Modeling the Impact of Routine Treatment on Schistosomiasis Elimination in Kenya

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Schistosomiasis in Kenya

Schistosomiasis is a neglected tropical disease caused by parasitic worms of genus Schistosoma.

1 **Prevalence**

Over 6 million people are at risk, with ~2.5 million infected

2 **Impact**

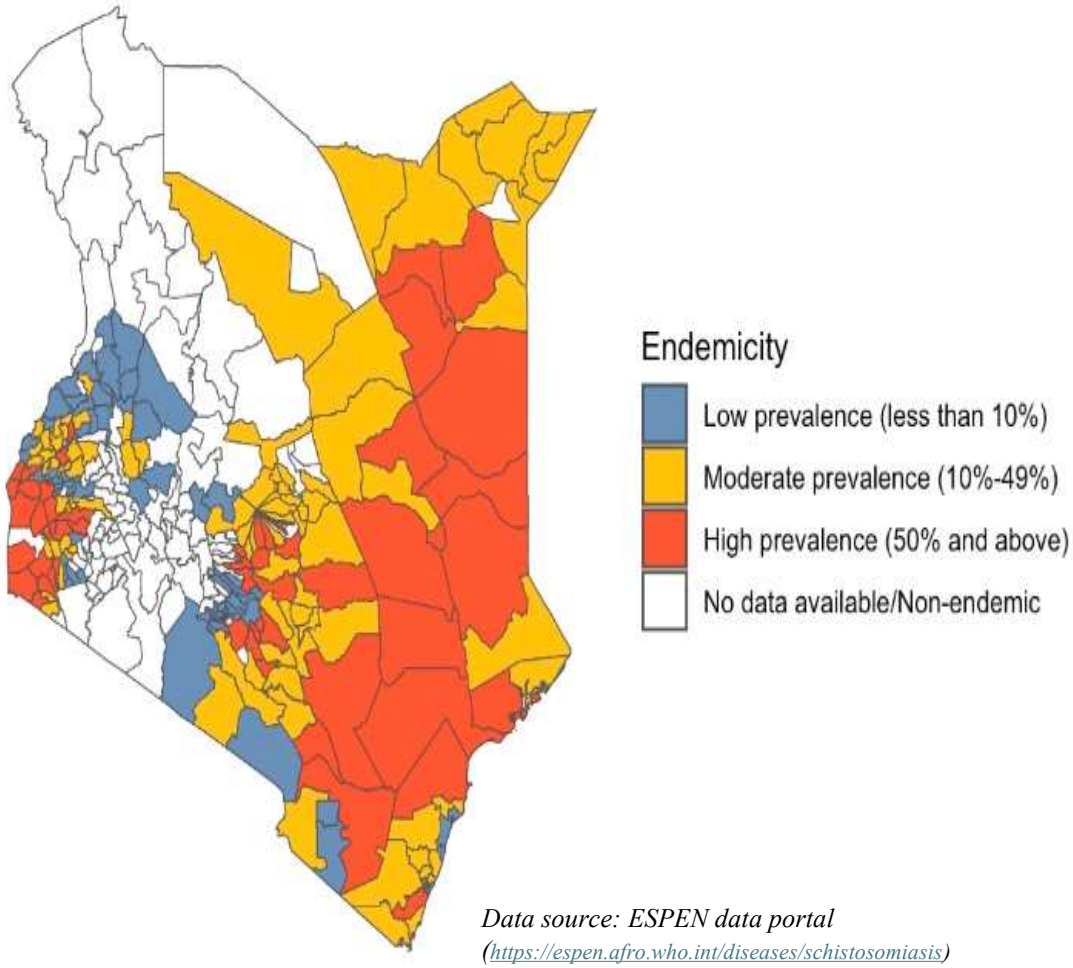
Chronic illness, reduced productivity, and increased healthcare costs

3 **Transmission**

Individual contact with cercariae-infected freshwater bodies

4 **Elimination Goals**

Elimination as a public health problem (WHO) and Kenya's BTS



Data source: ESPEN data portal (https://espen.afro.who.int/diseases/schistosomiasis)

(Gichuki et al. 2019), (Kepha et al. 2023), (Colley et al. 2014), (World Health Organization 2022), (Ministry of Health 2022)

Current Control Strategies

WHO preventive chemotherapy guidelines:

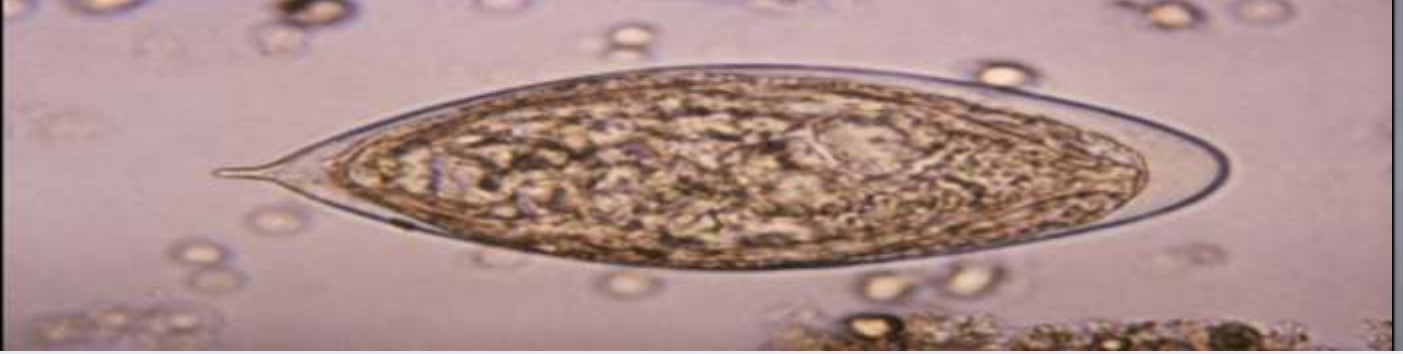
Mass drug administration (MDA) targeting at least 75% (2+ years):

- Once a year treatment in areas with prevalence ≥10%
- Twice a year treatment in areas with prevalence ≥50%

Kenya preventive chemotherapy guidelines:

Annual MDA campaign for areas with prevalence ≥2% targeting 2+ years at 75% coverage

(World Health Organization 2022), (Ministry of Health 2022)



Challenges to Elimination

Achieving sustained therapeutic coverage remains a challenge:

Never Treated

Individuals who have never received treatment after multiple MDA rounds.

Not Treated

Individuals who were not treated during the previous campaign due to factors such as age.

Impact

Effect of maintenance of the targeted therapeutic coverage beyond campaign period, on the elimination targets.

(Kuraet al. 2024), (Ministry of Health 2022)

Proposed Intervention

Introduction of routine house-to-house treatment following MDA campaign.

Goal

Maintain targeted therapeutic coverage beyond campaign period

Approach

MDA campaigns followed by routine house-to-house treatment.

Benefit

Reduce infection reservoir, accelerate elimination timeline.

Research Question and Objectives

Research Question

How does the implementation of routine house-to-house treatment following MDA campaign affect the prevalence of schistosomiasis and the timeline for achieving elimination in Kenya by 2030?

Specific Objectives

- Model the transmission dynamics of schistosomiasis in Kenya.
- Evaluate the impact of routine house-to-house treatment on the timeline for reaching elimination targets.

Literature Review

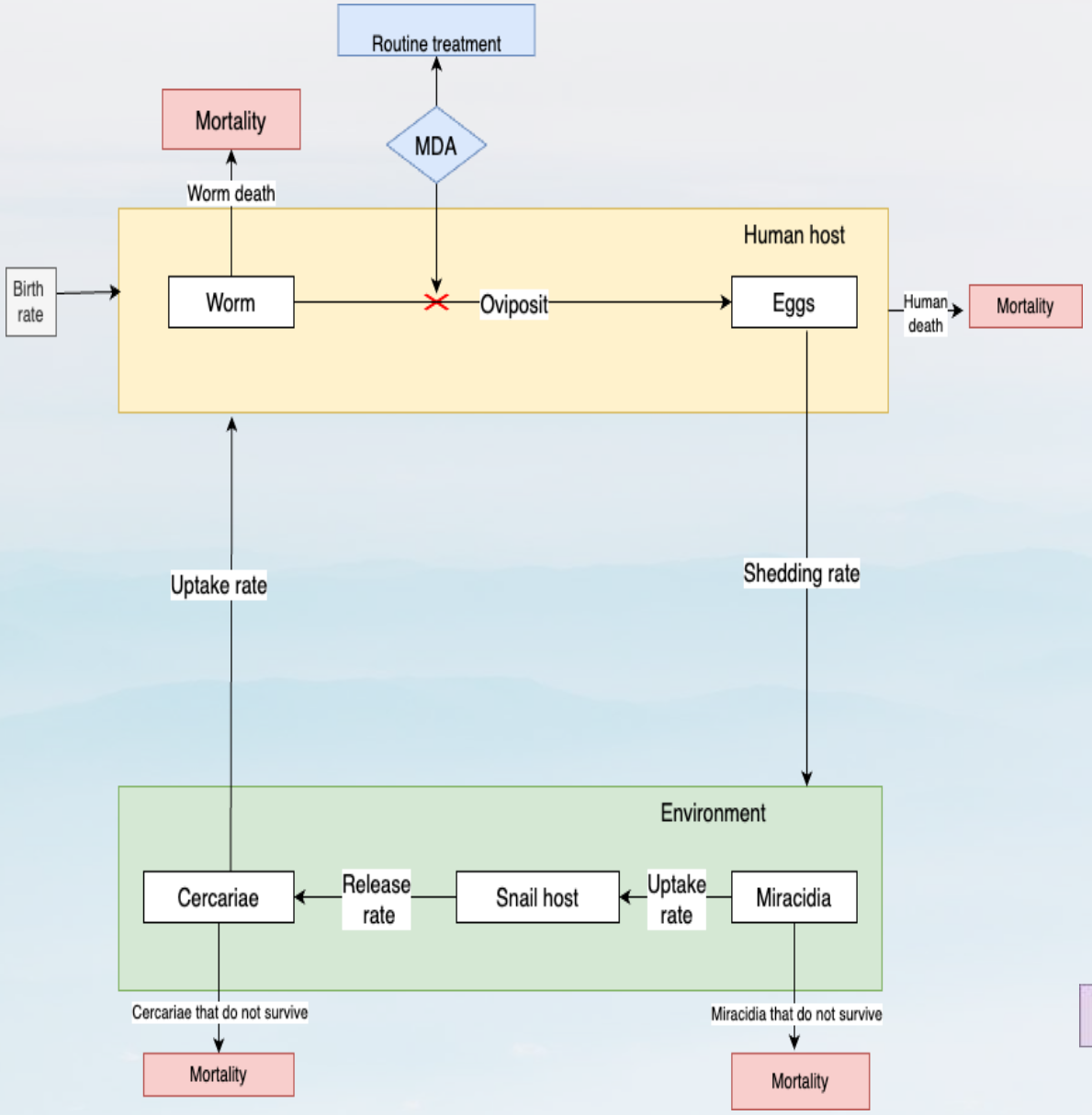
1 Importance of Treatment Coverage:

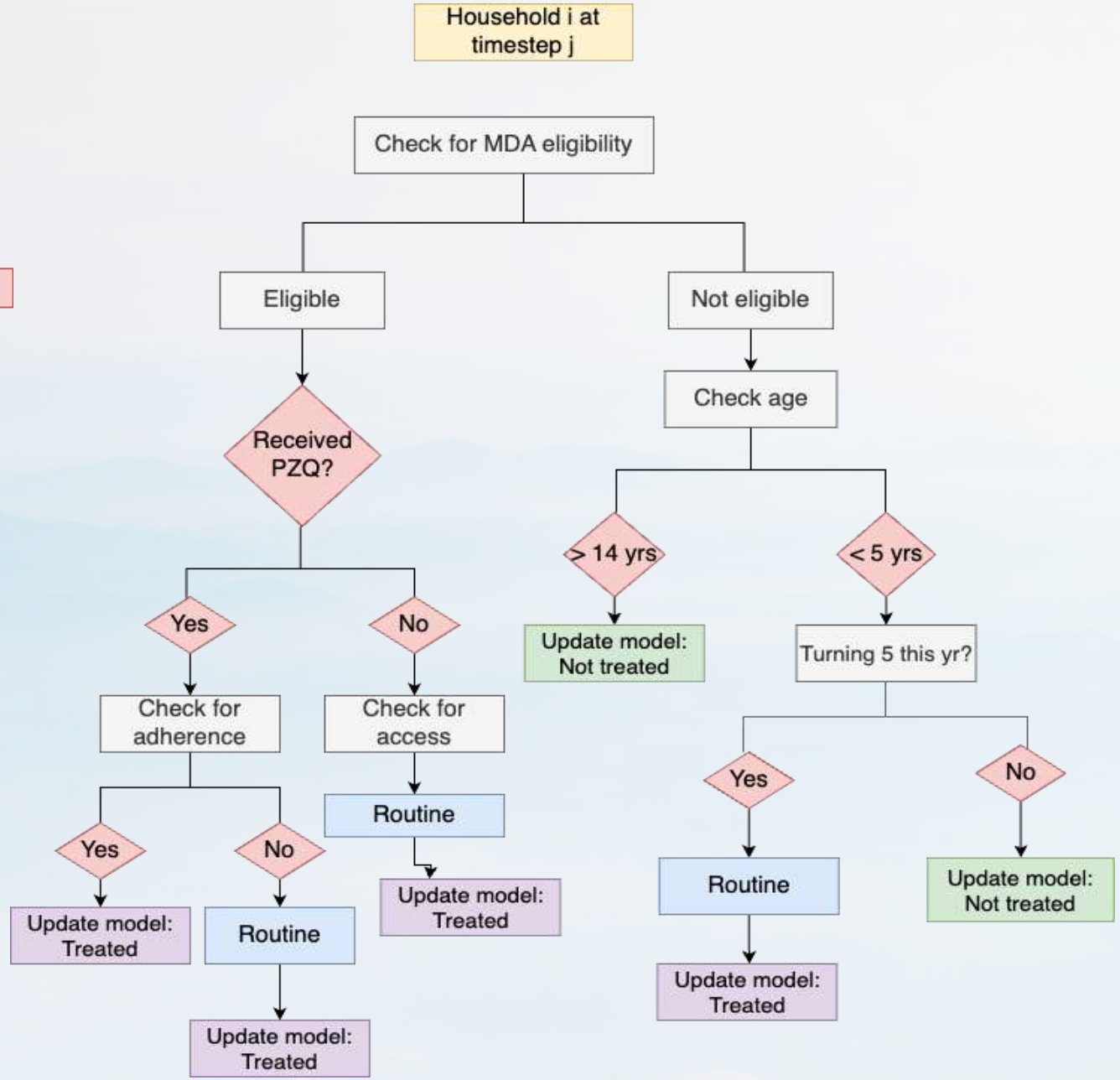
- Minimizing the proportion of NT individuals can shorten the duration of control programs (Kura et al., 2024).
- Focusing treatment on a limited age group while excluding other high-risk groups can result in undetected disease rebound and irreversible morbidity (Kate et al., 2014, Faust et al., 2020).

2 Role of Agent-Based Models:

By simulating the complex interactions between individuals, their behavior, and the environment, ABMs can shed light on disease dynamics and guide optimal control strategies (Graham et al., 2021).

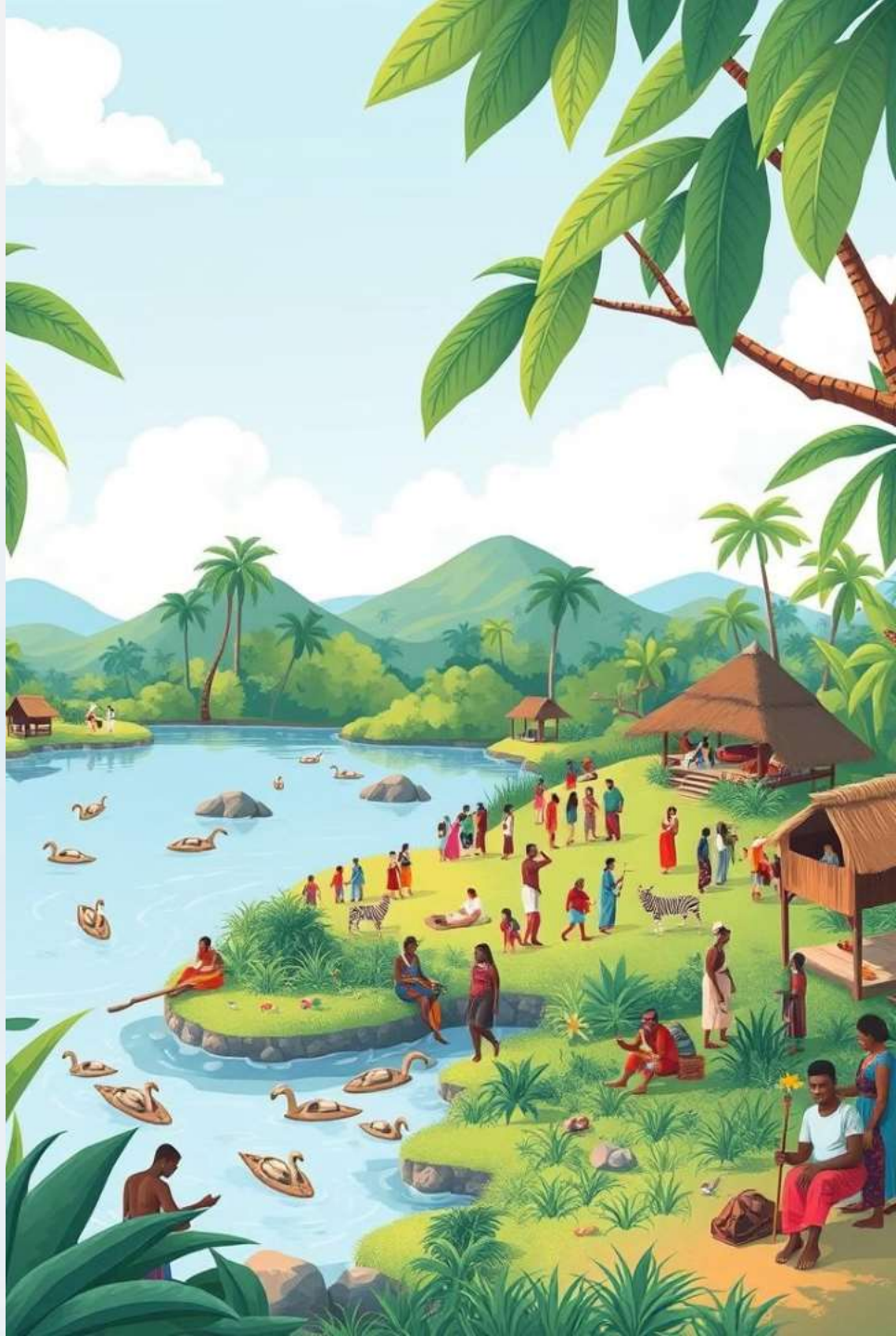
Model Structure





Model Assumptions

1. Homogenous mixing of susceptible, exposed, infected population
2. Individuals are classified into susceptible, exposed, infected and recovered population
3. Treatment is administered to the susceptible, exposed and infectious population
4. Not all individuals adhere to treatment
5. Preventive chemotherapy does not prevent re-infection



Scenario Modeling: Exploring Intervention Options

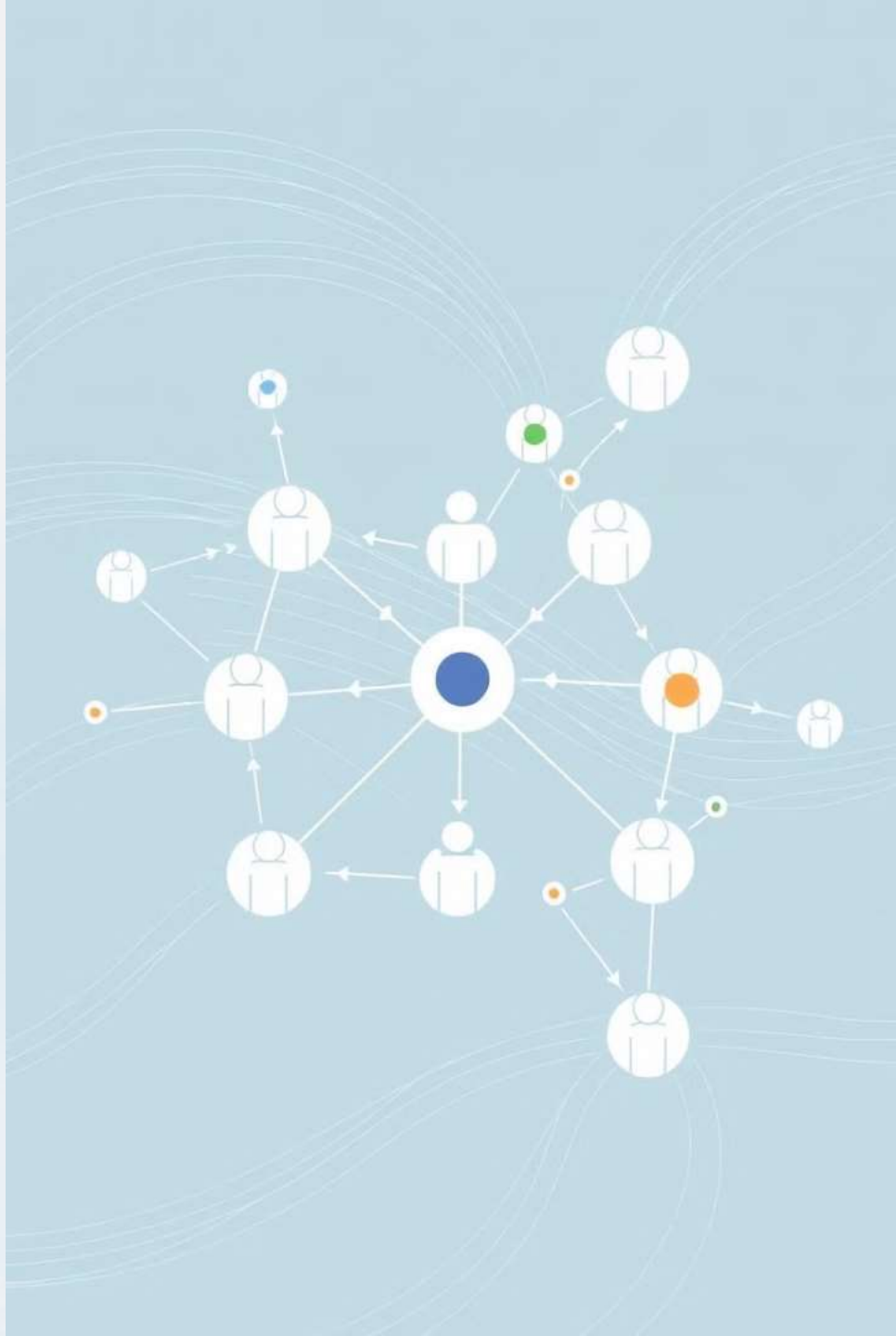
Scenario	MDA Coverage	Routine Treatment
Baseline	75%	None
Intervention 1	75%	Yes
Intervention 2	80%	Yes
Intervention 3	85%	Yes

Model Implementation

1
- Define agent, environment, attributes and interactions, decision rules
- Set up the different classes

2
- Implement simulation loop
- Data collection and analysis

3
Results visualization



Next Steps …

- Extend the model to capture heterogeneous transmission
- Conduct scenario modeling
- Present results

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