

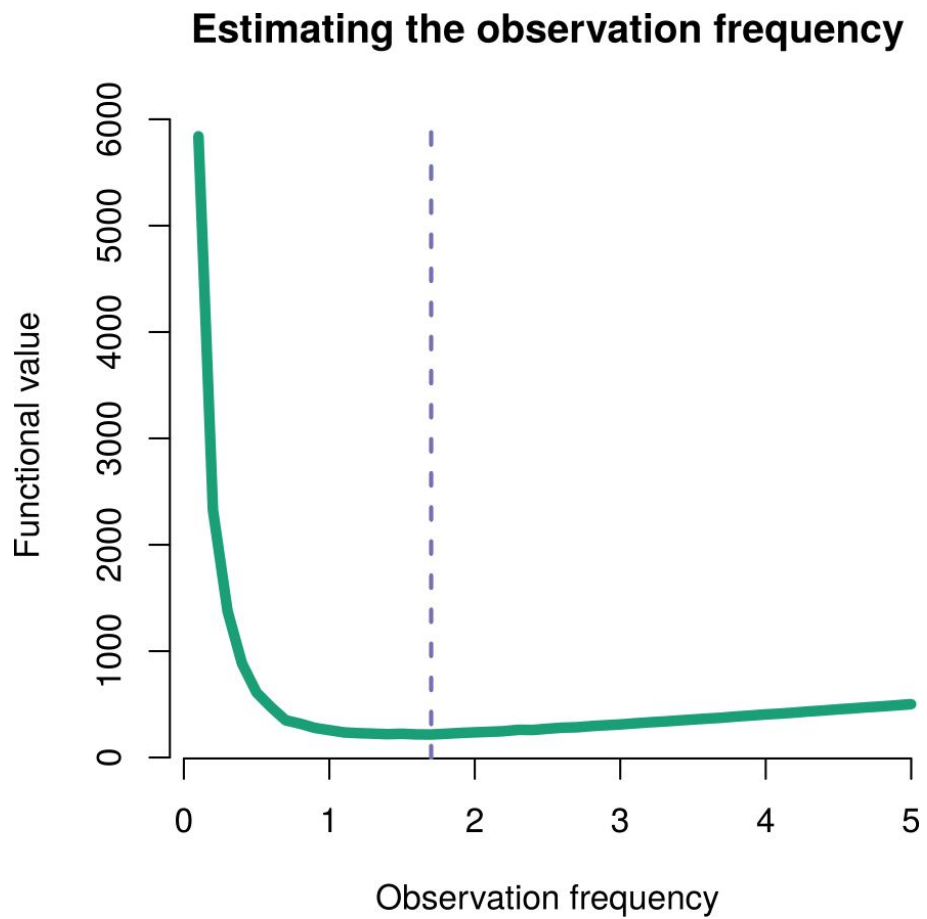
Supplementary Figures

VERA: agent-based modeling transmission of antibiotic resistance between human pathogens and gut microbiota

This supplement contains:
Supplementary Figures 1– 4

Figure	Title
1	Input parameters values for <i>Shigella</i> spp.
2	The plots of report generating for <i>Shigella</i> spp.
3	The plots of report generating for <i>Shigella</i> spp. with other model behavior.
4	Comparing Cholera outbreak data from WHO's report with simulated data by agent-based VERA-model.

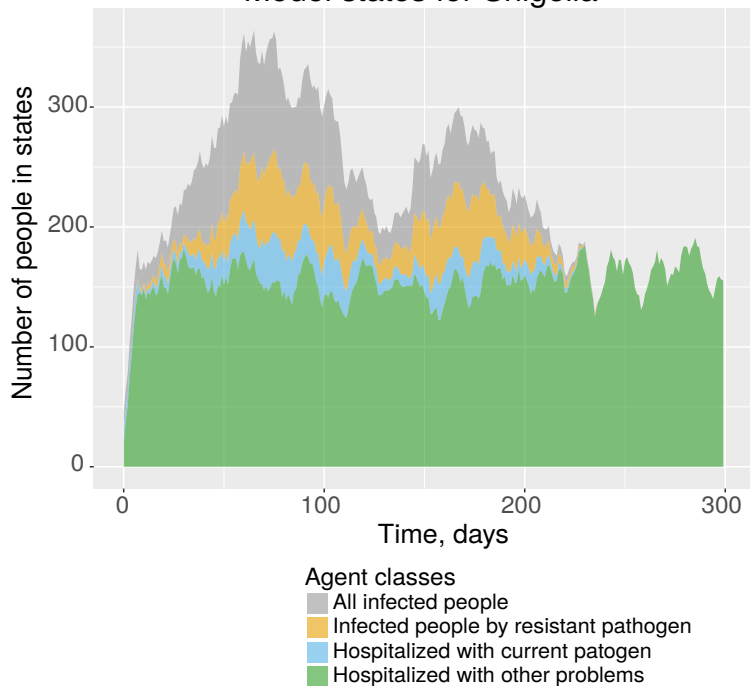
Supplementary Figure 1 | The estimated optimal frequency of observation for *Shigella* spp. Green line depicts values of functional, and blue line means optimal observation intensity.



Supplementary Figure 2 | The plots of report generating for *Shigella* spp. These plots depict first major scenario of model run results. In this case the first peak is on day 65, the second - at 167 after a fall of 134 days. **a)** The number of agents that have been infected with the pathogen or are on treatment at each simulation day. Gray indicates the total number of infected agents, of which the resistant pathogen-infected agents are shown in yellow, and those hospitalized with the pathogen are shown in blue. Also, the number of agents hospitalized with non-pathogen infection (green color) is indicated. **b)** The proportion of agents that have been infected with the pathogen or are on treatment at each simulation moment (day). **c)** The number of agents transitions from one state to another at each simulation moment (day). **d)** The proportion of agent transitions from one state to another at each simulation time (day). AB = antibiotic.

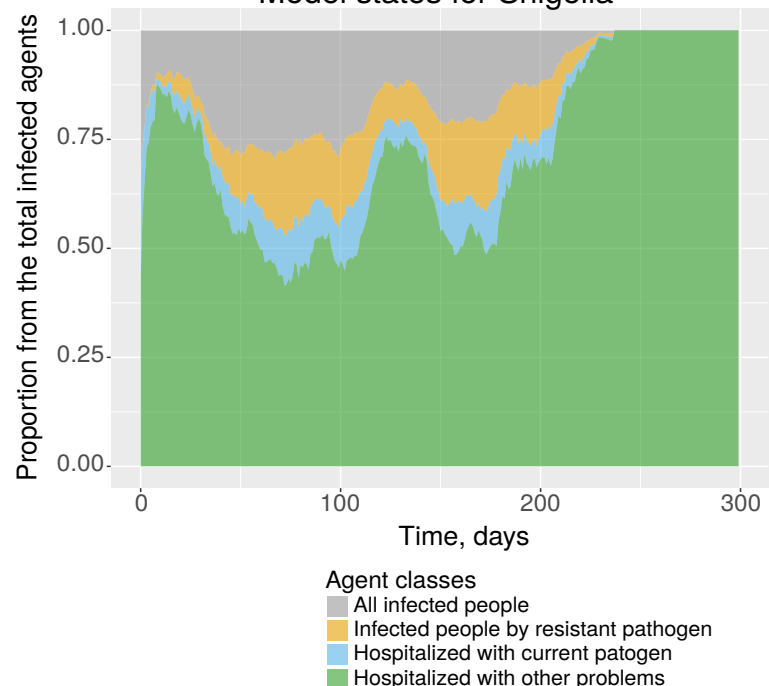
a)

Model states for Shigella



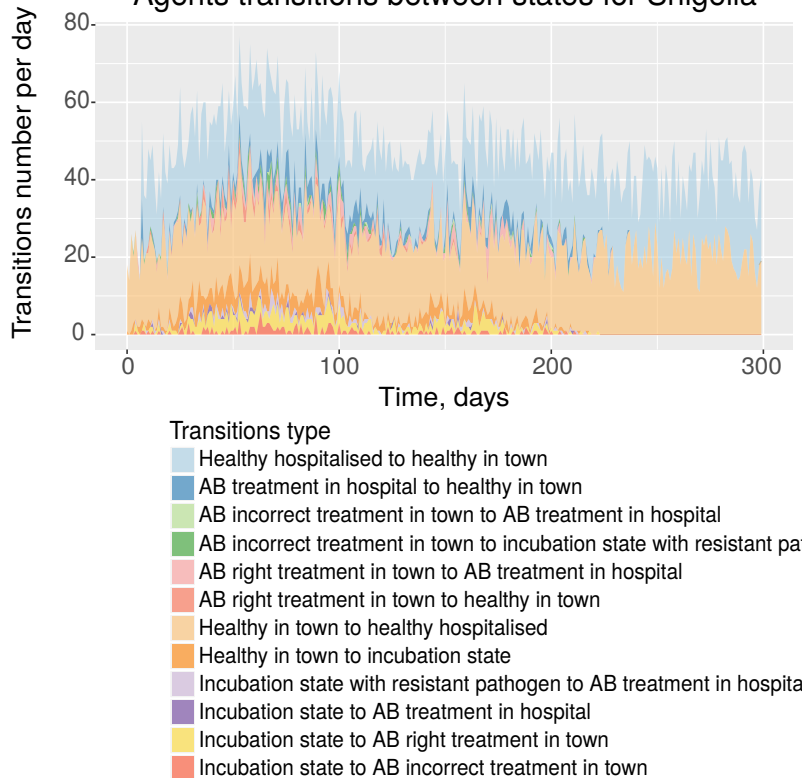
b)

Model states for Shigella



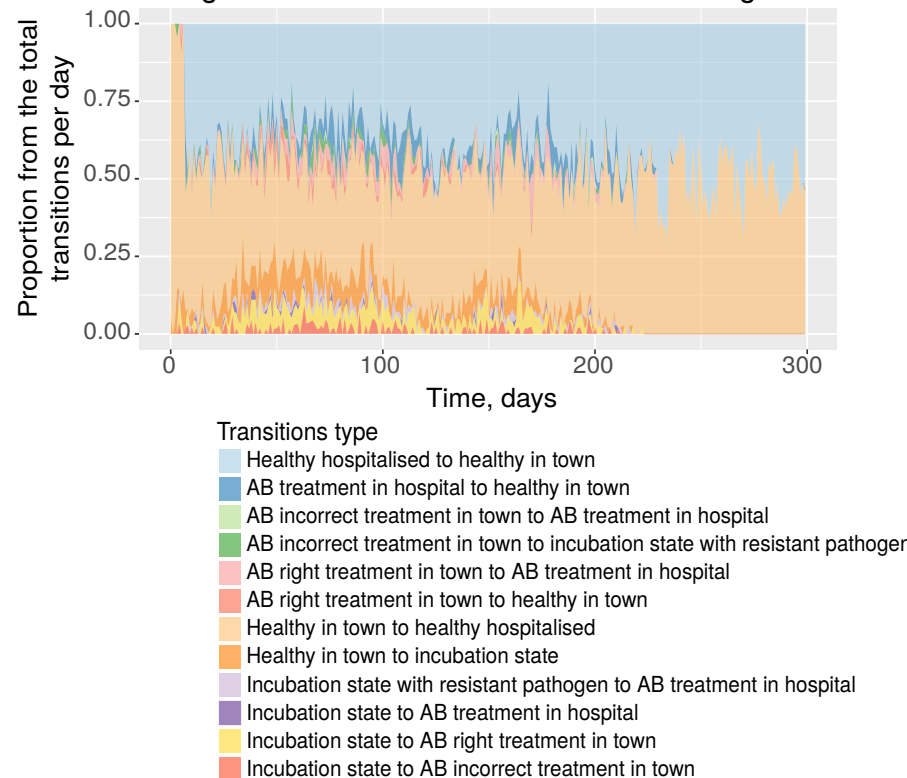
c)

Agents transitions between states for Shigella



d)

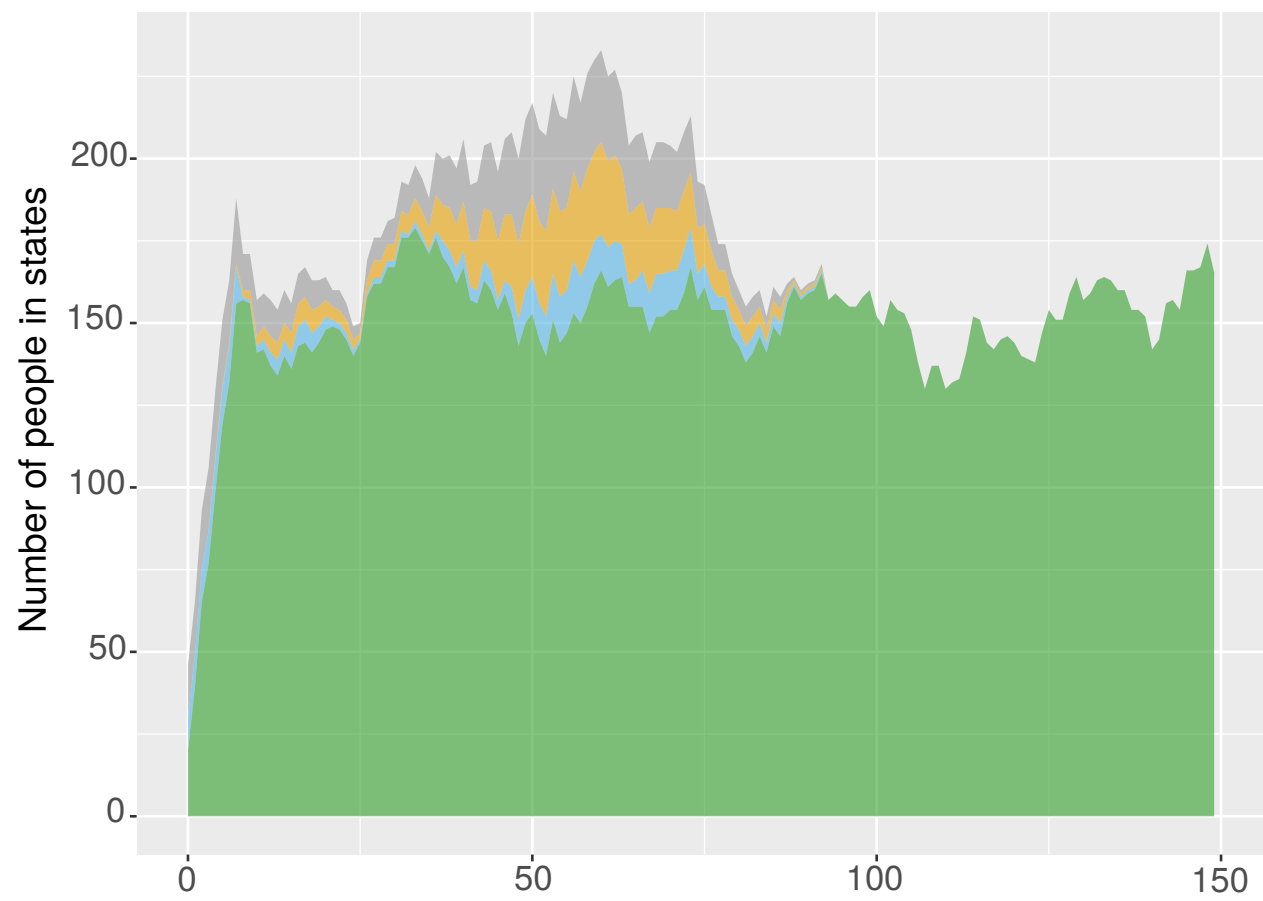
Agents transitions between states for Shigella



Supplementary Figure 3 | The plots of report generating for *Shigella* spp. with other model behavior. These plots (same on Suppl. Fig. 2) show second major scenario of model run results. There is the pandemic is falling on 74 day. The plots of report generating for *Shigella* spp. in same way as for Suppl. Fig. 2. **a)** The number of agents that have been infected with the pathogen or are on treatment at each simulation day. Gray indicates the total number of infected agents, of which the resistant pathogen-infected agents are shown in yellow, and those hospitalized with the pathogen are shown in blue. Also, the number of agents hospitalized with non-pathogen infection (green color) is indicated. **b)** The proportion of agents that have been infected with the pathogen or are on treatment at each simulation moment (day). **c)** The number of agents transitions from one state to another at each simulation moment (day). **d)** The proportion of agent transitions from one state to another at each simulation time (day). AB = antibiotic

a)

Model states for Shigella

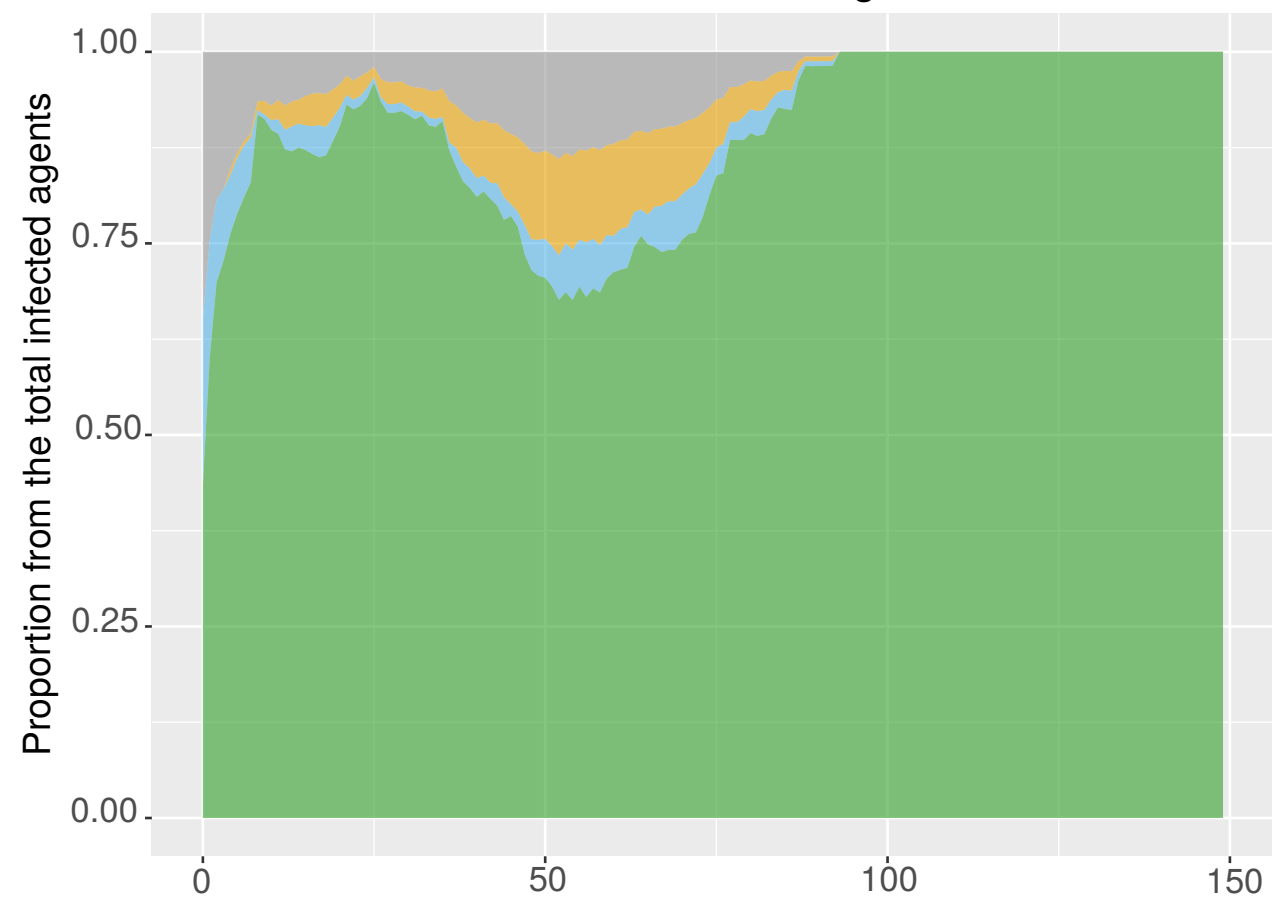


Agent classes

- All infected people
- Infected people by resistant pathogen
- Hospitalized with current pathogen
- Hospitalized with other problems

b)

Model states for Shigella

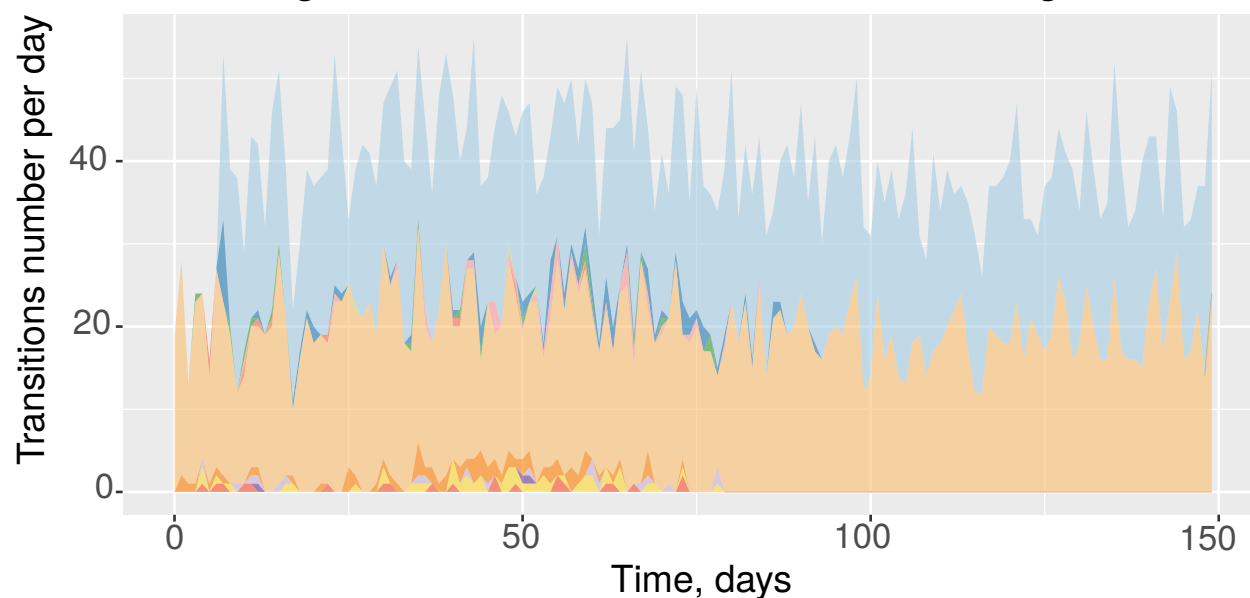


Agent classes

- All infected people
- Infected people by resistant pathogen
- Hospitalized with current pathogen
- Hospitalized with other problems

c)

Agents transitions between states for Shigella

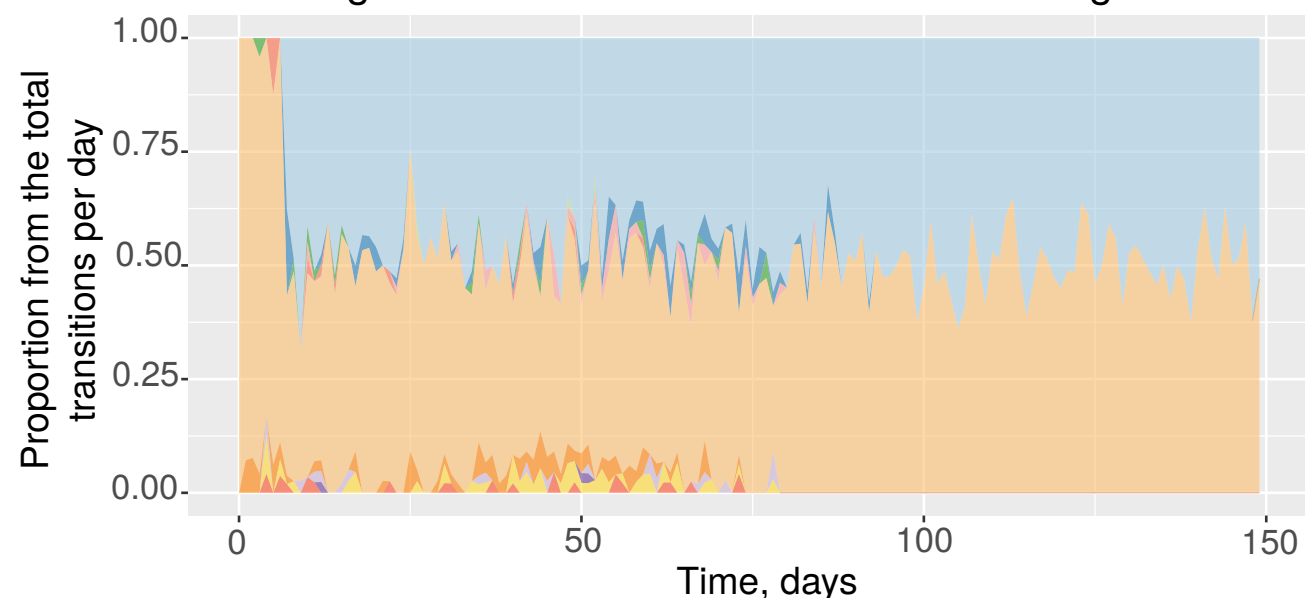


Transitions type

- Healthy hospitalised to healthy in town
- AB treatment in hospital to healthy in town
- AB incorrect treatment in town to AB treatment in hospital
- AB incorrect treatment in town to incubation state with resistant pathogen
- AB right treatment in town to AB treatment in hospital
- AB right treatment in town to healthy in town
- Healthy in town to healthy hospitalised
- Healthy in town to incubation state
- Incubation state with resistant pathogen to AB treatment in hospital
- Incubation state to AB treatment in hospital
- Incubation state to AB right treatment in town
- Incubation state to AB incorrect treatment in town

d)

Agents transitions between states for Shigella



Transitions type

- Healthy hospitalised to healthy in town
- AB treatment in hospital to healthy in town
- AB incorrect treatment in town to AB treatment in hospital
- AB incorrect treatment in town to incubation state with resistant pathogen
- AB right treatment in town to AB treatment in hospital
- AB right treatment in town to healthy in town
- Healthy in town to healthy hospitalised
- Healthy in town to incubation state
- Incubation state with resistant pathogen to AB treatment in hospital
- Incubation state to AB treatment in hospital
- Incubation state to AB right treatment in town
- Incubation state to AB incorrect treatment in town

Supplementary Figure 4 | Comparing Cholera outbreak data from WHO's report with simulated data by agent-based VERA-model. A set of runs was generated for Cholera config properties, which likely corresponds to epidemic situation in Yemen on April 2017. The gray lines are the total number of pathogen infected agents from model runs. The green line indicates the median value of the whole runs of pathogen infected agents, the blue one is median of hospitalized agents with *Vibrio cholerae* pathogen. The red line is a real data from WHO's report "Situation report on the cholera outbreak in Yemen, 27 April–12 June".

Cholera cases, Yemen

