Decision Tool to Evaluate COVID-19 Risk to Metro Transit Riders

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Route 5 Passenger Loads on May 12, 2020

Busy section of the route

Stops along the route
Sample Vehicle Trip (from APC data)

- Aggregate passenger volumes (no individual passenger records)
- No connection between boarding and alighting of the same passengers
Individual passenger trajectories were estimated using a mathematical model and plotted along the route.

Passenger contacts and communities were detected to form a social contact network.
Definition of Risk

The number and/or the duration of contacts that a rider has with other riders during a transit ride.

Factors such as wearing mask, sanitation of buses, etc. are crucial but not considered in this study.
Risk Measure for Stop Pairs

Number of contacts for a rider going from stop i to stop j

Duration of contacts for a rider going from stop i to stop j

Crossing the busy section causes higher risk
Risk Measures along the Route

Number of people a rider encounters while riding 5 / 10 stops

More (triple) contacts in the busy section

Duration of contacts a rider has while riding 5 / 10 stops

Longer (~8fold) contacts in the busy section
How Can the Risk be Mitigated?

• Limit the number of people on each bus (capacity reduction)
• Add more buses (increase frequency) to reduce bus loads
• Realign routes to reduce the contact risks, e.g. by:
  – Breaking up long trips
  – Breaking up large communities
  – Reducing transfers

We use simulation to evaluate the outcome of control decisions
Effect of Capacity Reduction on the Risk Measures (Simulation)

- Limiting capacity causes denied boarding and longer wait times.
- Limiting capacity will reduce contacts significantly.
- There is a trade off between longer wait time and higher risk.

### Graph
- **Risk**
- **Wait time**

Major reduction in risk happens at capacity of less than 10
Conclusions

• With rigorous mathematical modeling and simulation, epidemic risk can be quantified and mitigated.

• Access to individual-based data is the key.

• We need to plan for transit service after the pandemic.
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Questions?

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