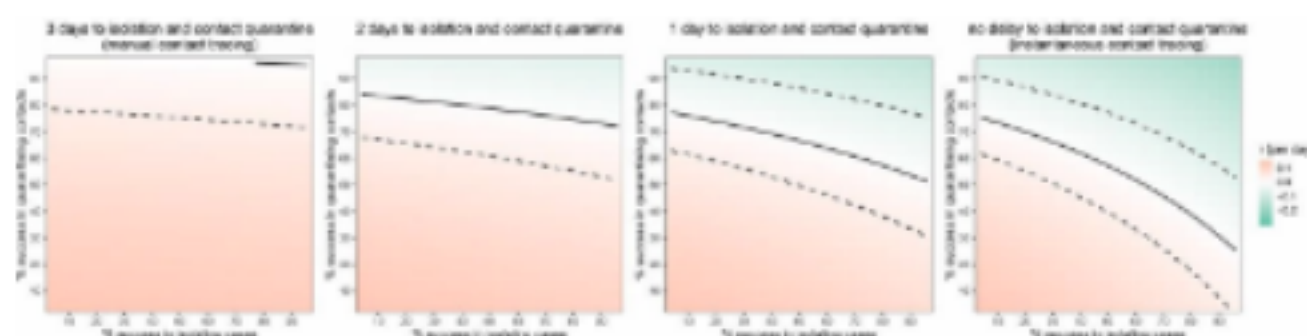
Lessons for Policy Makers 2: Effective contact tracing is key

Covi-ID is part of the COVID SafePaths Ecosystem: A global, citizen-centric movement to develop free, open-source, privacy-by-design tools for citizens, public health officials, and communities to effectively response to the pandemic while preventing a surveillance-state.

BACKGROUND

To fight COVID-19, emerging market countries need to deploy high-tech track and trace solutions in a low-tech environment. Existing track and trace solutions to fight COVID-19 depend critically on widespread adoption of smartphone usage. But 55% of users in emerging markets do not have a smartphone. Alternative methods to obtain geo-location data, including cell tower triangulation is imprecise and thus ineffective.

For economies to re-open, track and trace needs to be fast. Ferretti et al. (2020) show that contact tracing can be effective to contain COVID-19 if we can isolate 60% of patients as soon as they have symptoms and 50% of their contacts instantaneously (see figure below).



TECHNOLOGY *(See a demo [here](#))*

Covi-ID | A platform consisting of a free web app for trusted *data custodians* (e.g. banks, universities) to become identity providers and easily issue Covi-ID QR codes, together with a free Android app for organizations (e.g. taxis, offices, supermarkets) to scan Covi-ID QR codes and help their employees and users stay safe. **Demo of open source web app available at <https://app.coviid.me>. Verifier app for organizations available in Google Play Store.**

Safe Places | A browser-based mapping tool for contact tracers to more efficiently interview infected patients and create anonymized maps and data files of public places and times where the infected patient has been.

Requires only minimal infrastructure | Covi-ID is designed to work in a low-tech environment where many users do not have smartphones.

WHY THIS SOLUTION IS NEEDED

Track, trace and treat | Contact tracing has been pivotal in containing and slowing the spread of COVID-19. However, this process is traditionally time consuming and prone to human memory errors – Covi-ID and COVID SafePlaces can help emerging countries to recover faster.

Simple status verification | Covi-ID also provides an integrated and easy to verify essential worker status.

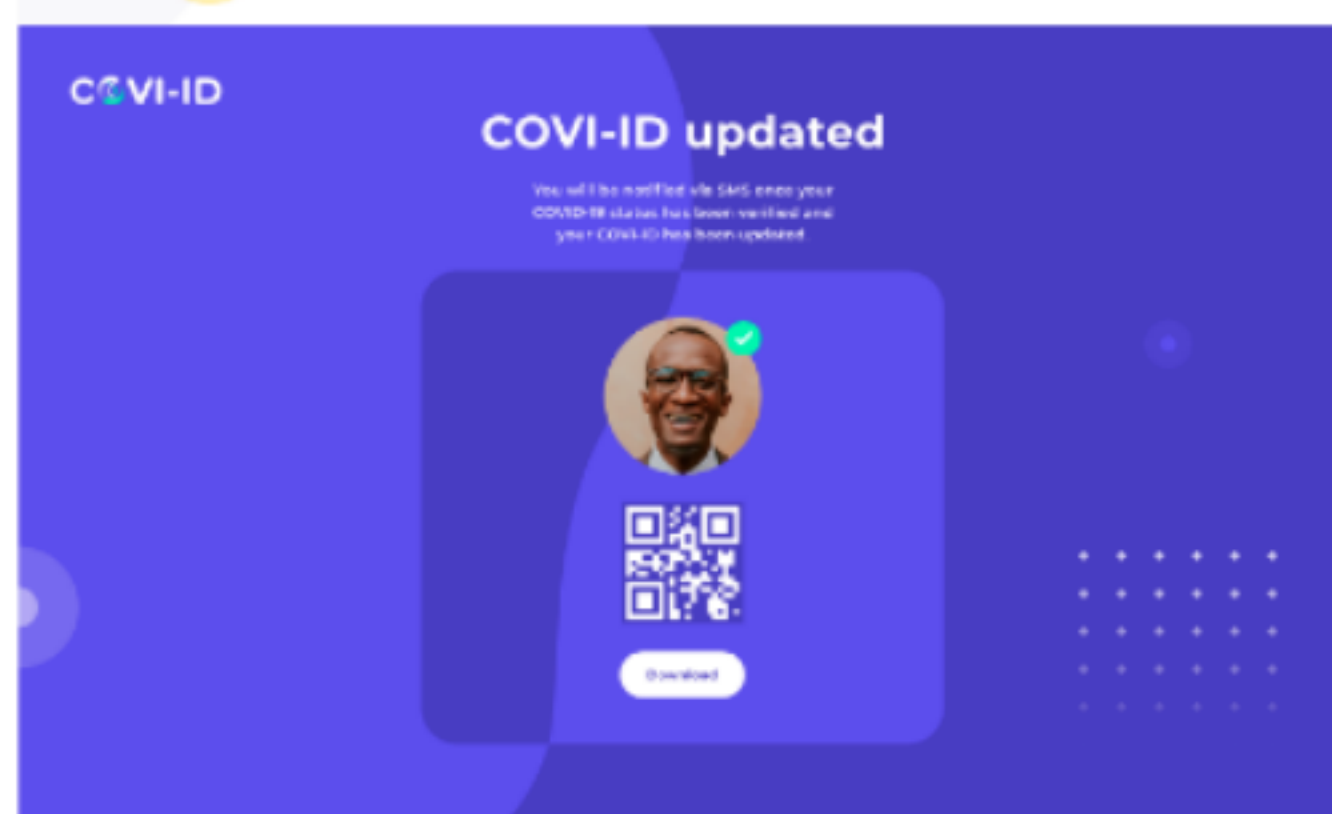
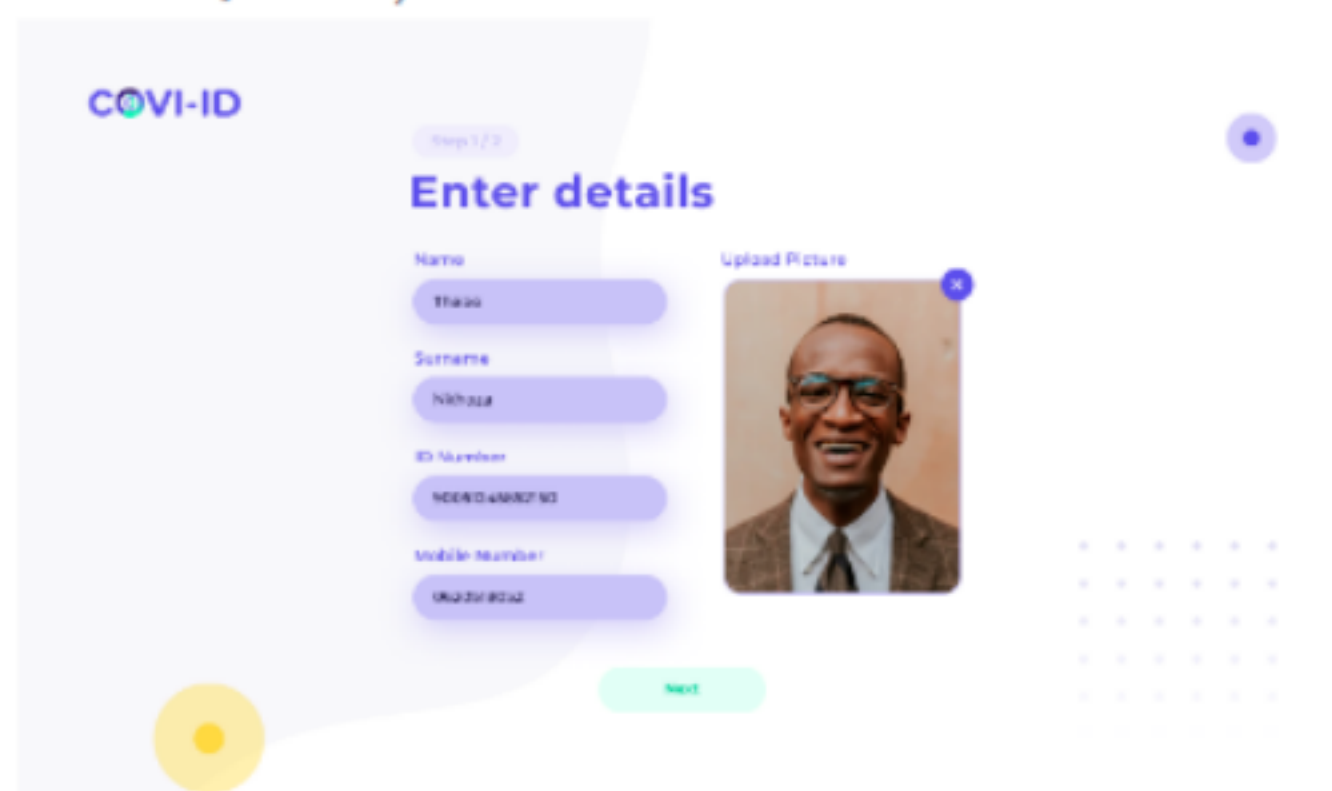
Keep it private and avoid a surveillance state | Covi-ID and COVID Safe Places reduces the risk of privacy violations by replacing centralized storage of sensitive data with self-sovereign identity; hence avoiding a surveillance state, empowering users, and stimulating innovation..

The future | Covi-ID and COVID Safe Places are more than short term fixes for a global pandemic, we build a resilient infrastructure for digital identity- and health credential management.

Developed at UCT and MIT, together with a group of global collaborators and volunteers from leading academic institutions and tech companies.

To learn more and get involved, visit us at: <https://coviid.me> and <https://covidsafepaths.org/>

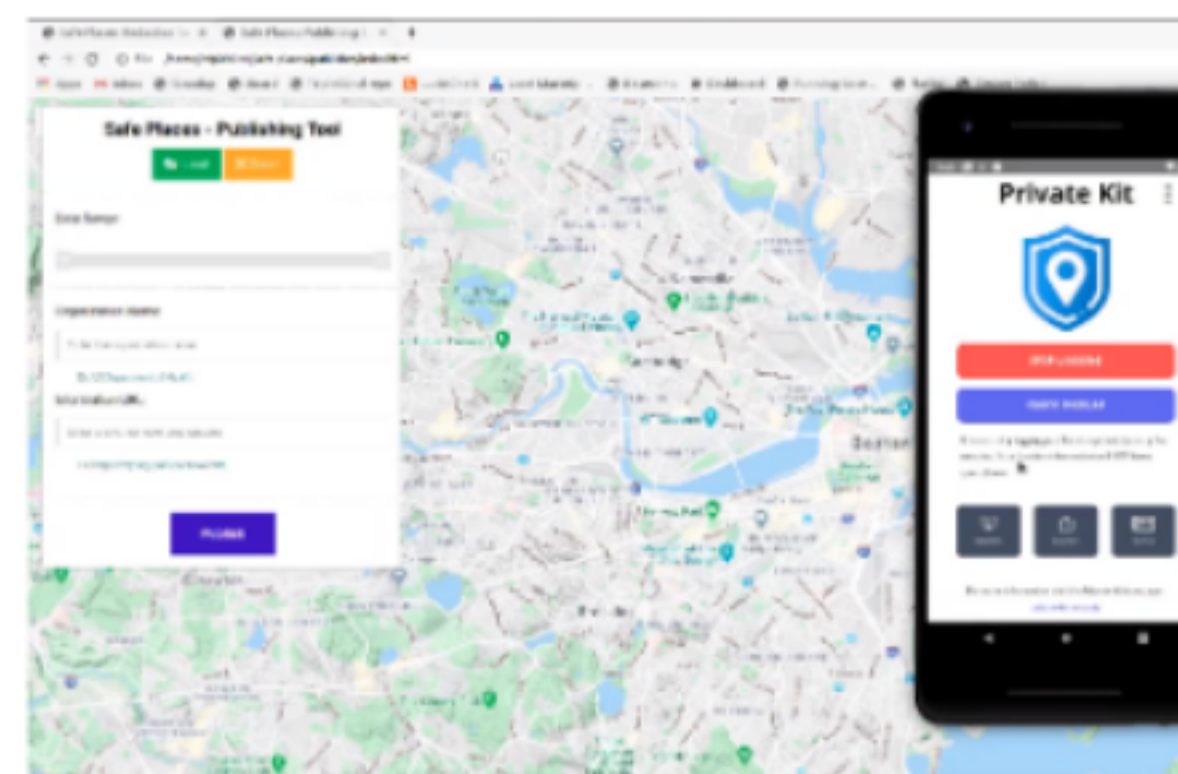
Our **custodial wallet** application allows anyone to generate Covi-ID QR codes, for themselves or others.



The free Covi-ID **verifier app** allows business owners to quickly set up a virtual organization on the platform. This will enable them to start issuing geolocation receipts to their employees and customers. These receipts are stored with the users' custodial wallet so that their privacy is always respected.

A **geolocation receipt** is a token that serves as a reminder for the user where she was and when. If a user tests positive for COVID-19, she can choose to release her geolocation receipts to COVID SafePlaces, which then creates an updated COVID-19 hotspot map and informs manual contact tracers.

Covi-ID integrates seamlessly with **COVID SafePlaces** and **COVID SafePaths** to provide the most comprehensive information for public health officials.



COVID SafePlaces demo available [here](#)

Developed by leading researchers in collaboration with global partners for roll-out and deployment



Privacy-Centric — Open-Source — Secure — Collaborative

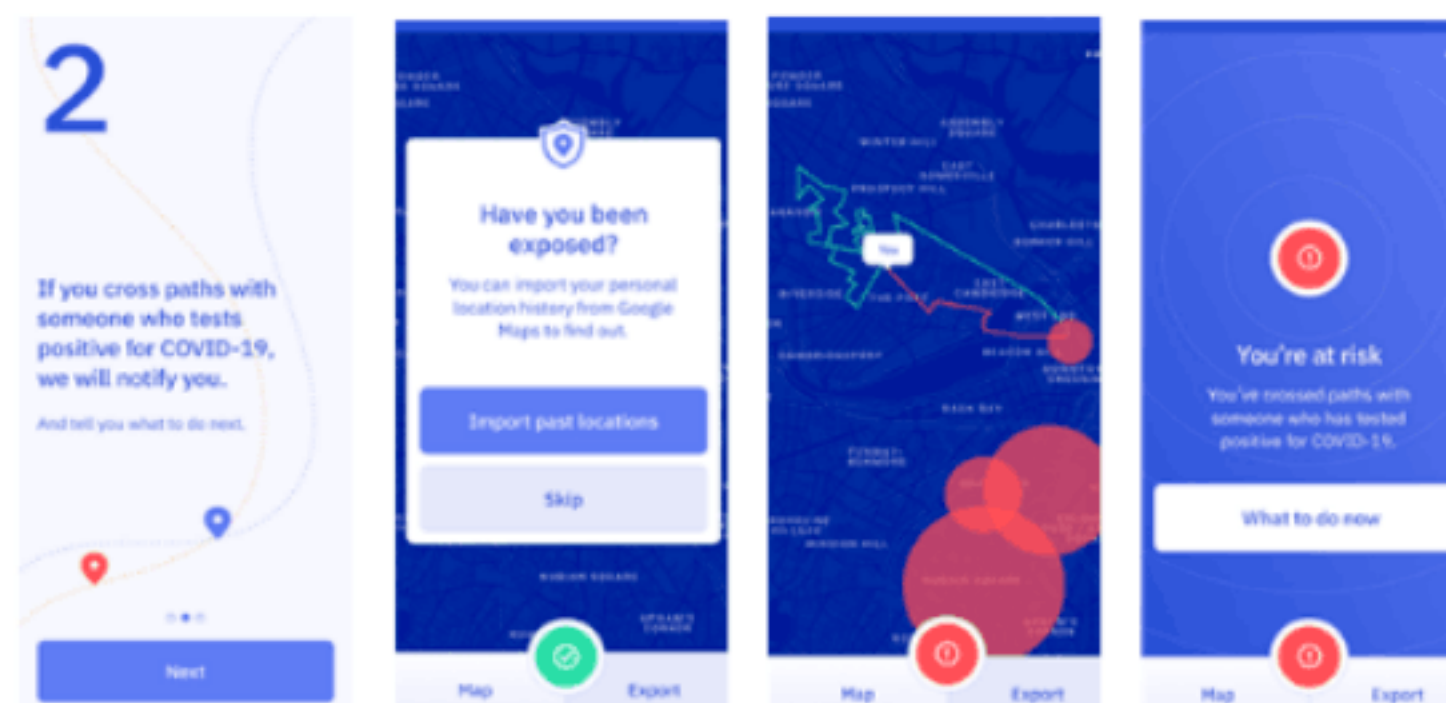
Our Approach to Track and Trace

How Covi-ID amplifies the efficiency of existing track and trace systems

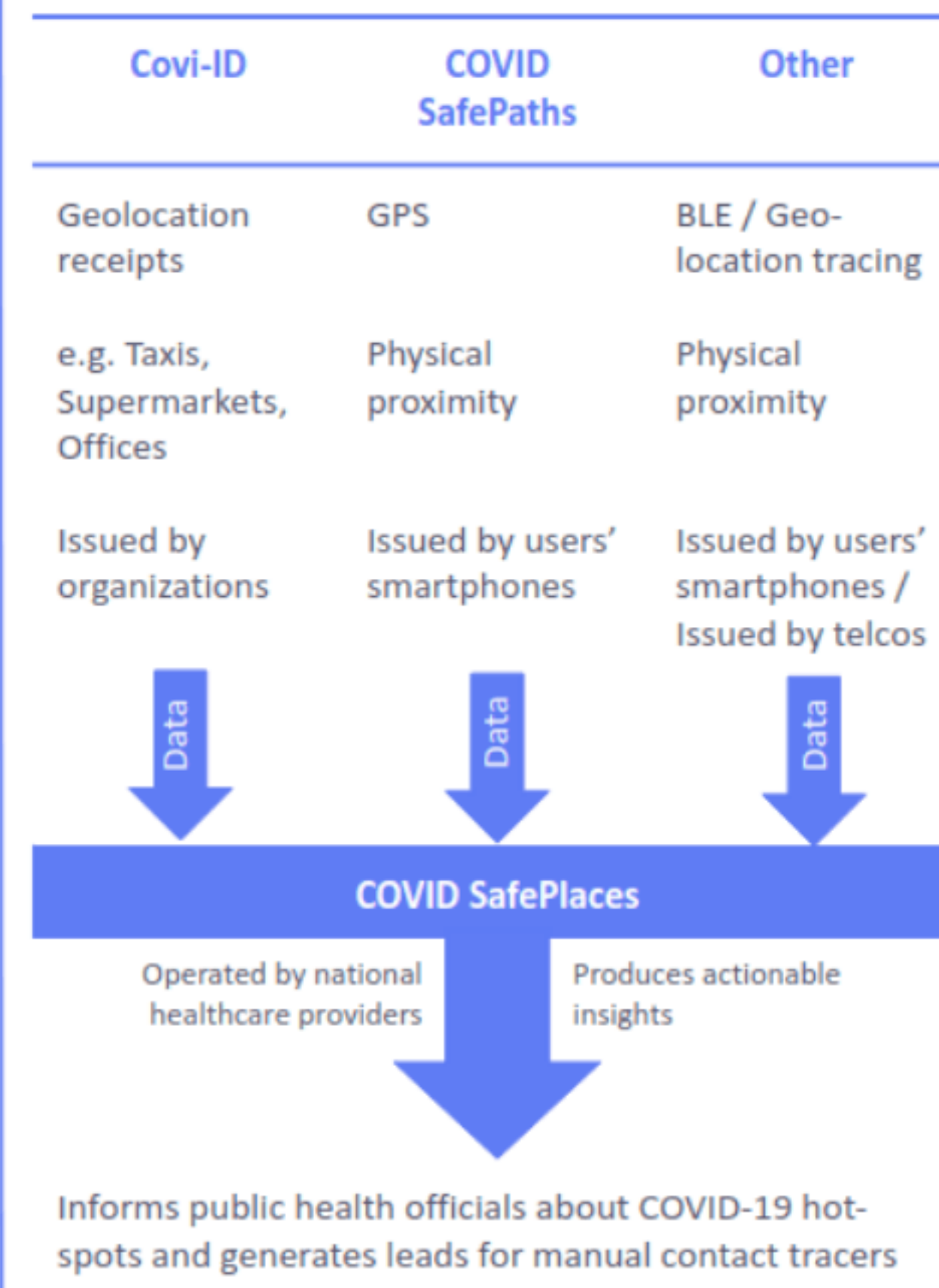
	Examples	Platforms	Challenges
Bluetooth	PEPP/PT, DP-3T, OpenTrace, Google/Apple	Android / iOS	Adoption very low (e.g. ~15% of population in Singapore)
GPS	COVID SafePaths	Android / iOS	Adoption unclear
Geolocation (cell phone triangulation)	National track & trace solutions (e.g. in SA)	USSD	Precision (location only precise within ~300-400m)
Geolocation receipts	Covi-ID	All users, including those without phones	Novelty of approach

Overview of different technologies used for track and trace. Covi-ID works hand in hand with COVID SafePaths and integrates seamlessly with **COVID SafePlaces**.

The system is designed so it can be easily integrated with other solutions, in particular with **COVID SafePaths**, but also with national track and trace solutions based on geolocation via cellphone triangulation



Covi-ID augments existing track and trace solutions by providing a new mechanism to feed valuable data into national emergency response systems



A Three Week Roll-Out Plan for Nationwide Adoption

Our three-step deployment framework has been verified for our ongoing pilots (e.g. in Haiti)

	Phase 1 Getting Started	Phase 2 Limited Deployment	Phase 3 Achieving Scale
What	<ol style="list-style-type: none"> 1. Align support from key officials to champion project 2. Assess country needs, infrastructure, and risks 3. Define local media strategy to socialize technology 4. Define training for officials and contact tracers 5. Secure stakeholders (e.g. malls, taxi operators, office buildings) for initial pilot 	<ol style="list-style-type: none"> 1. Launch pilot in clinics and communicate those via media 2. Test technology and gather feedback 3. Gain initial understanding of COVID-19 spread 4. Document and report pilot results 5. Publish use case with lessons learned 6. Rich feedback will be incorporated into future software releases 	<ol style="list-style-type: none"> 1. Number of pilots and users grow. Effort gains additional media attention, helping scale 2. Design and issue comprehensive and wide-ranging communications to promote citizen adoption of Safe Paths app 3. Government officially endorses the technology and promotes it through widely available COVID-19 related programs 4. Document and publicize pilot use case(s) 5. Model is replicated in neighboring jurisdictions
Who	<ol style="list-style-type: none"> 1. Key officials and local champion 2. UCT/MIT/EY volunteers / champion run country assessment 3. UCT/MIT/EY volunteers design training program for local officials and contact tracers 4. Media / Comms lead design comms strategy 	<ol style="list-style-type: none"> 1. Physicians, contact tracers, and users test the technology 2. UCT/MIT/EY volunteers/Champion gather feedback, assess pilot results, and report findings to key officials 3. Key officials provide feedback and direction 4. Media / Comms lead, with support from UCT/MIT/EY volunteers/Champion, publish use case 	<ol style="list-style-type: none"> 1. Same as phase #2, but at larger scale 2. Local partners, across sectors, are mobilized and involved to help scale 3. Key officials liaise with neighboring jurisdictions to replicate model 4. Governing board for a large-scale enterprise
Why	<ol style="list-style-type: none"> 1. Secure political capital 2. Understand country situation and gaps 	<ol style="list-style-type: none"> 1. Identify and solve critical issues with technology and processes 2. Understand conditions for larger deployment. 	<ol style="list-style-type: none"> 1. Achieve critical mass of users and verifiers 2. Widespread tracking informs interventions and impacts disease containment at the individual and community level
Economics	<ol style="list-style-type: none"> 1. Technology is free 	<ol style="list-style-type: none"> 1. Technology is free 2. Minimal deployment cost 	<ol style="list-style-type: none"> 1. Technology is free 2. Coordination / Deployment costs may grow, as effort scales
When	Week 1	Weeks 2 - 3	Week 3 onwards

Thank you!

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**SABCoM GitHub Repository:
<https://github.com/blackrhinoabm/sabcom>**

**Covi-ID: <https://coviid.me>
MIT's COVID SafePaths: <https://covid-safe-paths.org>**