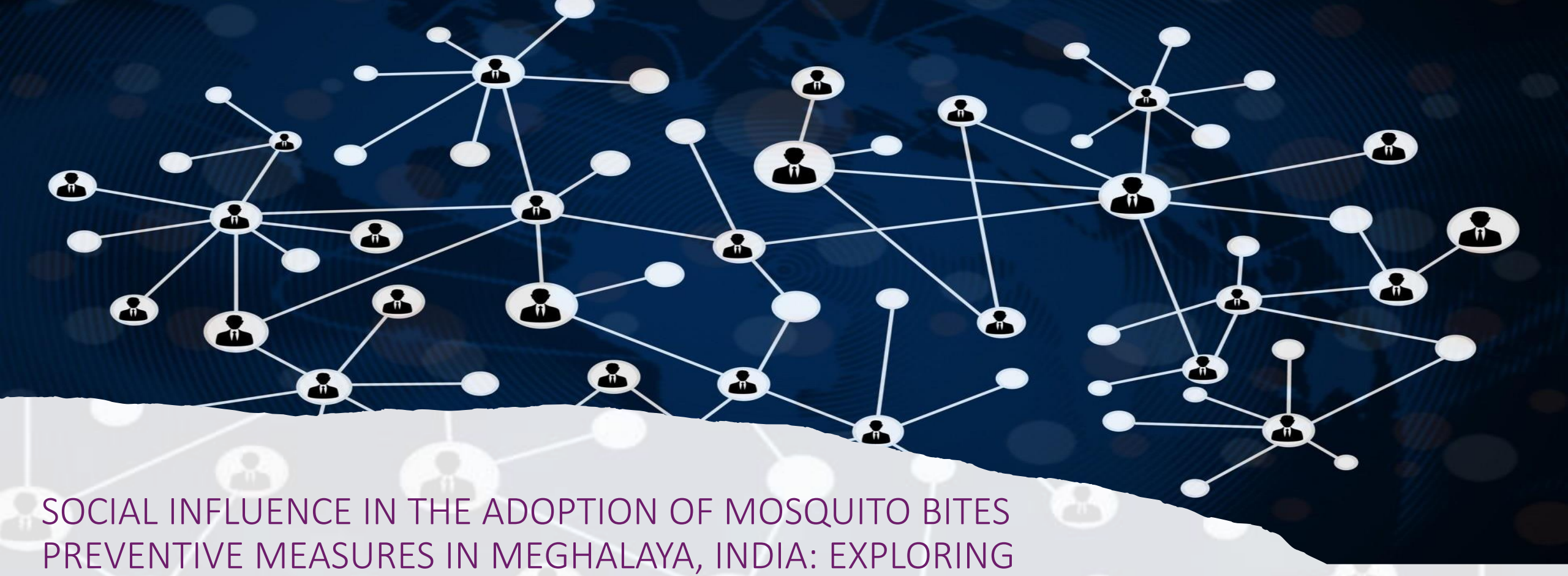

SOCIAL INFLUENCE IN THE ADOPTION OF MOSQUITO BITES PREVENTIVE MEASURES IN MEGHALAYA, INDIA: EXPLORING CONTAGION MECHANISMS THROUGH AN EMPIRICAL AGENT-BASED MODEL

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- World Health Organization set a global eradication goal of 2030. Large-scale interventions resulted in little change in poor, migrant, and hard-to-reach populations.
- Residual epicentres continue to present a challenge to ongoing eradication efforts and prevention in such contexts requires targeted approaches which engage with and are tailored to local communities.
- Large-scale government sponsored prevention programmes have mainly focused on the use of Indoor Residual Spraying (IRS) and the distribution of Long-Lasting Insecticidal Nets (LLINs). While the use of LLINs is widespread, IRS is contested.
- As an alternative, households may turn to other indoor measures such as air-borne repellents, including coils and vaporizers. When working or socializing outdoors, villagers may use protective clothing, insect repellent spray, or body cream to prevent mosquito bites.
- Given the number of measures available, it remains important for public health programmes to identify the factors that explain why people use or resist using certain malaria prevention measures.

BACKGROUND: MALARIA ERADICATION AND PREVENTIVE MEASURES

Past research in this area has primarily focused on individual and household characteristics, neglecting the role of social relationships.

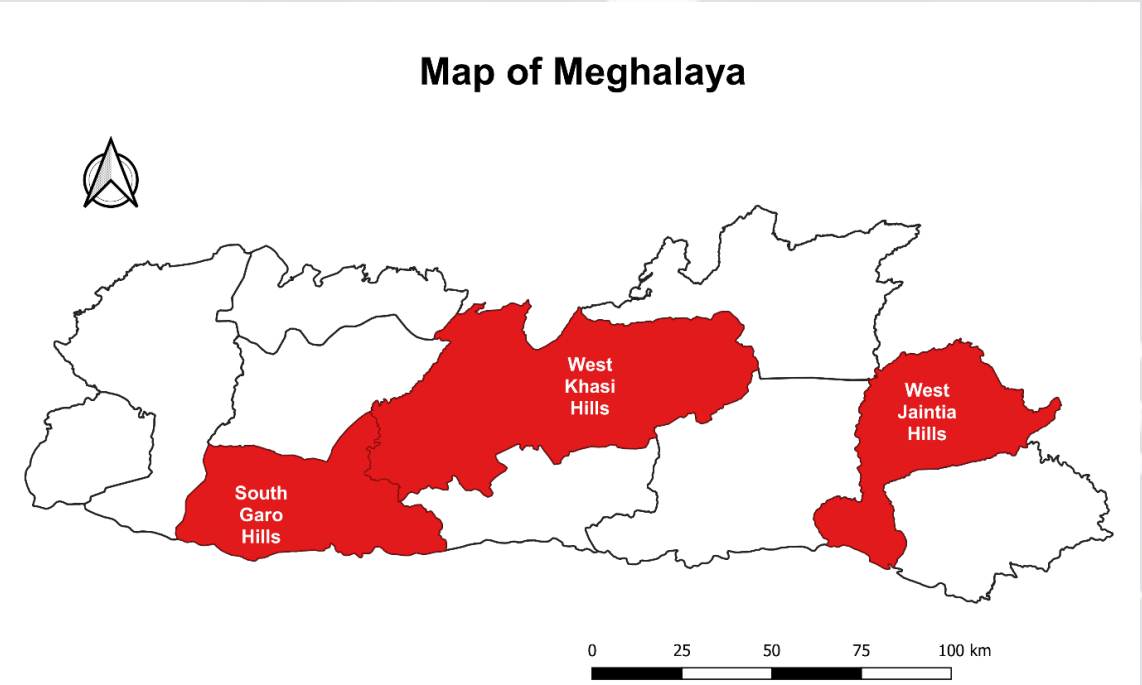
In an individual perspective, preventive measure use can be explained by classic threshold models of diffusion: individuals are more likely to adopt the use of a measure if a high proportion of the population already uses it, where diffusion varies according to individual characteristics.

Network exposure models of diffusion recognise that the adoption of measures spreads through social networks: individuals are more likely to use a measure if a high proportion of those they are connected to (i.e., communicate with) already uses it. Thus, an individual's social network could facilitate support for but also resistance to different practices.

Within a social network, of particular importance are:

- Zealots. Some actors may be more stubborn than others, and exercise a higher pressure toward adoption (or not) than other less stubborn actors
- Negative ties. Positive ties may reinforce behavioral choices, but little we know about the role of negative ties: do they counteract positive ties with the same weight?

THEORETICAL BACKGROUND: NETWORK EXPOSURE, ZEALOTS AND NEGATIVE TIES



THE SETTING: MEGHALAYA

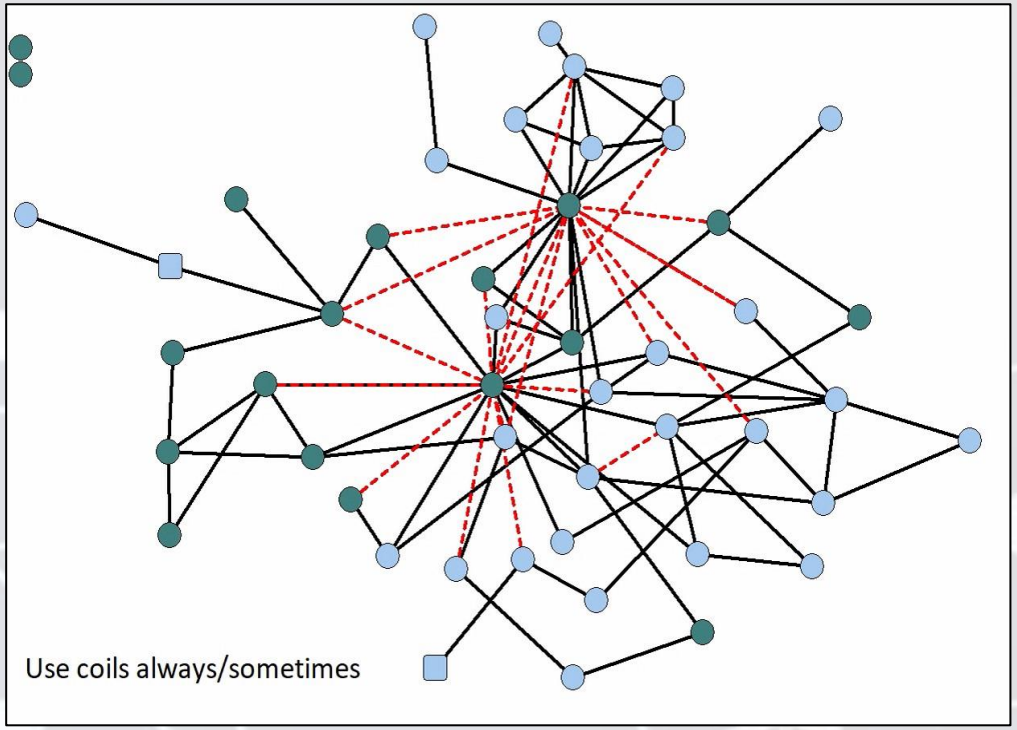
- A hilly and mountainous area covered by patches of tropical forest interposed with rice-agroecosystems.
- Its climate is the wettest in India, making it an optimal setting for malaria, with multiple mosquito species transmitting malaria parasites.
- It is inhabited mostly by "tribal" people, who are particularly prone to malaria because of their geographical marginalization, poor access to health care, low socio-economic status, and cultural and religious values and beliefs.
- Most malaria cases occur in the Garo Hills, West Khasi Hills, and West Jaintia Hills, inhabited by the Garo and Khasi-Jaintia tribes.
- Health system: modern public health programmes and tribal traditional medicine.
- In each village there is an Accredited Social Health Activist (**Asha**), who serves as the primary source of health information and basic care, and a Khasi and Garo tribal **Traditional Healer**.

THE STUDY

Cross-sectional social network study undertaken in ten villages.

Data on individuals were collected by visiting each house and administering a questionnaire.

- Individual characteristics
- Use of malaria preventive measures
- Social network data:
  - whom they talk to about health related matters within their own village
  - whom they avoid, within their own village.
- In each village we interviewed the Asha and, when available, the Traditional Healer
- From social network data we obtain a social network per village.



Adoption of preventive measures (green nodes) within a village network. Red dotted ties indicate whom they avoid, black ties whom they talk to.

In a previous analysis*, we employed static SAOM models and found that villagers' social network and household exposure to measure use outweighed individual characteristics, opinion leaders, and network size in explaining what malaria-preventive measures they used.

With SAOM we did not go into details about why exactly some measure are hard to adopt

Here we want to understand:

1. NETWORK EXPOSURE THRESHOLD: how many people who adopt, villagers need to be connected to adopt themselves?
2. NEGATIVE TIES EFFECT: does one negative tie to someone who adopt countereffect the probability of adoption?

Under these assumptions:

- HOUSEHOLD EXPOSURE: having most of the household to adopt increase adoption probability
- POSITIVE ZEALOT EFFECT: a positive tie to the Asha (Positive Zealot) increase adoption probability
- NEGATIVE ZEALOT EFFECT: a positive tie to the Traditional Healer (Negative Zealot) decrease adoption probability

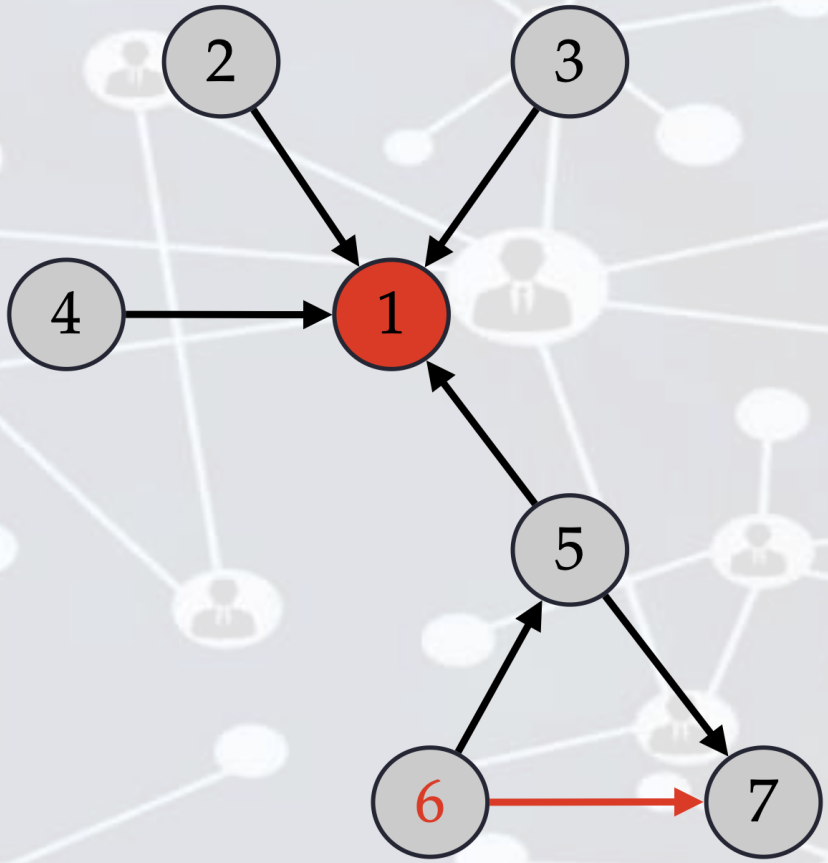
To do so, we fit ABM models to estimate the above parameters to replicate the diffusion processes in one village, for the use of Insecticide creams. Other villages and other preventive measures will be analysed in future work.

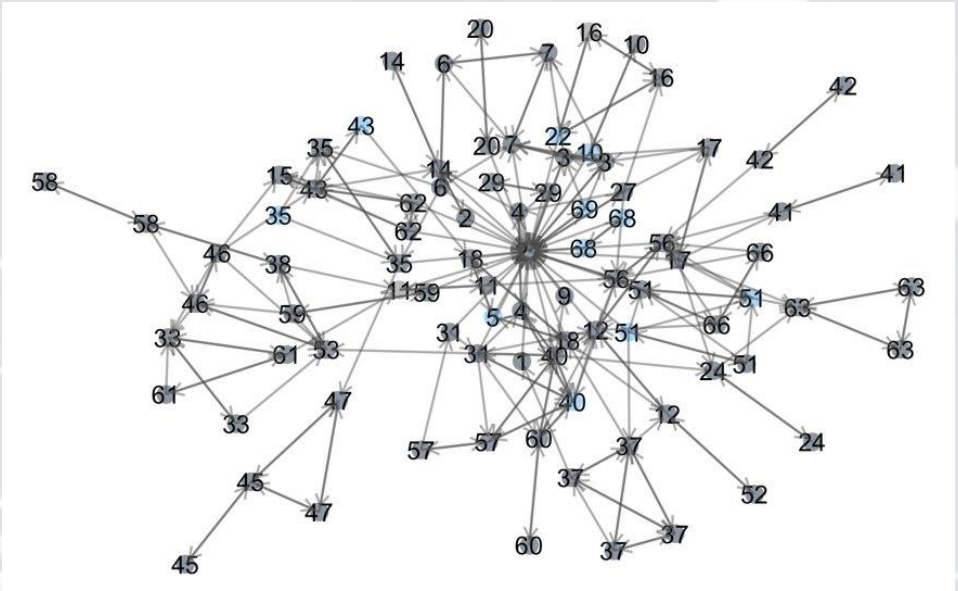
AIMS OF THIS PRESENTATION

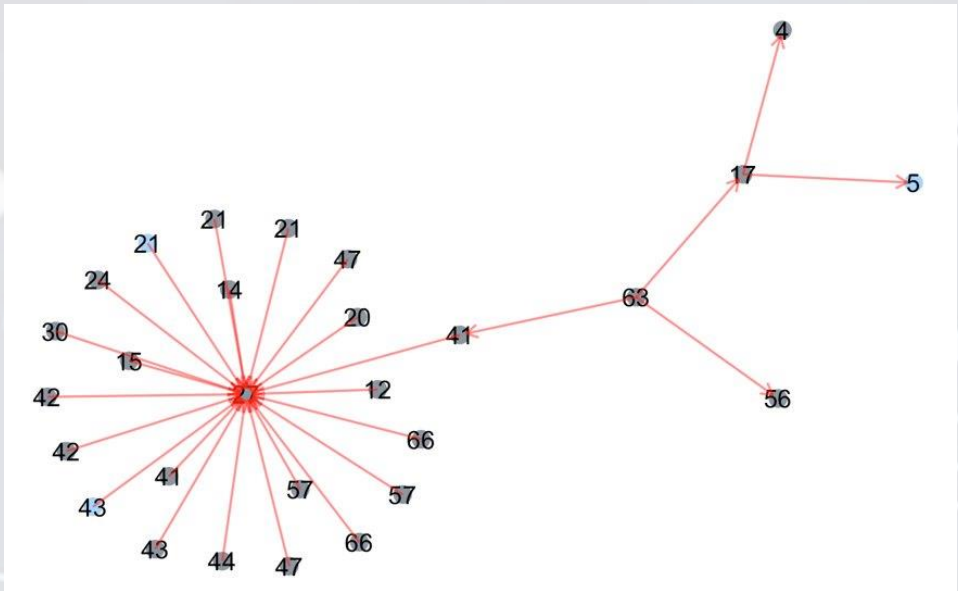
*E Bellotti, A Voros, M Passah, Q D Nongrum, C B Nengnong, C Khongwir, A M van Eijk, A Kessler, R Sarkar, J M Carlton, S Albert, Social network and household exposure to malaria prevention measures explain their use in rural communities of Meghalaya, India. Working Paper

ANALYTICAL STRATEGY

- Agent-based model: computational dynamic model of the diffusion process in the empirically-observed networks
- ABM models individuals' adoption of preventive measure (binary choice) as a logistic objective function of local network properties
- Aim: fitting the observed adoption rate of a specific preventive measure by simulating, in time, the processes we hypothise to be at the core of this rate.
- Method: genetic algorithm searching parameter vector minimising distance between observed and simulated adoption rate





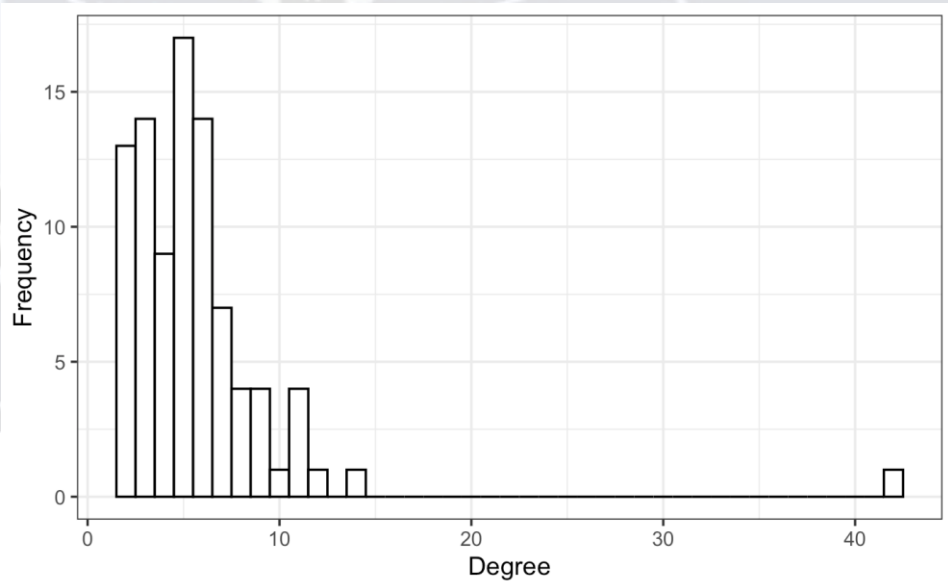


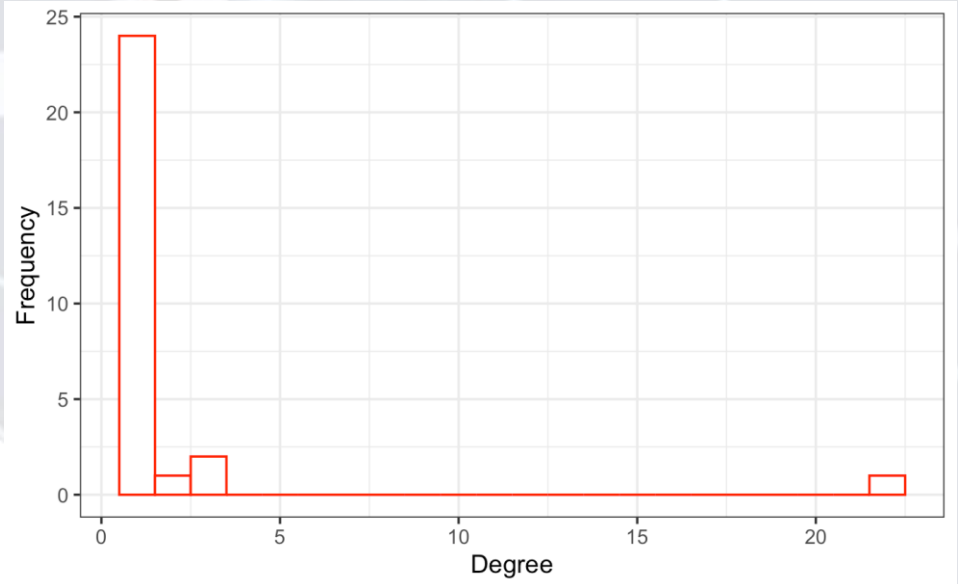
nodes = 93 (main component)

Triangle = ASHA = triangle
Square = Traditional healer
N. = Household

Light blue = adopted

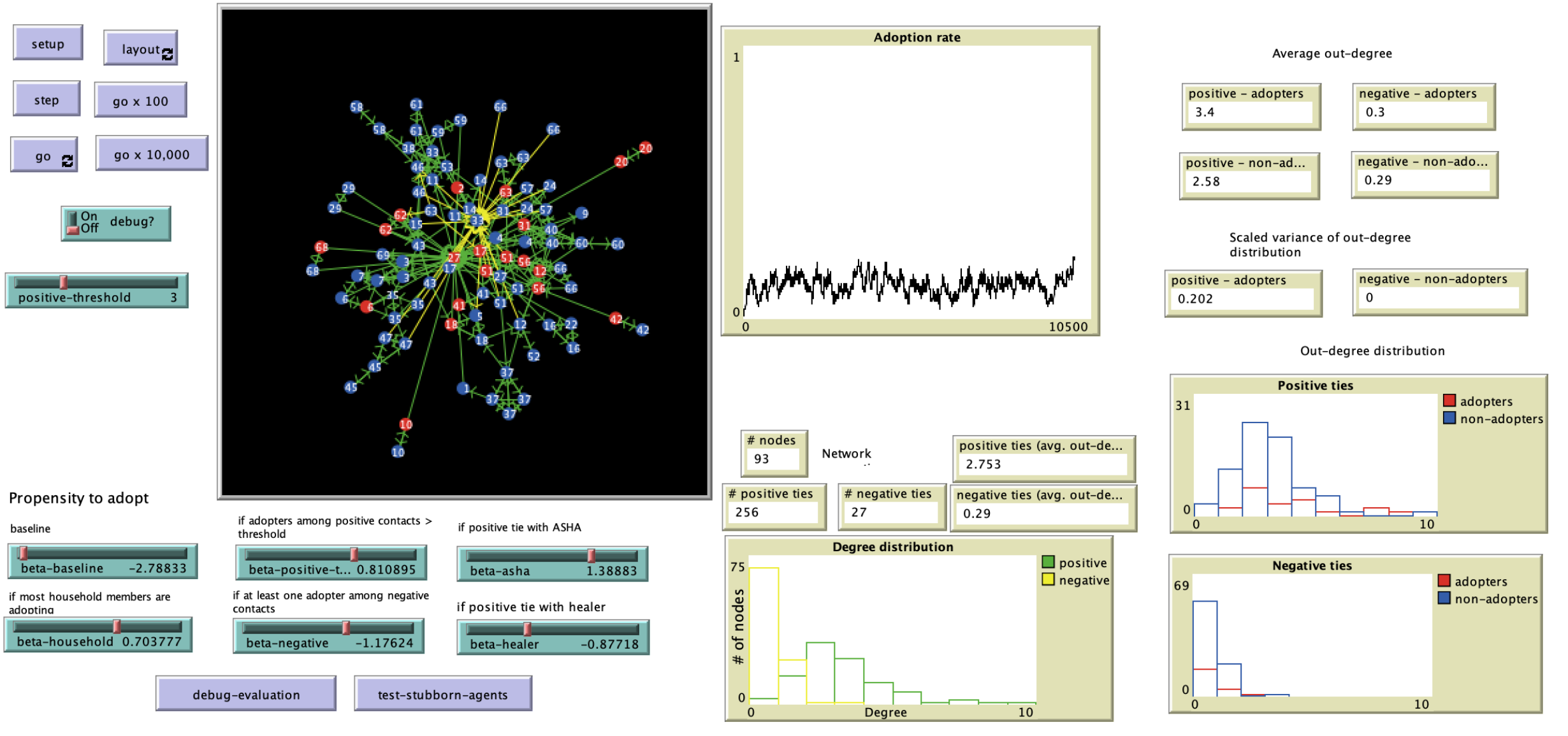
Adoption rate (cream) = 0.125





Out-degree distribution
(left = positive, right = negative)

DESCRIPTIVE STATS OF VILLAGE WK1 AND ADOPTION OF INSECTICIDE CREAM



ABM DESIGN

ABM developed and simulated via NetLogo 6.3

PROCESS	Estimated parameter
Baseline	-2.788
Hypothesis	
Threshold-based contagion	0.811
Threshold for contagion	3
Negative influence	-1.176
Assumptions	
Adoption by most household members	0.704
Positive tie to ASHA	1.388
Positive tie to Traditional Healer	-0.877

RESULTS

LIMITS AND FUTURE WORK

LIMITS OF OUR RESEARCH

- We are fitting a dynamic model on cross-sectional data. We cannot really disentangle selection VS influence (villagers may start to talk to people who use specific measures).
- We don’t know when people started to adopt, especially the Zealots.
- We have only fitted the global adoption rate (single summary stats).

FUTURE WORK

- We will compute uncertainty measures of estimates
- We will fit the model to a wider set of summary stats (not just adoption rate).
- We will extend the analysis to other villages and other measures? Do the same model explain adoption of inefficient measures? (i.e. burning materials)

POLICY TESTING

ABM will allow us to simulate possible policy scenarios, i.e. increasing the n. of Asha per village, reducing negative ties, etc. to improve adoption rate

THANKS FOR THE ATTENTION!

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Research reported in this presentation was supported by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health under Award Number U19AI089676.