COVID-19 IN UW CAMPUS: Can’t I just go to one party?

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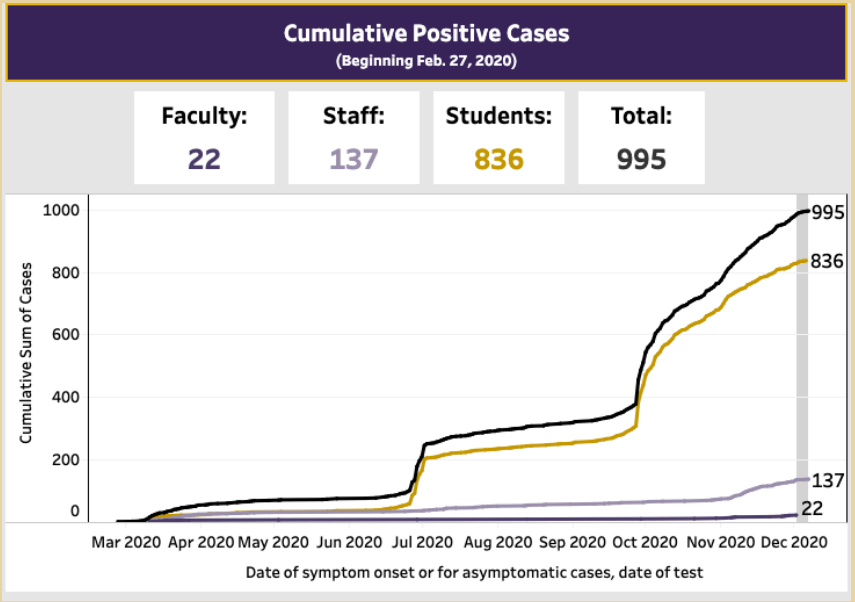
Where we are right now

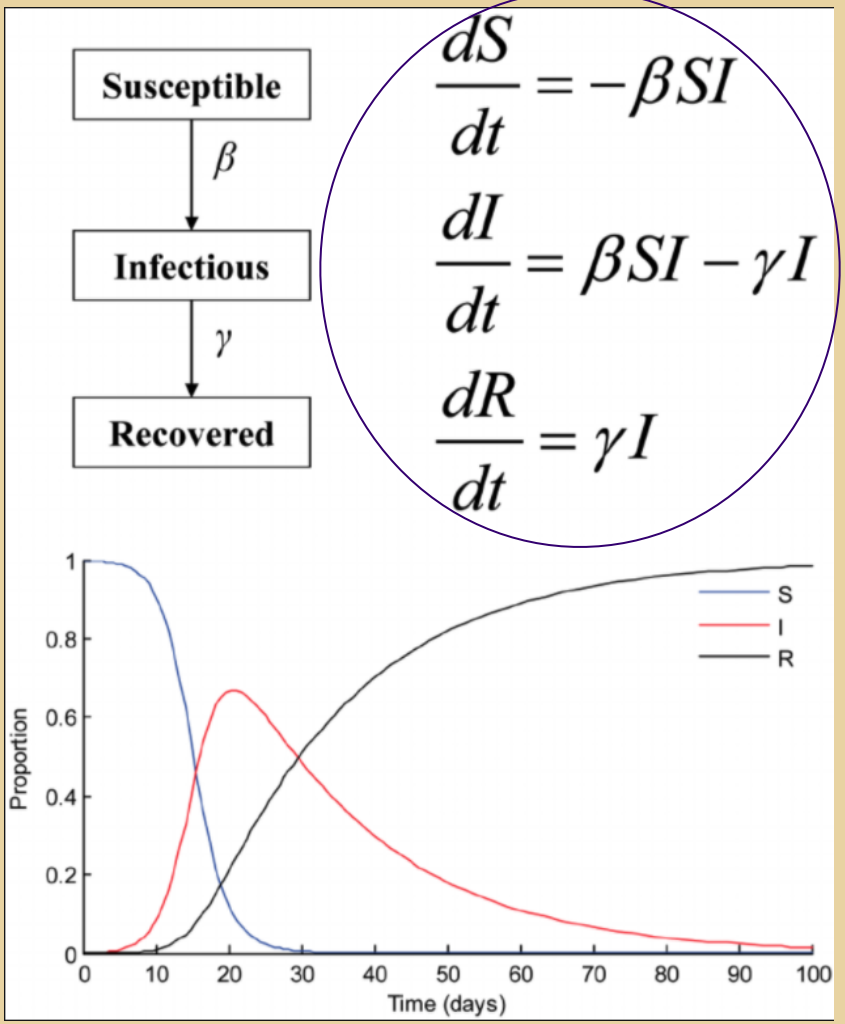


2 UW fraternities punished by Greek system amid COVID-19 outbreak

Oct. 13, 2020 at 5:51 pm | *Updated Oct. 14, 2020 at 7:59 am*

Beta Theta Pi fraternity house at the University of Washington is on probation for breaking COVID-19 rules. (Ken Lambert / The Seattle Times)

Traditional Model of Disease Simulation



SIR MODEL: the big picture of disease simulation

Everyone in the population progress from 3 states:

- **Susceptible**
- **Infectious**
- **Recovered**

(The differential equations here represents the rate of transition from each states!)

Assumption:

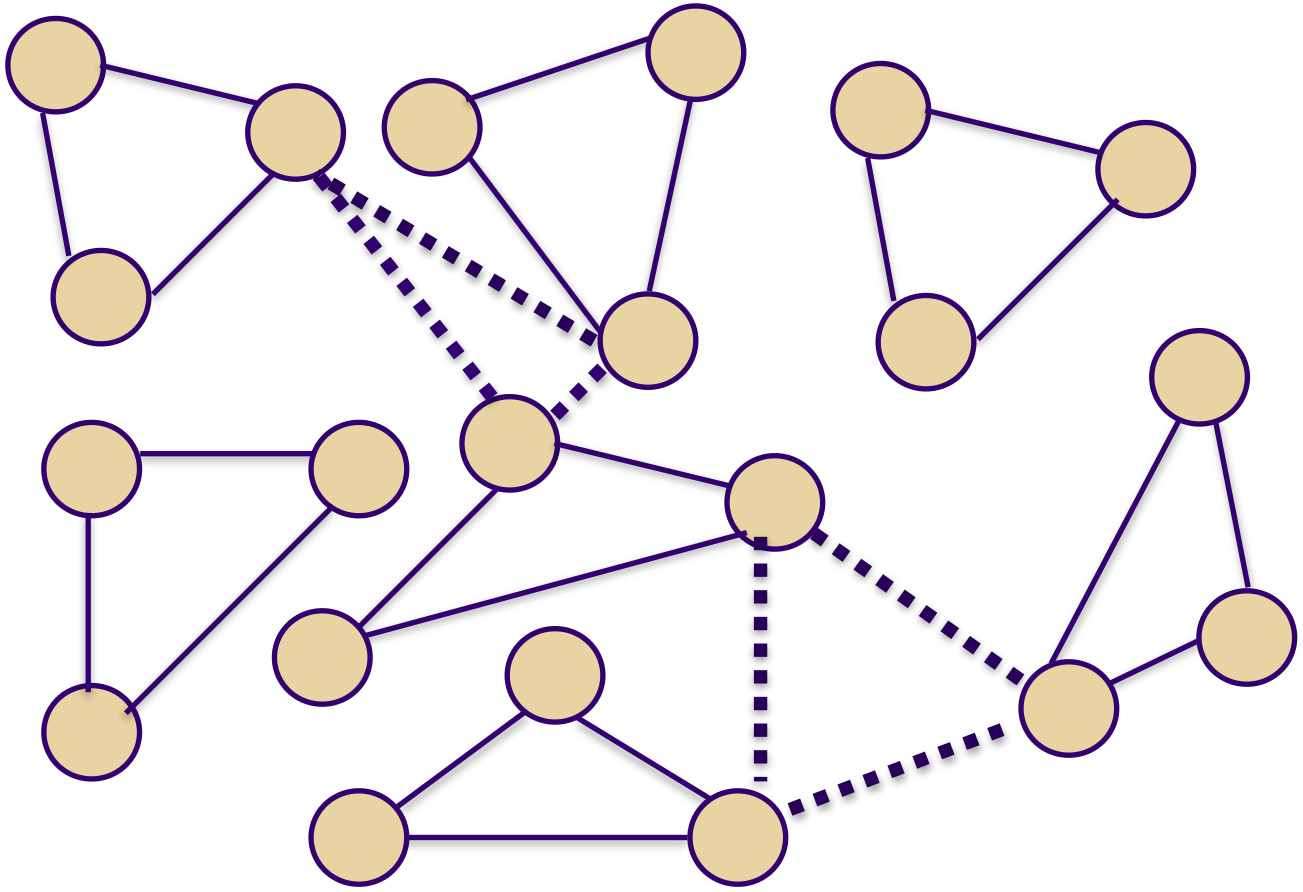
Everyone comes into contact with the infectious individuals at the same rate

BUT IF I WANT TO MODEL A SMALL COMMUNITY (eg. A COLLEGE CAMPUS)
AND LEARN ABOUT THE IMPACT OF DIFFERENT TYPE OF SOCIAL ACTIONS,
I NEED TO CAREFULLY MODEL DIFFERENT TYPE OF SOCIAL RELATIONSHIP

After all,
It is more likely for the disease to transmit in certain relationship (eg. coworker, roommate, friends) who you see more often in a masked/maskless way than someone you saw on the street.

What is Network Model ?

It is a model designed to represent people and their relationships.



Instead of assuming an equal mix in the population like the SIR model did, the Network Model looks more into the relationship between individuals.

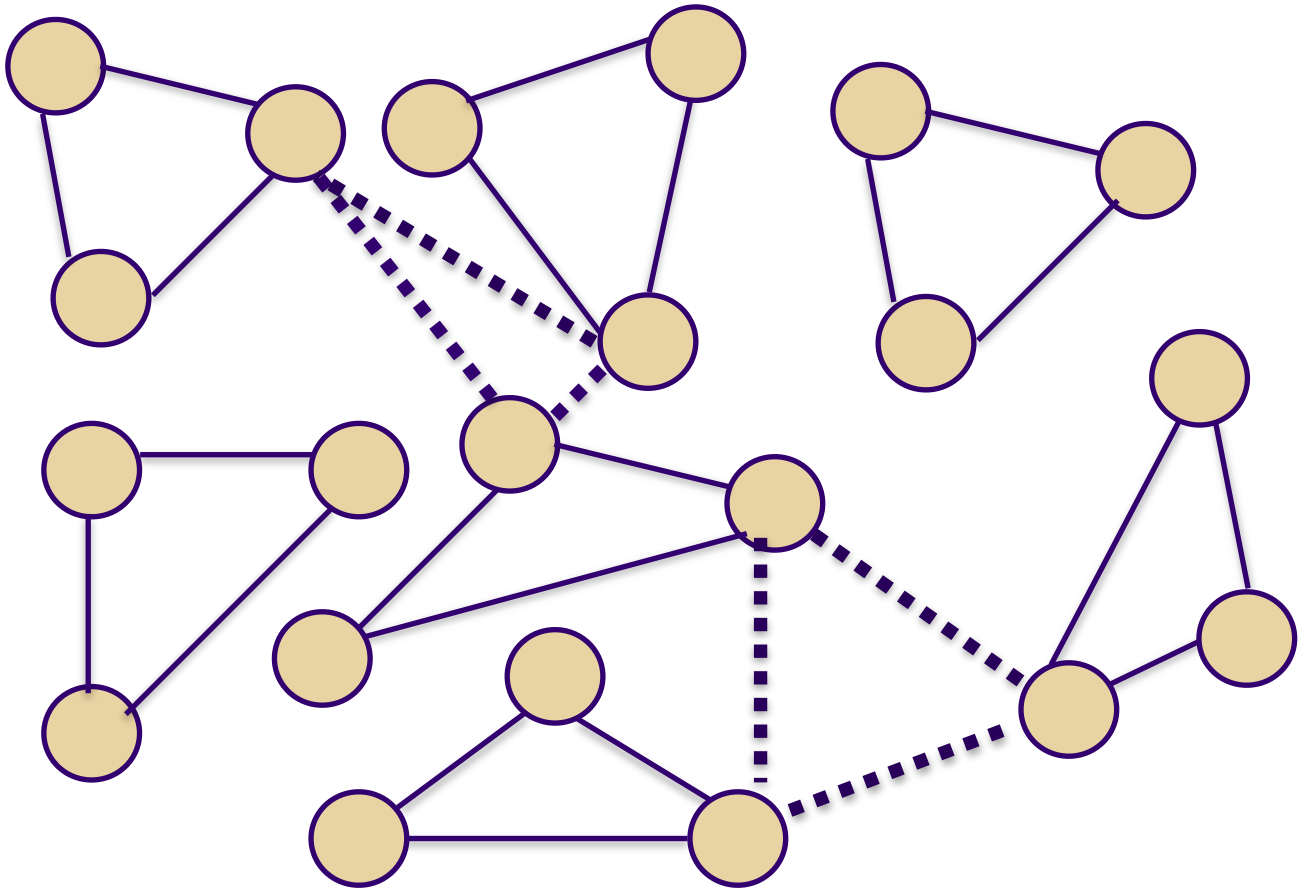
Coworker Connection

Roommate Connection

Person

What is Network Model ?

A model designed to represent objects and their relationships.



An individual can only spread the disease to their neighbor.

(UNLESS THERE'S A PARTY!)

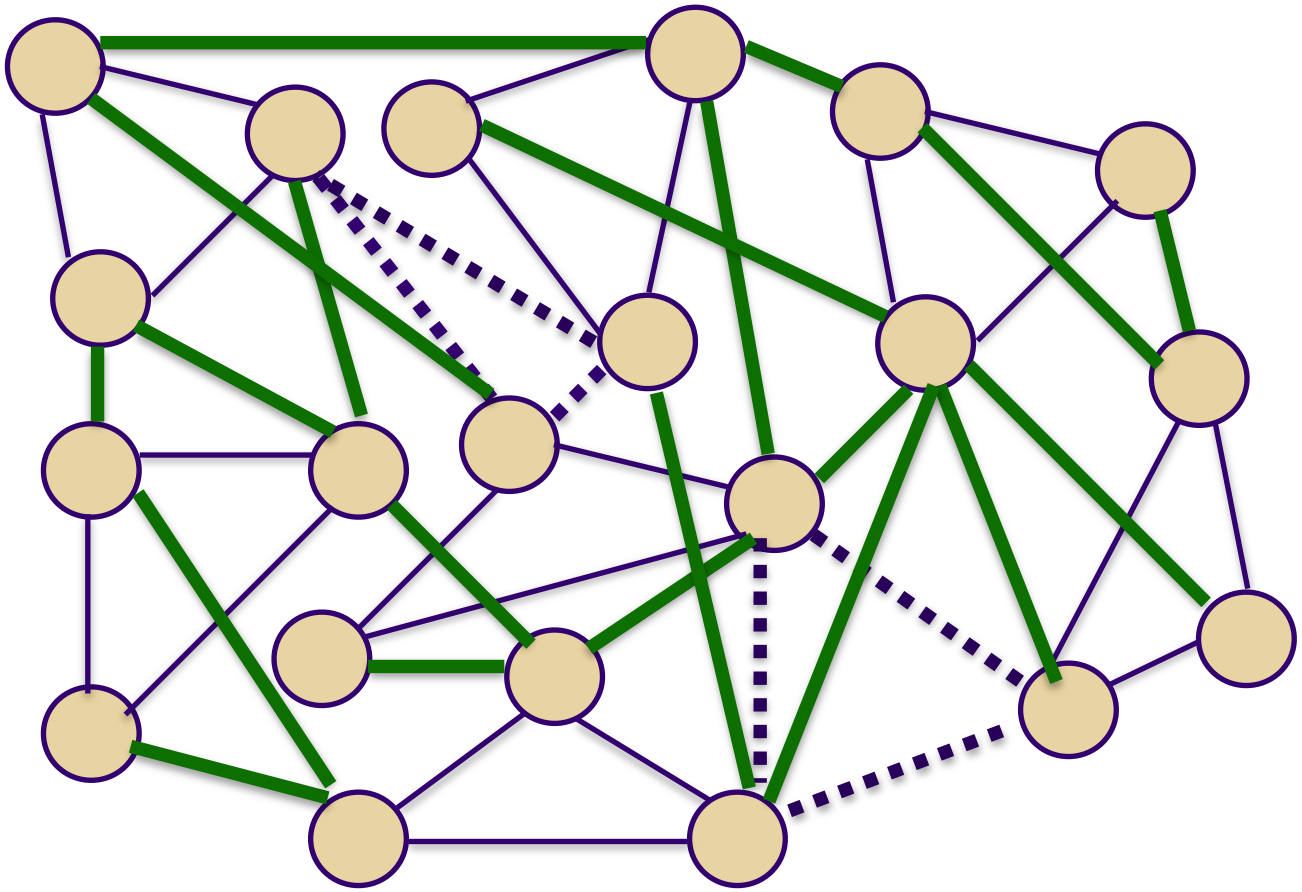
Coworker Connection

Roommate Connection

Person

What is Network Model ?

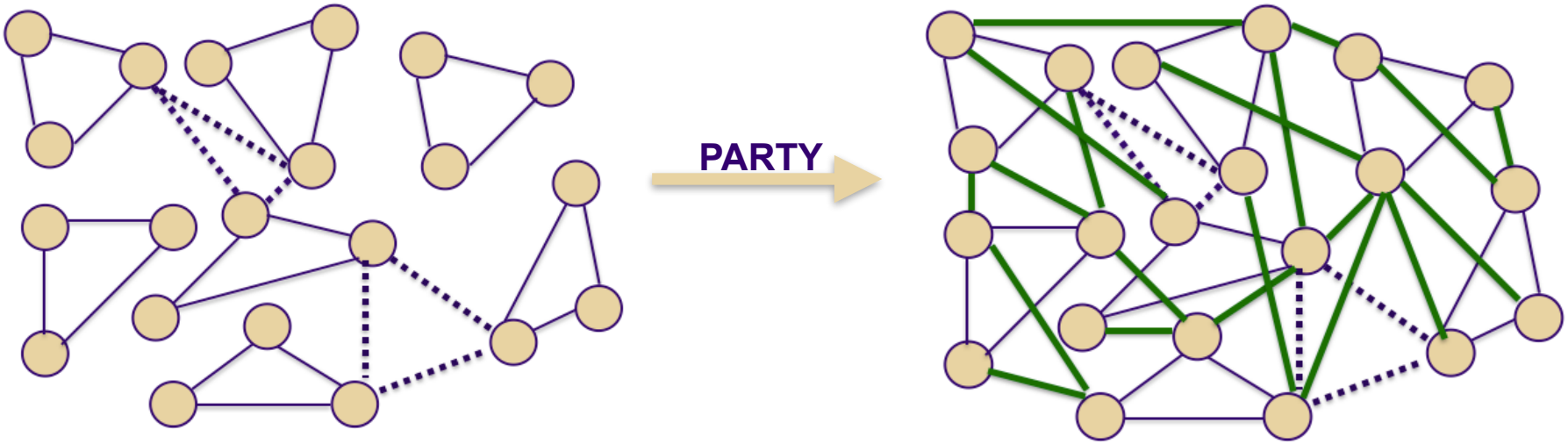
Assumption: 50% of people go to a party and 50 percent of these partygoer wear masks!



When there's a party, an individual can spread the disease to their non-neighbors.

- Party connection
- Coworker Connection
- Roommate Connection
- Person

COMPARISON!



NO PARTY NETWORK

PARTY NETWORK

WHAT WOULD HAPPEN IF SOMEONE THROWS A PARTY IN UW CAMPUS?

Research Assumption

- A residential hall in UW has 200 residents
- each dorm room has 3 roommates in average
- half of the residents have in person jobs
- each work place has 3 workers in average
- The initial infection percentage is 0.05

> If there's party

- 50 percent of people went to the party
- 50 percent of these "partygoers" will wear mask

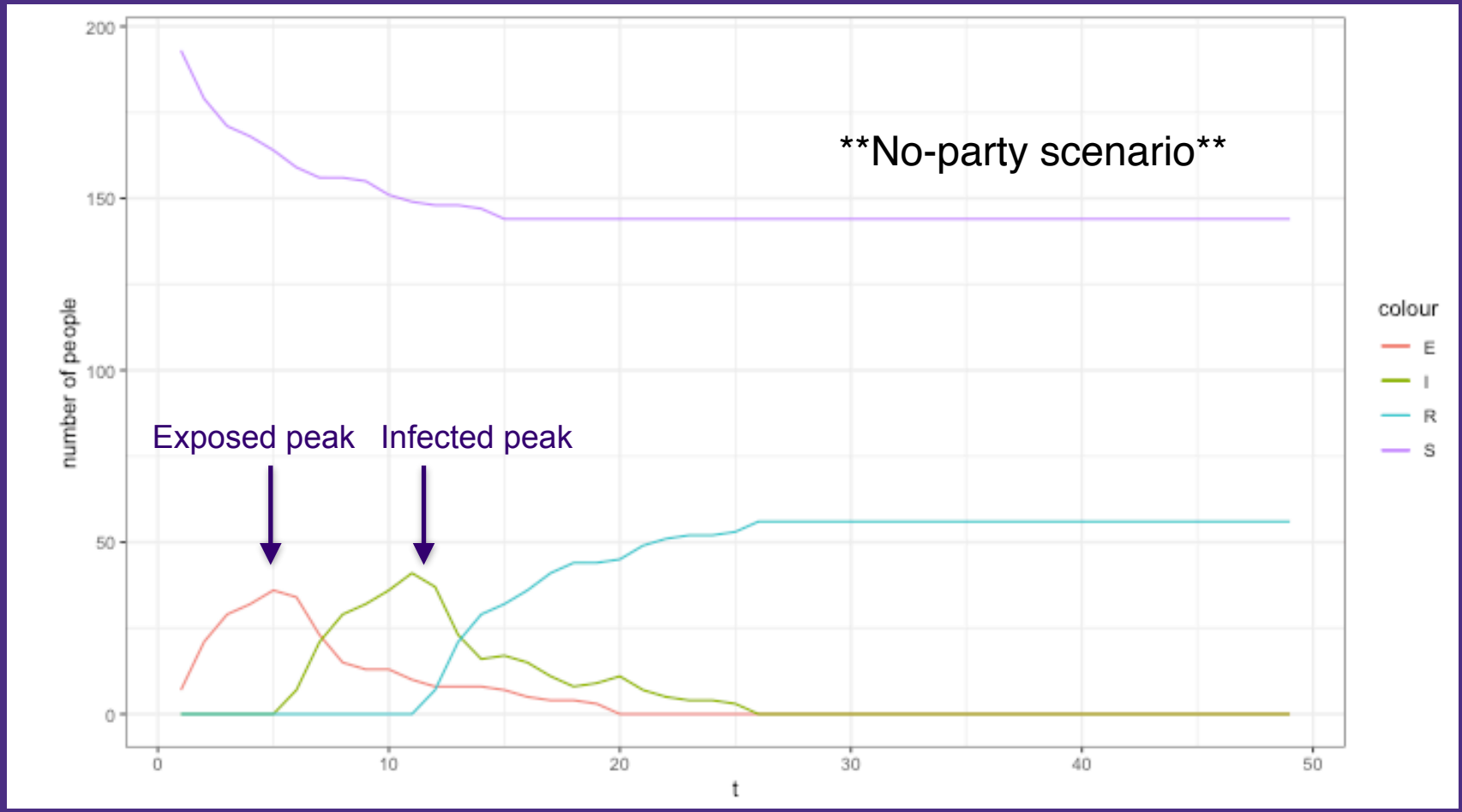
- **Assumptions: 4 phases of infections**
  - **Susceptible**
  - **Exposed / infectious (1-5 days after the onset of illness)**
  - **Infected/ non-infectious (6 -15 days)**
  - **Recovered (>15 days)**
- **Since there are no authority data about the effectiveness of mask, we assume that**

Between An infected person and a susceptible person	Both do not wear mask	Both wear mask	infected person wear a mask, susceptible do not	susceptible person wear a mask, infected do not
Transmission rate	70%	1.5%	5%	21%

Notes: Real-world statistics might differ significantly

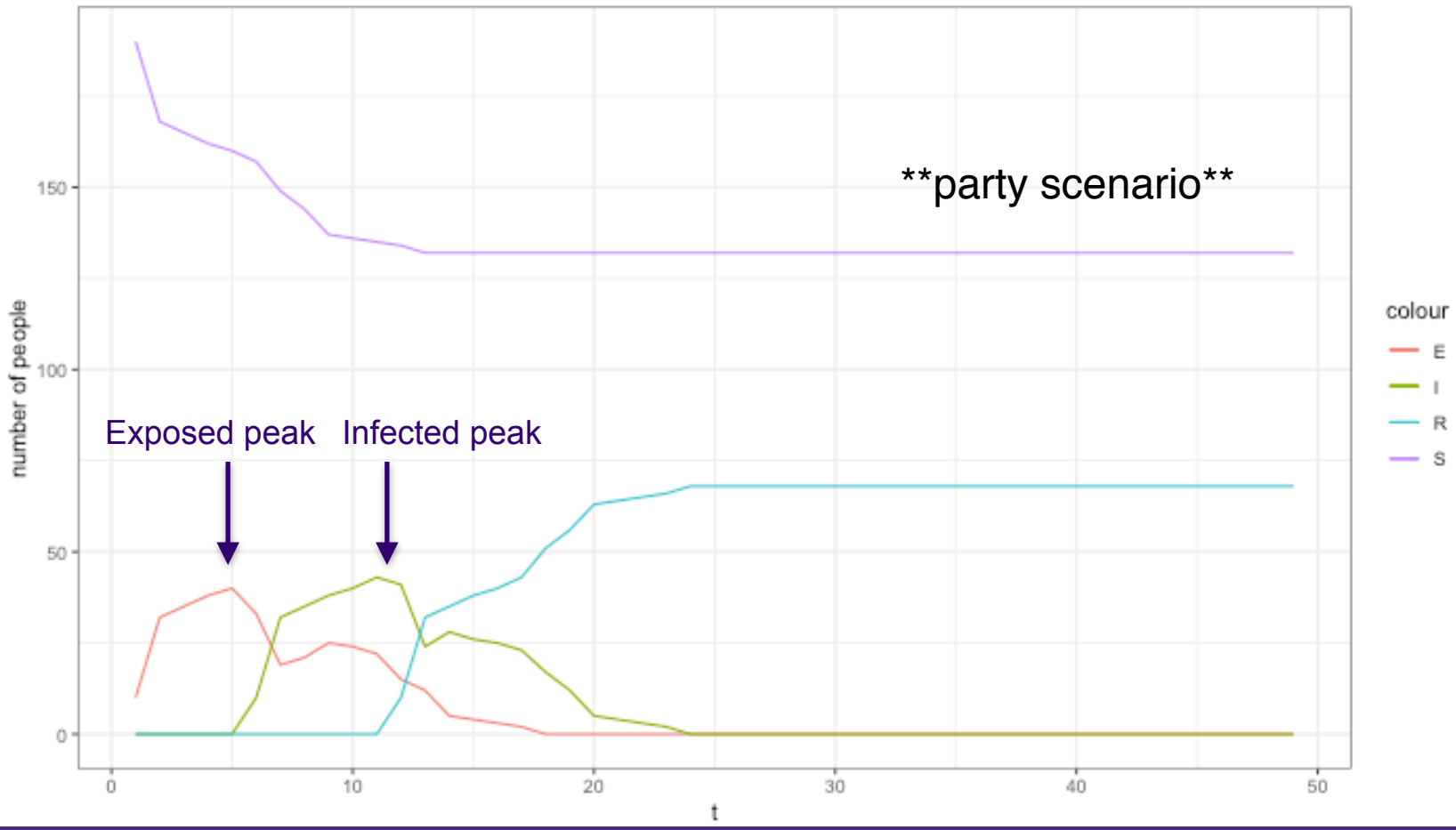
How Would Disease Spread Over Time?

> DAY 49

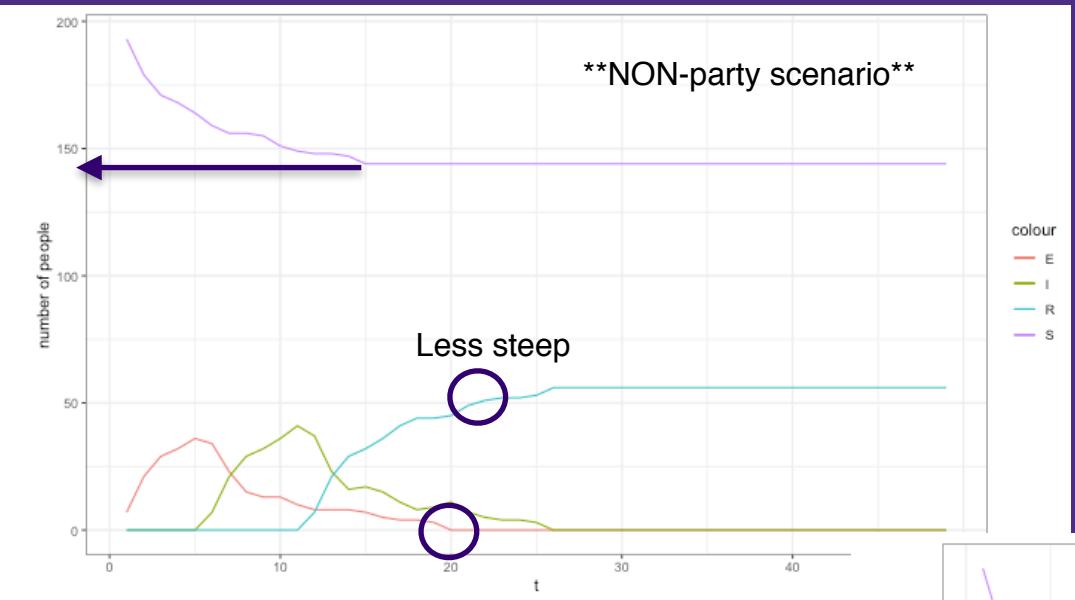


What if there's a party?

> DAY 49



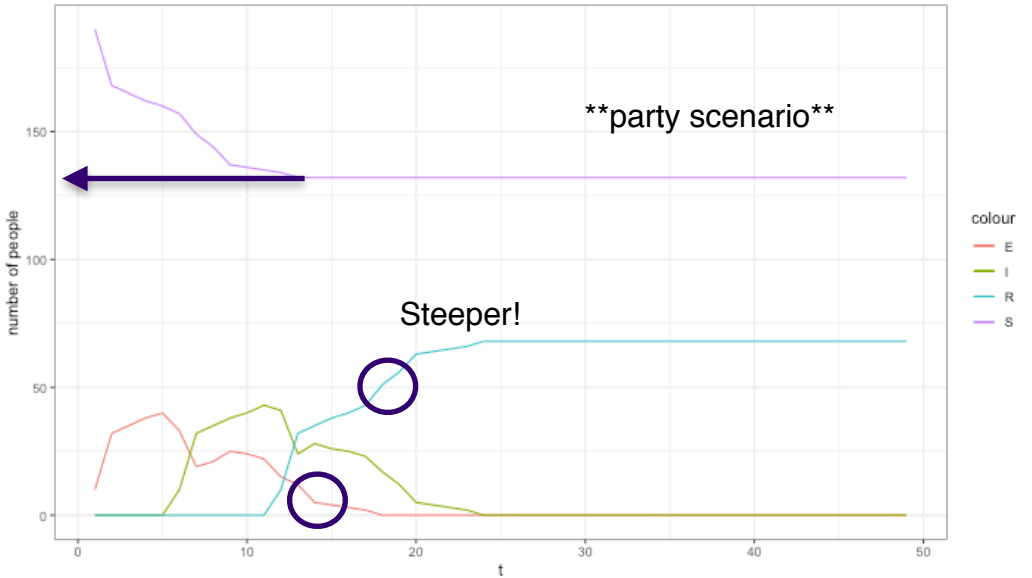
COMPARISON!



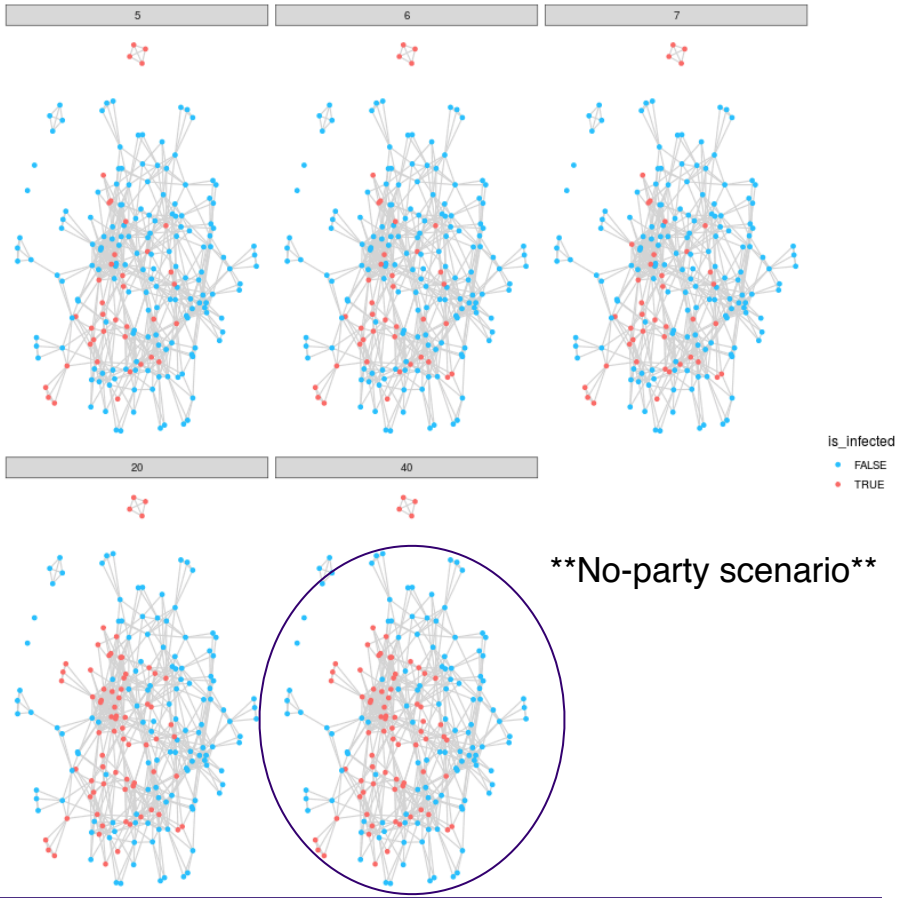
Observation:

- **In no-party scenario, we see that a lot more susceptible than in the party scenario. That means a lot more people were exposed and infected in the party.**

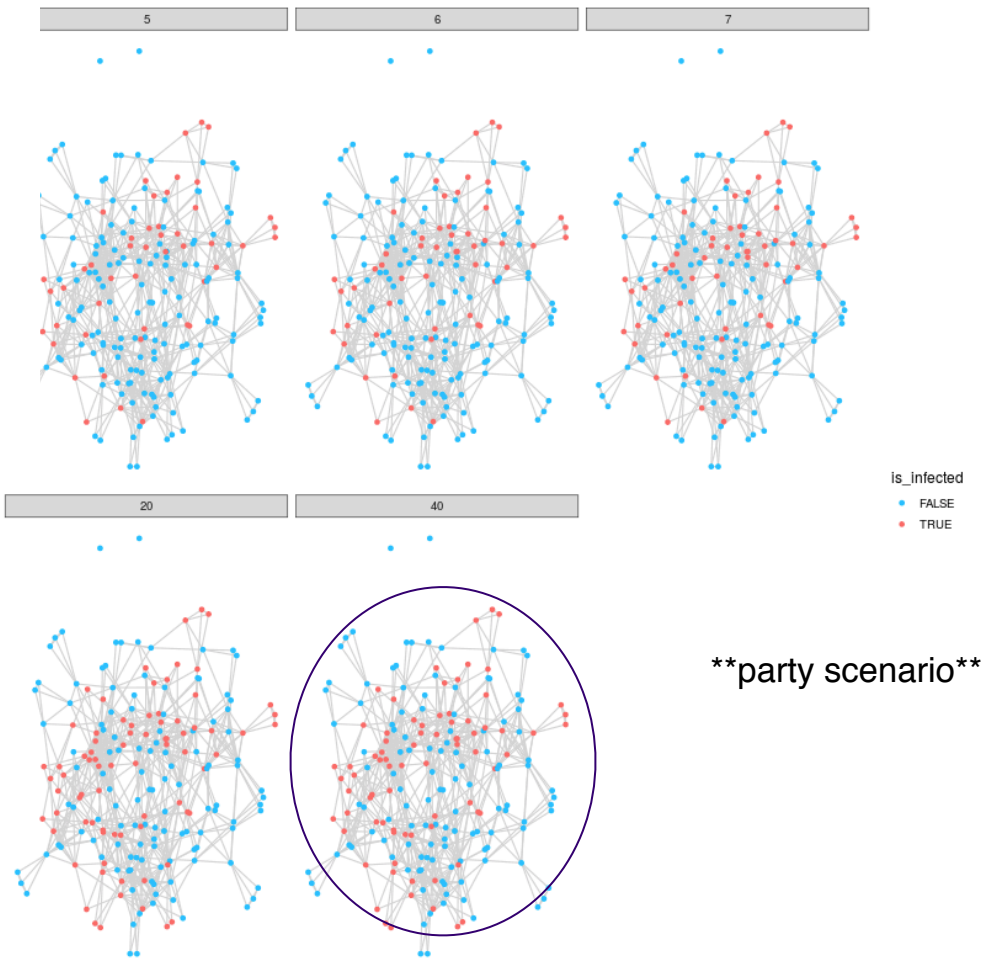
- **in the no party scenario, you can see that the number of exposed individual is really low around day 20. And in the party scenario, the number of exposed individual was really low around day 14. This make senses because there are few susceptible left and everyone is progressing with the disease.**



Visualize the spread with Network Model



No-party scenario



party scenario

In the Party Scenario:

1) there are more infected people
2) People are more closely connected, which made it easier for disease to spread!

THIS SHINY APP

> **We have set up an website where this simulation can extend beyond UW campus, and you get to play around the parameters!**

https://harperzhu.shinyapps.io/DiseaseSimulation/

Limitations and Potential Future Work

As there have not been enough research about coronavirus , many of our research assumption may not be realistic. More work is needed to fully understand the spread of COVID-19.

In the future, I plan to construct more parameter and run the code with a large number of random seeds to fully understand the relative importance of different parameters.

Notes: Real-world statistics might differ significantly

Acknowledgement

- I am deeply grateful to DRP for giving me this opportunity to study more about Network modeling and the SIR model in disease simulation.
- Special thanks goes to my wonderful mentor Anna, who has helped me overcome the roadblocks all along.

THANK YOU!

Question/Comments?