# APPLYING AN AGENT-BASED SOCIAL NETWORK IN TRAVEL FORECASTING: EFFECTS ON DISEASE SPREAD

Joanna **Ji**, Gabriel Ignatius **Hannon**, Qin **Zhang**, Ana Tsui **Moreno,** Rolf **Moeckel**

Technical University of Munich
School of Engineering and Design
Dept. of Mobility Systems Engineering
Professorship of Travel Behavior

## Objective

1. **Synthesize** and **insert** a **social network** for an existing synthetic population into a **travel demand model**
2. Consider **impact of social network** in **epidemic spread** modeling

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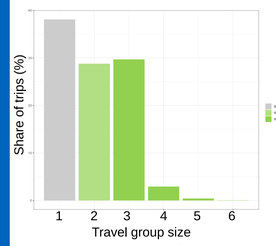
## Introduction




According to MiD 2017, 45% of trips in Germany were performed with at least one companion [6]

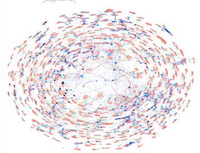
Human mobility is influenced by social connections, a link with increasing attention in transportation modeling. [1, 2, 3]

Previous studies and models of epidemic models have relatively simple travel demand [ 4, 5]

***However, none have integrated social networks into a comprehensive travel demand model + epidemic spread model framework, and explicitly considered the impact of social networks on epidemic spread.***


**Study area: Munich metropolitan region [7]**
Five central cities (Augsburg, Ingolstadt, Landshut, Munich and Rosenheim) and their suburbs
Population:
- 4.5M people
- 2.1M households

Downsample: 5% of population



**Data: Snowball Data from ETH Zurich [8]**
- 793 named egos; ~40,000 edges
- Characteristics include: Age, Gender, Distance, Degree, Cliques

## References

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## Contact & Download

**Joanna Ji**
Technical University of Munich
joanna.ji@tum.de

**Gabriel Ignatius Hannon**
Technical University of Munich
gabriel.hannon@tum.de

**Qin Zhang**
Cambridge University
qz323@cam.ac.uk

**Ana Tsui Moreno**
Technical University of Munich
ana.moreno@tum.de

**Rolf Moeckel**
Technical University of Munich
rolf.moeckel@tum.de

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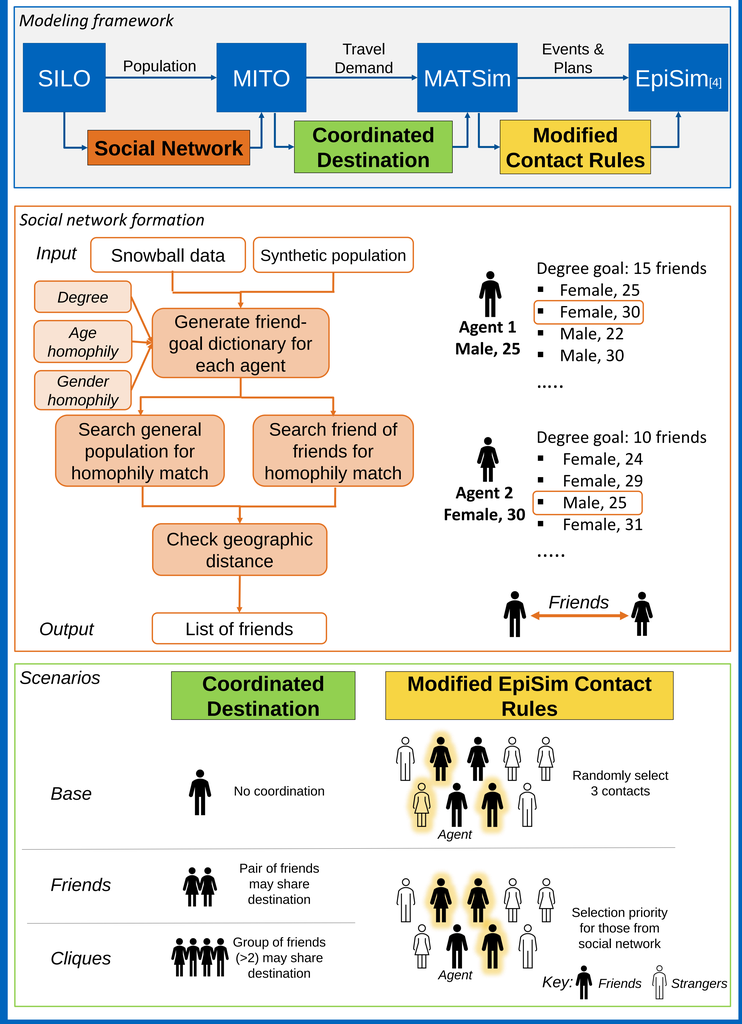
## Methodology

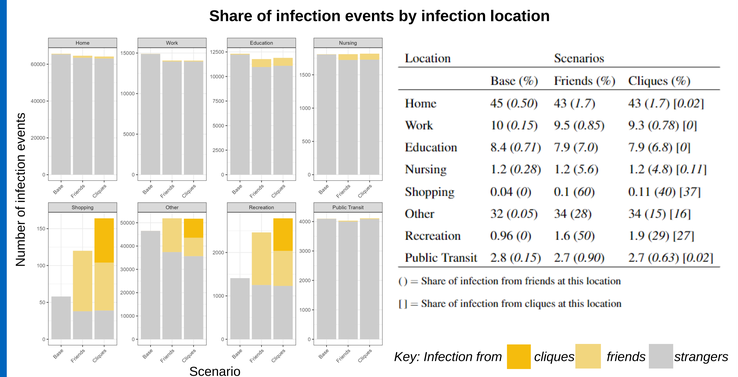



## Results

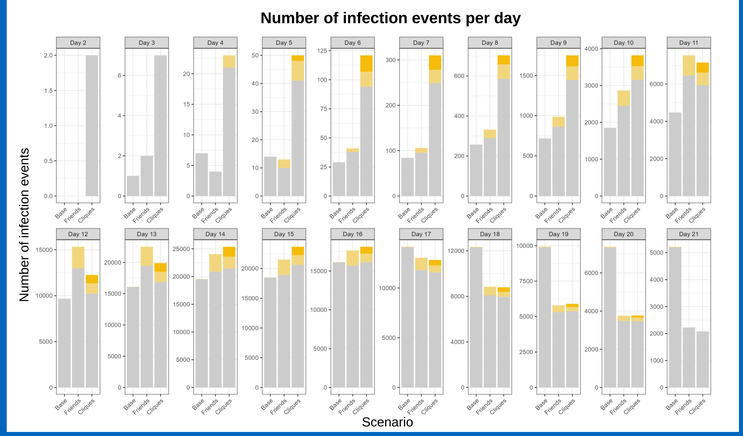
**Share of infection events by infection location**

| Location | Scenarios | | |
|---|---|---|---|
| | Base (%) | Friends (%) | Cliques (%) |
| Home | 45 (*0.50*) | 43 (*1.7*) | 43 (*1.7*) [*0.02*] |
| Work | 10 (*0.15*) | 9.5 (*0.85*) | 9.3 (*0.78*) [*0*] |
| Education | 8.4 (*0.71*) | 7.9 (*7.0*) | 7.9 (*6.8*) [*0*] |
| Nursing | 1.2 (*0.28*) | 1.2 (*5.6*) | 1.2 (*4.8*) [*0.11*] |
| Shopping | 0.04 (*0*) | 0.1 (*60*) | 0.11 (*40*) [*37*] |
| Other | 32 (*0.05*) | 34 (*28*) | 34 (*15*) [*16*] |
| Recreation | 0.96 (*0*) | 1.6 (*50*) | 1.9 (*29*) [*27*] |
| Public Transit | 2.8 (*0.15*) | 2.7 (*0.90*) | 2.7 (*0.63*) [*0.02*] |

( ) = Share of infection from friends at this location
[ ] = Share of infection from cliques at this location




**Number of infection events per day**




## Take-aways

- Presents a **scalable method** to produce a **geospatially anchored social network** with realistic characteristics from a small, egocentric social network data sample for downstream transportation modeling
- Social network combined with an agent-based travel forecast model and epidemic spread model **show influence on disease spread patterns** by **hastening** it's progression and **changing spread pattern**