

A METHOD TO SYNTHESIZE TRANSPORTATION NETWORK COMPANIES (TNC)-AWARE POPULATION MICRODATA SAMPLE

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Introduction

Novel transportation modes are best modeled using **agent-based meso/microscopic simulation platforms**. Definition of agents (e.g. households or persons) is a fundamental step in developing such models. Ideally, model developers should **capture typical workday travel patterns of the entire population** of travelers within the study area. However, such detailed data are unavailable due to privacy concerns, as well as technical and financial feasibility issues. Hence, **modelers opt for population syntheses** based on Public Use Microdata Sample (PUMS), summary census data, and land use data.

Traditional population synthesis techniques were developed decades before the emergence of Transportation Network Companies (TNCs). Accordingly, **TNC-aware transportation mode microdata are essential for the development of agent-based TNC-aware transportation models**. The proposed method in this study results in a **population microdata sample that is aware of TNCs**, thus enabling pioneer work on population synthesis for TNC modeling.

Study Objective

This objective of the study is **to present a detailed method of developing TNC-aware population microdata sample for use in population synthesizers for the purpose of developing agent-based TNC-aware models**. In addition, the method presents high-resolution **micro-level indicators of travel preferences and behaviors** in Birmingham, AL, a TNC-served area. This is a much-needed type of information for developing an agent-based model in MATSim, the only modeling platform currently able of simulating TNCs.

Method

The proposed method utilizes a **travel diary survey** designed to capture the required attributes necessary to synthesize the TNC-aware population microdata. This travel diary survey is developed in accordance with the ITE Manual on Transportation Engineering Studies using the **Qualtrics Research Core** platform. The survey consists of the following seven blocks.

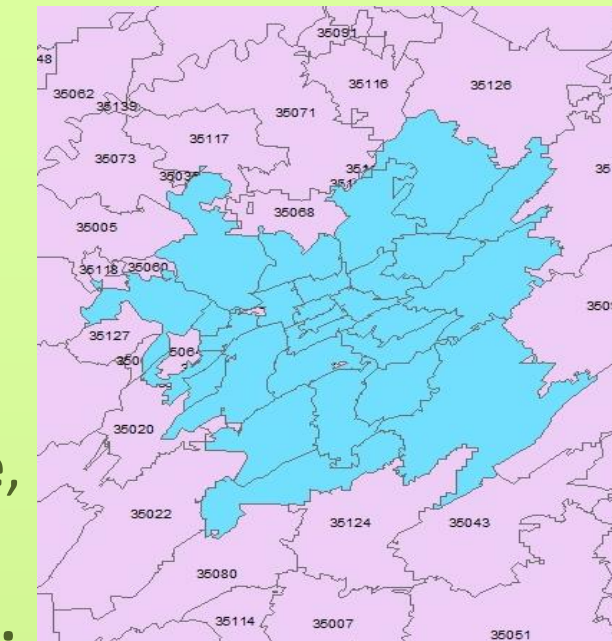
1. An **Informed Consent** from each respondent
2. **ZIP Code validator** to verify the ZIP code of the respondent's residence & compare it to the predetermined population microdata area using "Matches Regex" code of JAVA and skip logic.
3. **Modal Preferences questions** to identify the user's modal preferences and the reasons behind the selection.

I have used the following in the Birmingham region at least once in the past year. Check all that apply.

 - Transportation Network Companies (Uber, Lyft, etc.)
 - Public Transit
 - Organized ride sharing program
 - Bicycle
 - None of the above
4. **Initial location** of the participant at the beginning of a typical day is recorded to prepare the complete travel diary.
5. **Travel Diary** to collect a typical **24-hour travel diary** indicating the purpose and mode used (including TNCs, their availability and user-perceived quality indices). An **ad-hoc application program interface (API)** is utilized that connects with Google Maps service to identify the longitude and latitude of every trip's origin and destination.
6. Information about **participants preferences** regarding transportation system available options and needs.
7. **Demographics data** (age, gender, employment, auto ownership etc.) re collected according to CENSUS criteria to understand factors that affect modal choices, including TNCs.

Application of the Method

The method was applied to the **Birmingham, AL, metro** area. The area is populated by 1,141,309 capita (per 2016 Census).

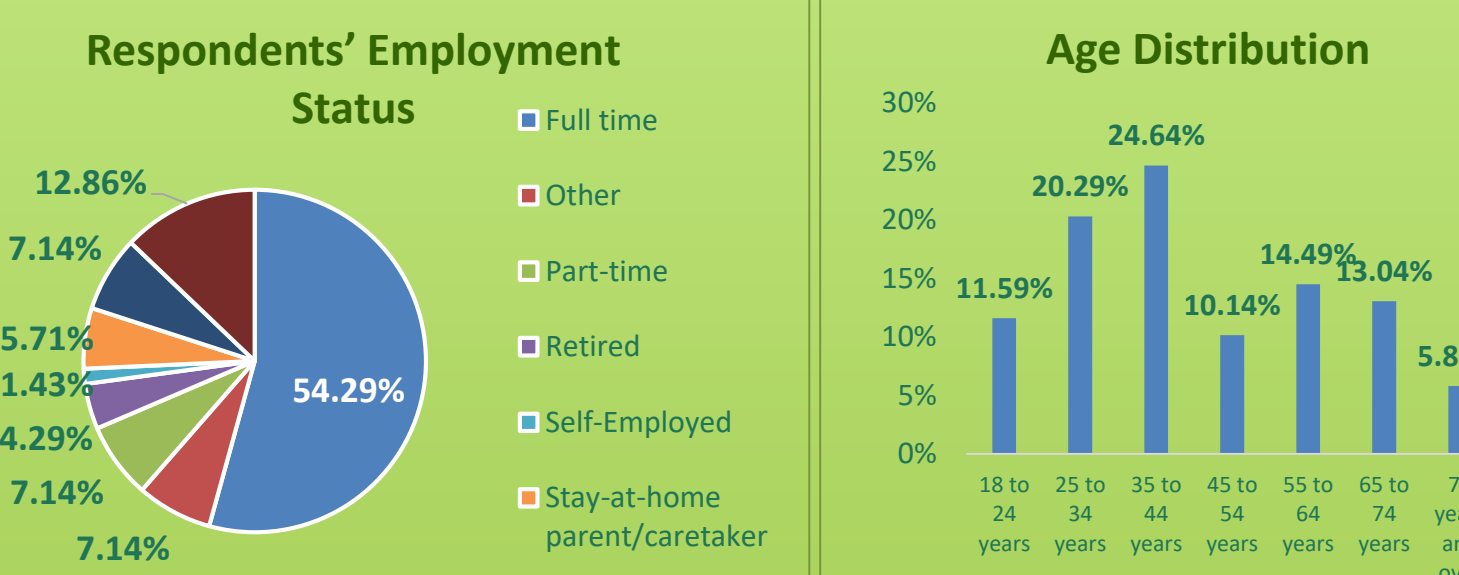


Following a **pre-testing phase**, actual survey data were collected in **Nov. & Dec. 2018**.

A **sample of 400 survey** responses was deemed appropriate to represent the travel behavior of the total population of the study area. The **sample size** was calculated using the following standard formula of population sample with an assumption of standard deviation being 0.5:

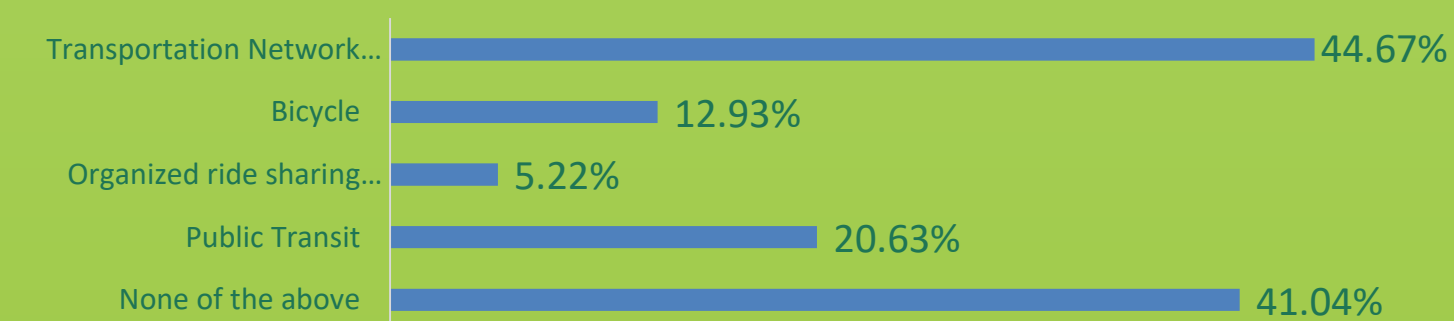
$$n = z_{\alpha}^2 \left(\frac{pq}{\delta^2} \right)$$

After testing and cleaning up the data, **423 responses** were used in the analysis presented herein.



Results and Discussion

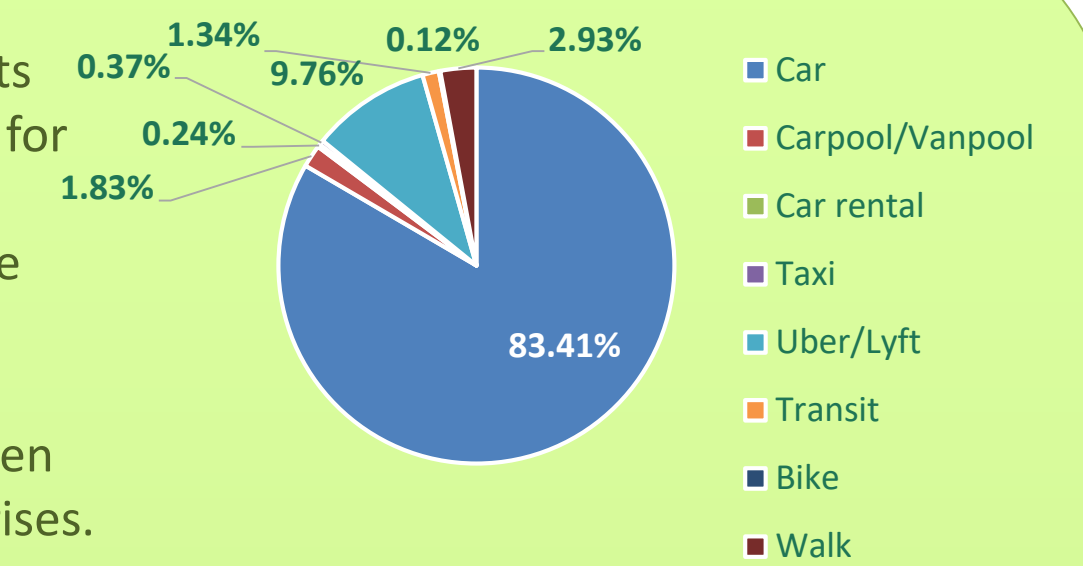
Q: I have used the following in the Birmingham region at least once in the past year:



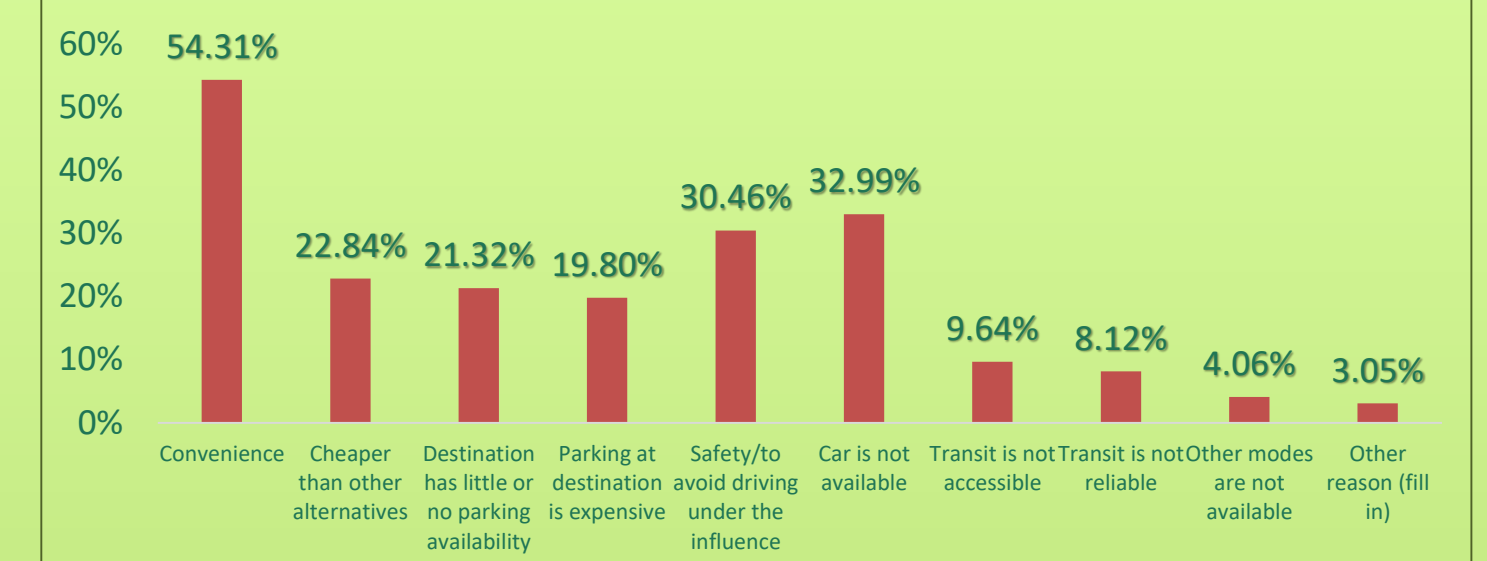
Around 45% of the responders are aware of TNCs and have used TNCs services at least once while traveling in the Birmingham region.

Mode Selection

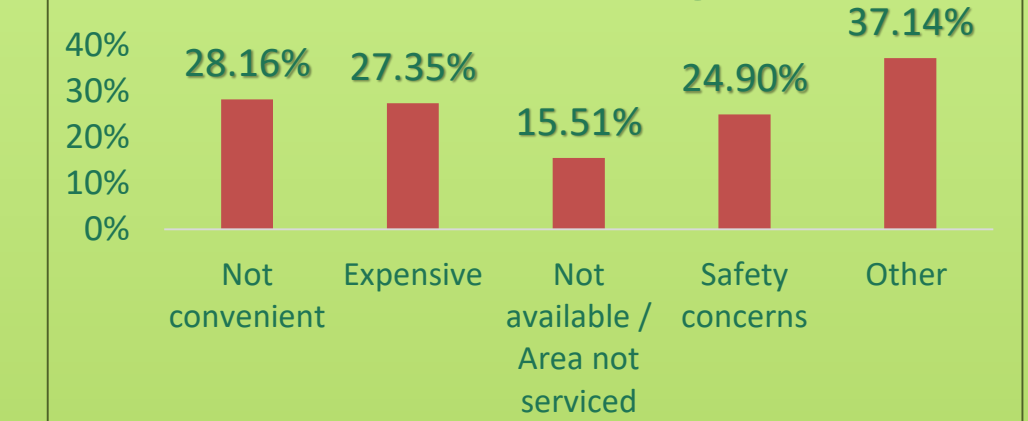
Most respondents depend on auto for typical day commuting in the study area. They choose TNCs or public transit when special reason arises.



Reasons for using TNCs



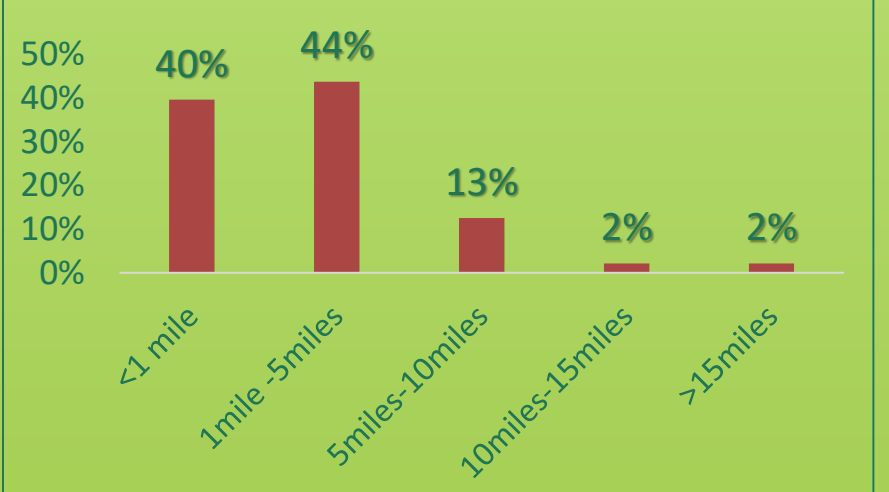
Reasons for not using TNCs



Most respondents who had chosen 'other' option wrote that they **have a car** so they don't need to take TNCs.

Responders use TNCs for **short trips**. The results indicate that TNCs can serve as a form of first/last mile service to/from public transit.

Distance traveled with TNC



Conclusions

The proposed method results in a population microdata sample that is aware of TNCs, thus enabling pioneer work on population synthesis for TNC modeling. This microdata sample is also beneficial to planning agencies in identifying relevant micro-level TNC usage patterns that would help in coordinating such services with existing plans. **This study was performed in support of the STRIDE sponsored project 2017-B, "Technology Influence on Travel Demand and Behavior"**.