The Last Mile Problem:
Addressing A Grand Transportation Challenge in Urban America

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The First/Last Mile Problem

The ‘Last Mile’ Problem

- Rail transit is disproportionately used for commute trips among households that live within a short walk (½ mile) of a metro station (Guerra et al., 2012)
- Personal security can exacerbate the problem (Veinter 2020)

Implications

- Could limit the benefits from transit infrastructure projects
- May attenuate the impacts of demand-side policies

Ride-hailing and The Last Mile Problem

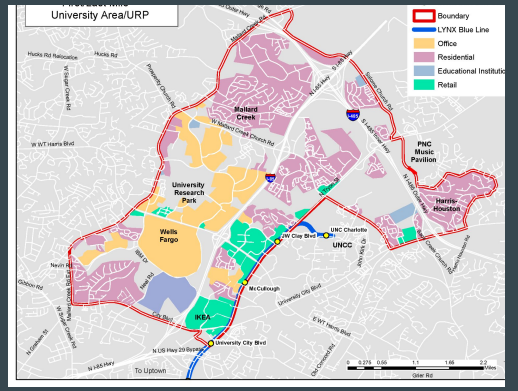
Ride-hailing technologies can potentially increase transit demand outside these zones:

- Nationwide survey of transit riders revealed 14% use ride-hail to connect to transit at least monthly (Masabi, 2020)
- In San Diego, the number of low-wage jobs within a 30-min commute by car vs. rail transit declines from a factor of 35 to a factor of 12 when rail transit is linked using car (Boarnet et al., 2017)
- When London Underground extended hours, Uber ridership in those hours rose (Rao, 2017)
- Hall et al., (2018) find that Uber entry boosts rail ridership in US

Ride-to-Transit Programs

Cities are beginning to experiment with leverage complementarity by subsidizing Ride-to-Transit (R2T) services (Schwieterman et al, 2018)

- More than 20 local governments and companies have rolled-out R2T programs to facilitate linkages to mass transit stations (Shaheen and Chan, 2016)
- Example. Charlotte pilot: Users received 40 Lyft trips/month, $4 per ride subsidy



Connect to Your First / Last Mile in these Easy Steps:

1 Two Ways to Participate

- Purchase a monthly pass via **CATSPass mobile app.** Within 48 hours, a code will be activated in your Lyft app for use within the geo-fenced area. A monthly pass purchased through CATSPass provides **40 Lyft** trips per month.

2 Pick Your Station

A trip must originate or terminate at either of those two station locations AND end or start in the designated geo-fenced area surrounding each station. These areas were selected to fill gaps in the existing transit network in order to provide better access to the region's extended rail system. See attached maps for geo-fenced areas for each station.

3 Pickup and Drop-off Locations

Each station will have a Lyft sign installed as illustrated below to designate the location to be picked up and dropped off by Lyft. Your Lyft trip must start or end at one of the two designated stations AND start or end in the geo-fenced area.

Uber Public Transit Partnerships

partnered with 500+ Transit Agencies globally

Innisfil Transit
Ontario, CAN

WMATA
Washington, DC

Miami Dade Transit
Miami, FL

PSTA
St. Petersburg, FL

DART
Dallas, TX

IndyGo Transit
Indianapolis, IN

DART
Des Moines, IA

Metro Rio
Rio de Janeiro, BR

MBTA
Boston, MA

RTD
San Joaquin, CA

Tri Delta
Contra Costa, CA

MARTA
Atlanta, GA

PBOT
Portland, OR

LAVTA
Livermore, CA

Canberra Metro
Canberra, AUS

Comet
Columbia, SC

Transport Canberra
Canberra, AUS

MTMA
Mountain View, CA

But Are these Programs Working?

No transit agency has evaluated the impact of these programs or cost-effectiveness

Endogeneity and measurement challenges make it difficult to estimate the effects of a subsidized complement:

- Data on take-up or ride-hailing alone cannot tell us about effects on public transit ridership (the outcome of interest)
- We would also like to know about extensive margin effects (mobility effects) and other substitution behavior (from cars)
- Potential for gaming these programs is not well-understood

Field experiments with ride-hailing services & careful data collection could help overcome these challenges

Research Questions

1. What is the demand response to subsidized Ride-to-Transit services?

(a) Effects on transit-linked Uber utilization?
(b) Effects on public transit ridership?
(c) Effects on substitution away from other modes (i.e. private car)?
(d) Effects on overall mobility?

2. Do subsidized Ride-to-Transit services differentially affect riders that are less mobile or that live/work further from existing public transit networks?

3. If the Ride-to-Transit program were scaled up and implemented at the city-level, would the effects quantified in 1 and 2 result in a significant reduction in congestion/emissions externalities?

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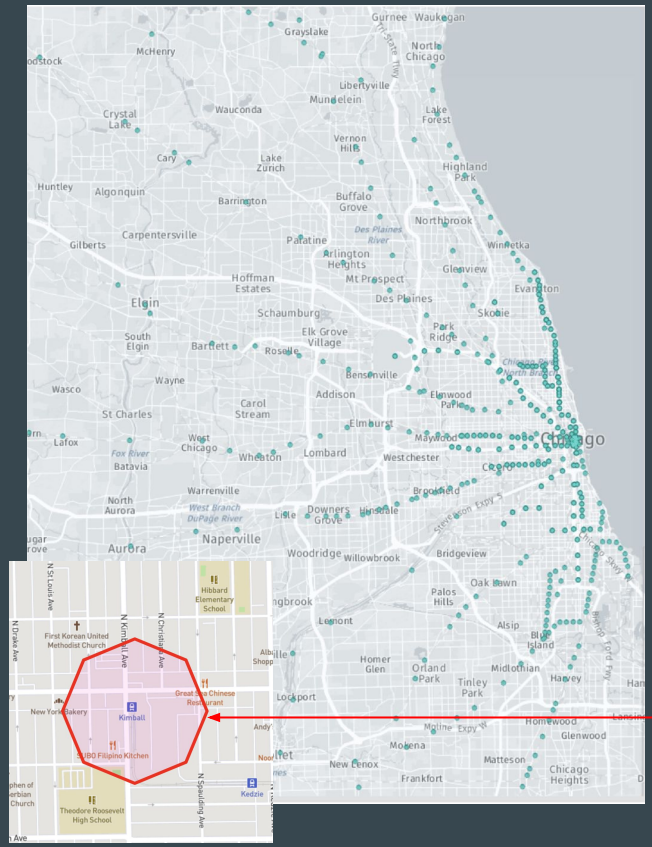
<u>Today's Plan: Discuss design and measurement before we scale.</u>

Research Design and Study Area



Sampling and Recruitment:

- Frame: Chicago Metropolitan Region (9.4 Million inhabitants)
- Recruitment: Uber will send email recruitment messages to a random set of riders inviting them to join study
- Randomize 1,000 riders into two groups

Randomization Details:

Treatment: 50% subsidy for transit-linked trips for 2 months (max $10/trip)

Control: no subsidy

Treatment Details:

- Subsidy treatment is geographically targeted using a geofence directly applied on the Uber platform
- Riders in in the treatment group only receive a price discount on trips that begin or end within 200 meters of a transit station

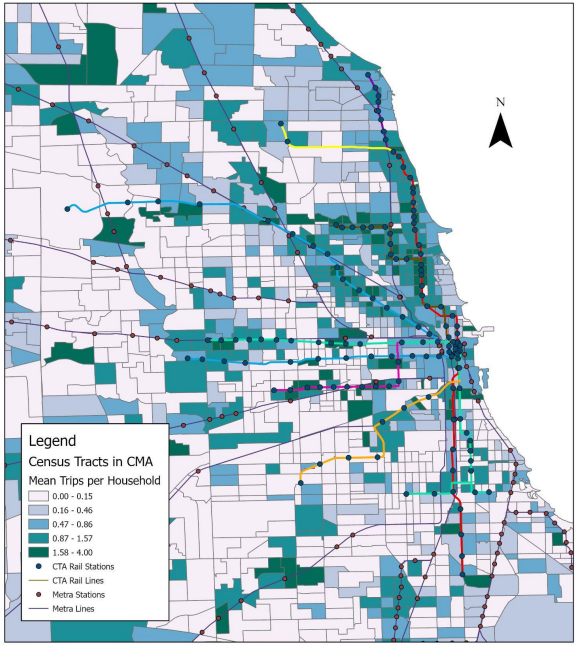
Chicago Rapid Transit: “the L”

Heavy Rail Service (“the L”)

- Third largest heavy rail transit system by ridership in the United States (APTA 2019)

- CTA 2020-2024 $5.1 billion Capital Improvement Program (CIP) is currently underway, including a $2.3 billion, 5.6 mile extension of the Red Line to serve far South Side neighborhoods currently lacking convenient access to frequent rapid transit.

Average Daily Rail Trips per Household by Census Tract

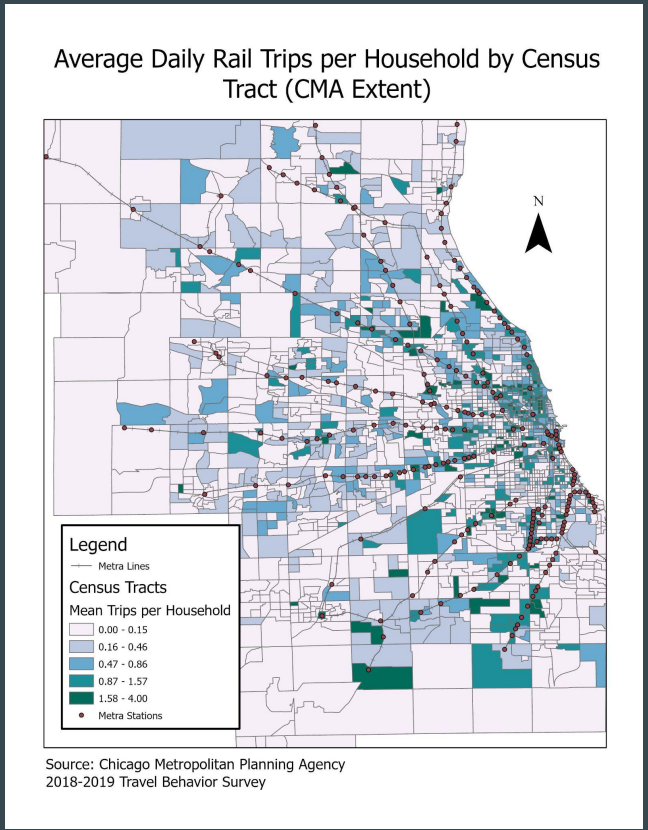


Source: Chicago Metropolitan Planning Agency
2018-2019 Travel Behavior Survey

Chicago Rapid Transit: Metra

Commuter Rail Service (“Metra”)

- Metra provides commuter rail service to over 242 stations on 11 lines, serving communities well beyond Chicago’s city limits.
- The fourth largest commuter rail agency by ridership in the United States (APTA, 2019).
- While serving a larger area than the CTA L, Metra has only 40% of the L’s average weekday ridership and lower frequencies.

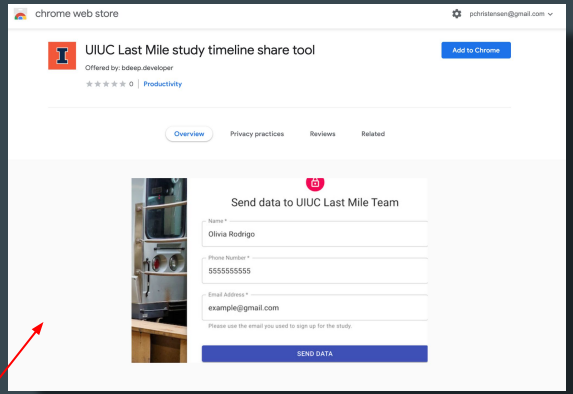


Research Design: Data Collection

1. Baseline, Midline, and Endline Qualtrics Surveys
    - Demographic Characteristics
    - Home and Work Locations
    - Labor Market Info
    - Trips Taken Yesterday

2. Uber Administrative Data
    - Number of trips, time, distance, fare, etc

3. Google Maps Timeline
    - Data extracted at midline and endline using Chrome extension or manual upload
    - Individual trip segments - origin/destination lat/lon, begin/end time, mode, distance
    - Google Maps API: route-based distance



Measurement: Google Timeline Validation

(1) RA takes transit-connected trips (Uber+Transit)
(2) Trip Log: Records exact route, mode, begin time, and end time on each segment
(3) Compares trip log distance to Timeline (begin/end locations)
(4) Compares trip log distance to Maps API (route)

Table 6. Google Timeline: Validation

	Trip Log (km)	Timeline (km)	Timeline Error	Maps API (km)	API Error
L	12.57	13.21	5.1%	13.47	7.2%
	(12.00)	(13.75)		(13.79)	
Metra	86.30	83.76	2.9%	87.44	1.3%
	(23.03)	(22.62)		(23.27)	
Motorized Vehicle	19.35	15.46	20.1%	20.38	5.3%
	(8.92)	(8.16)		(23.27)	
Total	118.22	112.43	4.9%	121.29	2.6%
	(17.88)	(14.96)		(17.31)	
Observations	34	34	34	34	34

RCT Pilot 2021: Sample

- Cohort 1: June-August
  - 18 participants
- Cohort 2: September-November
  - 36 participants
- Cohort 3: November-January

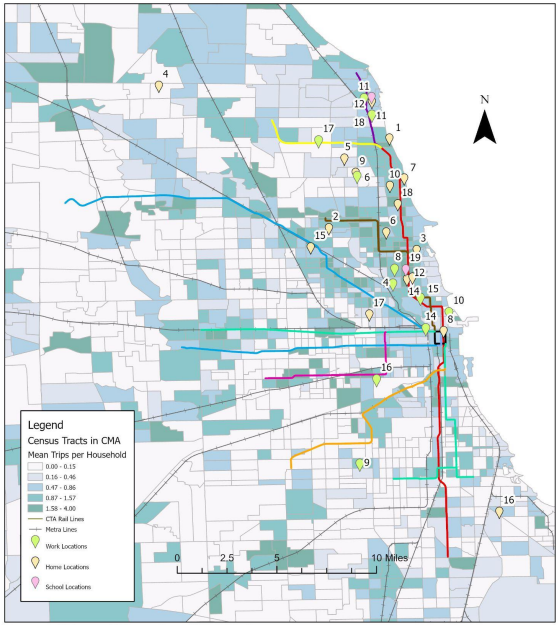
Table 1. Baseline Characteristics Presentation

Variables	Overall
Gender	
Male	0.23 (0.43)
Female	0.71 (0.46)
Other	0.05 (0.23)
Baseline Characteristics	
Age	32.29 (7.98)
Married	0.20 (0.40)
Currently Working	0.89 (0.31)
Car Owner	0.17 (0.38)
Household Size	2.22 (1.13)
Children in Household (under 16)	0.36 (0.72)
Education	
College Education	0.48 (0.50)
High School	0.50 (0.50)
Mobility	
Mobility Constraints	0.07 (0.26)
Trips Taken Yesterday (Uber Excluded)	0.71 (1.04)
Observations	56

Note: Column (2) reports the means and standard deviations for their respective study groups.

RCT Pilot: Home/Work Locations

UIUC Pilot Survey Home, Work, and School Locations



Source: Chicago Metropolitan Planning Agency
2018-2019 Travel Behavior Survey

Table 3. Work/Home Distance: Baseline

	Work		
Home	Within 1/2 Mile	More than 1/2 Mile	Total
Within 1/2 Mile	0.223	0.20	0.429
More than 1/2 Mile	0.223	0.343	0.571
Total	0.457	0.543	1.00

RCT Pilot: Google Timeline

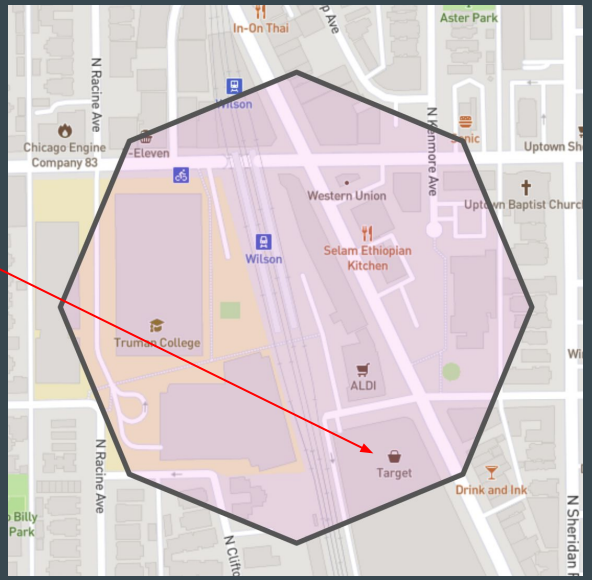
Table 4. Daily Distance per Person: Google Timeline vs API

	Timeline Distance (km)	API Distance (km)	Difference
L	20.14	20.72	2.9%
	(17.80)	(17.8)	
Metra	13.86	13.39	3.4%
	(19.52)	(9.95)	
Motorized Vehicle	17.69	17.21	2.7%
	(26.813)	(17.62)	
Total	16.86	16.60	1.5%
	(22.81)	(15.56)	
Observation	868	868	868

Do Participants Game these Programs?

Participants can potentially game location-based ride-hailing subsidy programs:

- Subsidized travel for other purposes
- We can observe whether a linked transit trip was taken
- We can test for strategic behavior
- We are considering additional treatment arms that we could use to test effects on strategic behavior



Preliminary Findings and Next Steps

(1) Without stratifying, take-up is disproportionately:
   (a) Female, employed, non-car owners (some families)
   (b) Individuals that either live and/or work more than ½ mile from a station

(2) Trip-Segment level travel measurement using Google Timeline:
   (a) Can distinguish between light/heavy rail in Chicago
   (b) Begin/end locations underestimate car travel (Google maps correction)

!

Next Steps

1) Continue validation exercises (additional lines)
2) Complete 3rd cohort in our Pilot
3) With add'l funding:
    a) consider geographic targeting
    b) additional treatment arms
    c) longer-run?
4) Sample weighting using transit survey data

Launch Study!

References

Boarnet, M. G., Giuliano, G., Hou, Y., & Shin, E. J. (2017). First/last mile transit access as an equity planning issue. Transportation Research Part A: Policy and Practice, 103, 296–310. https://doi.org/10.1016/j.tra.2017.06.011

Guerra E, Cervero R, Tischler D. Half-Mile Circle: Does It Best Represent Transit Station Catchments? Transportation Research Record. 2012;2276(1):101-109. doi:10.3141/2276-12

Venter, C. J. (2020). Measuring the quality of the first/last mile connection to public transport. Research in Transportation Economics, 83(May), 100949. https://doi.org/10.1016/j.retrec.2020.100949

Rao, S. (2017). London's new late night alternative: The Night Tube + Uber. *Medium.* *https://medium.com/uber-under-the-hood/londons-new-late-night-alternative-the-night-tube-uber-8f38e56de983*

Hall, Jonathan D. Hall, Craig Palsson, Joseph Price (2018) Is Uber a substitute or complement for public transit?, *Journal of Urban Economics*, 108, pp. 36-50 https://doi.org/10.1016/j.jue.2018.09.003.