The Evolutionary Vaccination Dilemma in Complex Networks

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Section 1

Vaccination Dilemma
Once upon a time …

1760

1928 ca.

2001

1662

1927

1991

2006

Beyond simple epidemics!
Once upon a time...

- 1760
- 1927
- 1991
- 1928 ca.
- 2001
- 1662
- 2006

Beyond simple epidemics!
A serious problem

General government expenditure on health as a percentage of total government expenditure (in US$), 2011 *

* Based on data updated in October 2013.

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.
A serious problem

BE VACCINATED THIS NEW YEAR AGAINST SMALLPOX
BE VACCINATED NOW
A serious problem

Clash of titans
Clash of titans

Cooperation VS Spreading
who will prevail?
Clash of titans

Epidemic Spreading

Update of Strategies

Evaluation of Payoffs

Outcome of Epidemic Spreading

\[ V_{\text{healthy}} \quad \pi = -c \]

\[ V_{\text{recovered}} \quad \pi = -c - T_l \]

\[ NV_{\text{healthy}} \quad \pi = 0 \]

\[ NV_{\text{recovered}} \quad \pi = -T_l \]
Section 2

Results
General picture

c = 0.1  
c = 0.5  
c = 1.0
Role of topology – ideal case \((\gamma = 0)\)
Role of topology – ideal case ($\gamma = 0$)
Role of topology – realistic case \( (\gamma \neq 0) \)
Role of topology – realistic case ($\gamma \neq 0$)
Section 3

Conclusions
Summing up...

Take home messages

• Cooperation is able to win over spreading (under certain circumstances).
Summing up . . .

Take home messages

- Cooperation is able to win over spreading (under certain circumstances).
- If the vaccine is not perfect, we observe different regions of prevalence.
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