North American Micromobility Panel

**Summary**

The goal of this document is to provide a detailed proposal for the North American Micromobility Panel study being conducted at UC Davis with the goal of reaching an agreement on survey recruitment and data transfers to support this research. We request two levels of participation by micromobility service companies:

1. Agreement to solicit users via email or other form of communication on behalf of UC Davis in the spring of 2020 and fall of 2020 to targeted users in select cities.
2. Agreement to a one-time transfer of individually aggregated (by week) data for all survey weeks following the completion of the final wave of the fall 2020 survey.

**Project Timeline**

* October – November 2019: Continue discussions of survey recruitment and data transfer agreements, rough draft surveys (initial and follow-ups)
* November – December 2019: Begin formal data transfer agreement negotiations, finalize recruitment strategy, finalize the survey instruments (initial and follow-ups)
* January – May 2020: Continue formal data transfer agreement negotiations, initial recruitment into the spring panels and first wave of spring survey, follow up weekly surveys
* June – September 2020: Analyze survey data and report preliminary year one findings (no analysis of user data)
* September – November 2020: initial recruitment into the fall panels (and re-recruitment of spring panel members) and first wave of fall survey, follow up weekly surveys
* December 2020 – May 2021: data transfer from mobility service providers to UC Davis, data analysis
* June 2021 – September 2021: Publish de-identified survey data (with respect to restrictions from data transfer agreements), final project reporting.

**Introduction**

The rise in bicycling and bike share services in North American cities is a sign of latent demand for bicycling. The more recent rise in dock-less bike and scooter shares (micromobility services) indicates the latent demand for “micro” transportation options could be substantial. Given that substitution of bicycling, scootering, and other small vehicle travel for car travel will help cities reach numerous planning goals (e.g., accessibility, emissions, climate, health, equity, etc.), there is a clear need for understanding the implications of these mobility services. This is especially true in states like California where the rise in micromobility services also represents a growing workforce and capital investment.

While micromobility services have potential for decreasing car travel and thus many negative externalities associated with car travel, the extent to which these services decrease car travel is currently uncertain. How these services might be leveraged to improve equitable access to everyday activities is also an important question many cities currently face. Quantifying the magnitude of micromobility service effects on travel behavior is an important first step for cities and regions to understand the role these services should play as mobility options. This project focuses on four primary research questions:

1. What travel modes do people shift from when they use micromobility services? Do those mode shifts relate to trip purpose or personal characteristics? Do those mode shifts result in meaningful reductions in ride-hailing and personal car travel? Do those mode shifts result in meaningful change in transit use?
2. Does micromobility use lead to reducing household vehicles and/or car lifestyles?
3. How different are users and non-users in terms of attitudes/perceptions and travel behavior? What potential barriers exist for widespread adoption? How do attitudes/perceptions about micromobility services change over time?
4. How do variations in micromobility services (docked vs. dock-less, conventional vs. electric assisted bicycles, bikes vs. scooters, etc.) differ in their appeal to users and in the attitudes/perceptions of non-users? Do people use these services for different purposes and have different mode substitution patterns?

**Study Design**

We currently have funding to create a longitudinal panel survey of micromobility service users along with a panel of non-users to understand the impact of micromobility services on travel behavior, attitudes, and other characteristics thought to play a role in addressing transportation goals such as mode shift, car ownership, access, and equity. The repeated measures of people’s behavior over the course of this longitudinal study will increase the internal validity of the study by showing change over time. The matched panel of non-users will also act to increase internal validity by providing a control population.

UC Davis proposes that micromobility service partners recruit users in 8-10 cities where their services are currently provided. The city selection will be based on transit availability, size of the micromobility fleets, region, and availability of a sampling frame for the matched sample. This selection process is expected to provide city examples where participant travel behavior can generalize to most North American cities.

*User Panel*

The sampling frame for the user panel will include people who have provided an email address or other form of contact to a micromobility operator in one of the study cities. For dock-less services, the sampling frame is generally their entire user base. For docked services, it may only be monthly subscribers to the specific bike share service. Depending on the number of service operators in the city, each operator will be asked to solicit a random sample of two groups of users (subject to change based on discussion with researchers and operators):

1. a randomly selected user group
2. a new and regular user (taken first trip within past six months and has an average trip frequency greater than five times per week)

By targeting these groups, we aim to show the current (via the random sample) and potential (via the targeted new/regular user sample) impacts of micromobility services on other mode use. We will set a quota of 200-400 users in each city for three weekly waves (four surveys total). If the quota is not reached in the spring survey period (see below), the fall survey period will be used to reach the quota. In cities where many operators compete, there is potential for a much larger user sample; however, there is also the potential to “cross-recruit” people who use more than one micromobility service. Survey questions will be designed (See appendix A for an outline), and panel members will not be allowed to respond to the survey more than once. We will seek a minimum user panel sample size of 2,000. A 3% response rate will be assumed (based on online panel recruitment rates from the UC Davis California Mobility Panel Study) and the operators will be asked to contact a share of their users based on this expected response rate and their ratio of number of vehicles in operation compared to competing operators in the same city. We will assume a 60% attrition rate, which the research team has found in prior longitudinal studies to be conservative.

*Non-User Panel*

The non-user panel will consist of a group of residents that live near the user panel in the service area of one or more micromobility services. This non-user group will act as geographic controls for the users to minimize any effects of service availability and explore the role of personal and household characteristics in moderating the effect of micromobility service use on other travel modes. To recruit non-users, the research team proposes to either buy targeted addresses from a marking company (e.g. Infogroup) that fit sociodemographic strata known to represent micromobility service users and use traditional mailers, or use an online survey panel service. The researchers will set a quota of people to match the sample size of the users in each city. The final decision will be based on costs and availability of detailed geographic quotas for panel services. The same response and attrition rates (3% and 60%, respectively) will be assumed for the non-user panel recruitment.

*Survey Questions and Implementation*

Th surveys will focus on the following categories: travel behavior, micromobility service use, micromobility service attitudes and perceptions, travel attitudes and perceptions, and socio-demographics. The first survey (20-30 minutes) will include one-time measures of variables that do not change or are unlikely to change (e.g., residential/workplace/school location, socio-demographics) (see Appendix A for a draft of the surveys). Most importantly, this survey differs from other surveys of micromobility users by collecting self-reported odometer readings for all household vehicles for each week of the panel. Paired with user data, this will offer the first look at the tradeoff between micromobility use and car use. Follow-up weekly surveys (3-15 minutes depending on reported change) will ask panel members to report odometer readings of household vehicles, intra-household travel negotiations, and any long-distance travel. In addition, if any major events occurred which altered household travel during the week, panel members will be asked to report them (see Appendix A). Panel membership and survey participation will be incentivized through a series of small payments. Users and non-users will be awarded a small payout for completing the first survey, and a larger payout for completing all four surveys (primary survey and three weekly follow-ups).

The survey schedule is as follows:

March-May (2020):

1. Week 1: Initial recruitment to user and non-user surveys, completion of spring wave 1
2. Week 2: follow-up survey (spring wave 2)
3. Week 3: follow-up survey (spring wave 3)
4. Week 4: follow-up survey (spring wave 4)

September-November (2020):

1. Week 1: Re-recruitment of spring participants who opt in for further participation and new recruitment to fill quotas, completion of fall wave 1
2. Week 2: follow-up survey (fall wave 2)
3. Week 3: follow-up survey (fall wave 3)
4. Week 4: follow-up survey (fall wave 4)

The purpose of the two survey periods (spring and fall) is two-fold. First, it allows us to capture changes in behavior of individuals over a long period of time (from spring to fall) for select users. This allows us to examine if micromobility service use is related to major travel lifestyle changes (e.g. car ownership), and the direction of individual level travel behavioral trends. Second, it allows an easy mechanism for reaching the sample quota by using the spring response and attrition rates to taylor the fall recruitment to attain our desired statistical power within our allotted budget.

**User Data**

Beyond survey data, we propose to ask participants to allow micromobility and ride-hail service companies to share individual data (aggregated weekly with no location data) with UC Davis. The proposed data are listed below. This data is requested for both the spring and fall survey periods but is described by a single period to improve clarity. For example, when we request trips for the prior three weeks, we do so for both spring and fall. This means that if a panel member participates in both the spring and fall survey periods, we would request a total of 6 weeks of travel data for that participant.

* **Micromobility trips:** With agreement by survey participants and in accordance with privacy agreements between users and micromobility service providers, we request a count of participant level trips for the prior time period of three weeks tabulated by one-way/round-trips, vehicle type, and week. No geographic or temporal information is needed. These counts quantify micromobility trip frequency for the survey panelists. Example below:

|  |  |  |
| --- | --- | --- |
| **Field** | **Description** | **Example** |
| person\_id | Unique person id | 256 |
| wave | Survey wave | 2 |
| start\_time | The date/time when period begins | 3/1/2019 00:00 |
| end\_time | The date/time when period ends | 3/7/2019 24:00 |
| oneway\_scooter\_trips | Count one-way scooter trips | 13 |
| oneway\_bike\_trips | Count one-way bike trips | 12 |
| round\_scooter\_trips | Count roundtrip scooter trips | 3 |
| round\_bike\_trips | Count roundtrip bike trips | 5 |

* **Micromobility distance:** With agreement by survey participants and in accordance with privacy agreements between users and micromobility service providers, we request a sum of all participant level micromobility traveled distance for the prior time period of three weeks tabulated by one-way/round-trips, vehicle type, and week. No geographic or temporal information is needed. These aggregated trip distances quantify micromobility miles traveled for the survey panelists. Example below:

|  |  |  |
| --- | --- | --- |
| **Field** | **Description** | **Example** |
| person\_id | Unique person id | 256 |
| wave | Survey wave | 2 |
| start\_time | The date/time when period begins | 3/1/2019 00:00 |
| end\_time | The date/time when period ends | 3/7/2019 24:00 |
| oneway\_scooter\_miles | Sum one-way scooter miles | 42.5 |
| oneway\_bike\_miles | Sum one-way bike miles | 4.8 |
| round\_scooter\_miles | Sum roundtrip scooter miles | 3.1 |
| round\_bike\_miles | Sum roundtrip bike miles | 2.2 |

* **Micromobility accessibility:** With agreement by survey participants and in accordance with privacy agreements between users and micromobility service providers, we request a count of participant level “looks” at the micromobility service app in which they do not check out a vehicle for the prior time period of three weeks tabulated by accessibility (walking distance TBD) and week. No geographic or temporal information is needed. These counts quantify micromobility demand frequency for the survey panelists.

|  |  |  |
| --- | --- | --- |
| **Field** | **Description** | **Example** |
| person\_id | Unique person id | 256 |
| wave | Survey wave | 2 |
| start\_time | The date/time when period begins | 3/1/2019 00:00 |
| end\_time | The date/time when period ends | 3/7/2019 24:00 |
| app\_looks\_in\_range | Count app looks when micro vehicle is within walking range | 12 |
| app\_looks\_out\_range | Count app looks when micro vehicle is NOT within walking range | 7 |
| ppp\_looks\_out\_system | Count app looks when person is out of a service area | 2 |

* **Ride-hailing trips:** With agreement by survey participants and in accordance with privacy agreements between users and Uber/Lyft, we request a count of participant level ride-hail trips for the prior time period of three weeks tabulated by two geographic categories (trips originating and terminating in the micromobility service zone (internal), trips originating or terminating outside of the micromobility service zone (external)), by whether the trips are pooled or not, and by week. No geographic or temporal information is needed. These counts quantify ride-hail frequency for the survey panelists.

|  |  |  |
| --- | --- | --- |
| **Field** | **Description** | **Example** |
| person\_id | Unique person id | 256 |
| wave | Survey wave | 2 |
| start\_time | The date/time when period begins | 3/1/2019 00:00 |
| end\_time | The date/time when period ends | 3/7/2019 24:00 |
| internal\_ridehail\_trips | Count ride-hail trips starting AND ending in micromobility service area | 3 |
| external\_ridehail\_trips | Count ride-hail trips starting OR ending outside micromobility service area | 4 |
| internal\_ridehail\_trips\_pooled | Count ride-hail trips starting AND ending in micromobility service area that are pooled | 2 |
| external\_ridehail\_trips\_pooled | Count ride-hail trips starting OR ending outside micromobility service area that are pooled | 1 |

* **Ride-hailing distance:** With agreement by survey participants and in accordance with privacy agreements between users and Uber/Lyft, we request a sum of participant level ride-hailed miles for the prior time period of three weeks tabulated by two geographic categories (trips originating and terminating in the micromobility service zone (internal), trips originating or terminating outside of the micromobility service zone (external)), by whether the trips are pooled or not, by two sub-trip categories (distance from driver acceptance to pick-up, and distance from pick-up to drop-off) and by week. No geographic or temporal information is needed. These distances quantify ride-hail distances for the survey panelists.

|  |  |  |
| --- | --- | --- |
| **Field** | **Description** | **Example** |
| person\_id | Unique person id | 256 |
| wave | Survey wave | 2 |
| start\_time | The date/time when period begins | 3/1/2019 00:00 |
| end\_time | The date/time when period ends | 3/7/2019 24:00 |
| internal\_ridehail\_miles | Sum ride-hail miles (from pick up to drop off) starting AND ending in micromobility service area | 3 |
| external\_ridehail\_miles | Sum ride-hail miles (from pick up to drop off) starting OR ending outside micromobility service area | 4 |
| internal\_ridehail\_pickup\_miles | Sum ride-hail miles (from driver accept to pick up) starting AND ending in micromobility service area | 3 |
| external\_ridehail\_pickup\_miles | Sum ride-hail miles (from driver accept to pick up) starting OR ending outside micromobility service area | 4 |
| internal\_ridehail\_miles\_pooled | Sum ride-hail miles (from pick up to drop off) starting AND ending in micromobility service area that are pooled | 3 |
| external\_ridehail\_miles\_pooled | Sum ride-hail miles (from pick up to drop off) starting OR ending outside micromobility service area that are pooled | 4 |
| internal\_ridehail\_pickup\_miles\_pooled | Sum ride-hail miles (from driver accept to pick up) starting AND ending in micromobility service area that are pooled | 3 |
| external\_ridehail\_pickup\_miles\_pooled | Sum ride-hail miles (from driver accept to pick up) starting OR ending outside micromobility service area that are pooled | 4 |

* **Transit trips and miles**: We will consider working with transit service operators to collect aggregate trip and distance data at the participant level for transit pass holding participants. However, this data would miss infrequent transit users who don’t hold transit passes. We will be collecting self-report data on transit use by all participants including having a transit pass, user perceptions of transit use frequency and distance, and user perceptions of micromobility connections to transit. At this time, no involvement with micromobility service providers is requested.

**Data Transfer Process**

We propose the data transfer process to work as follows:

1. Following the completion of all surveys, UC Davis will download the data from Qualtrics (the company providing the survey interface) and send a table to each company with unique person identifier and email addresses (or phone number depending on the information participants provide).
2. Each company aggregates the data by individual based on email/phone numbers for the survey weeks and sends the data in the format requested above with the unique person identifier (but no email or phone number) to UC Davis. This ensures that each company is only handing over non- personally identifiable information (PII).

While the above transfer procedure will ensure each company only provides non-PII, UC Davis will have the ability to identify people because we will also hold the email or phone number in relation to the unique person identifier. We have experience handling PII and have confirmed with University ethics and legal that because of our consent process we can hold this information. However, if any company is not comfortable with this process, we have a secondary proposed process below. While we would prefer to hold PII for easy access to participants for follow-up questions regarding their responses, we can choose to not hold PII by using a third-party intermediary. This process would work as follows:

1. UC Davis will set up a procedure with Qualtrics (the company providing the survey interface) to hide all PII submitted by respondents to our survey and replace the PII with a unique person identifier.
2. Qualtrics will then send a table to each company with unique person identifier and email addresses (or phone number depending on the information participants provide) on behalf of UC Davis.
3. Each company aggregates the data by individual based on email/phone numbers for the survey weeks, and sends the data in the format requested above with the unique person identifier (but no email or phone number) to UC Davis. This ensures that each company is only handing over non- personally identifiable information (PII). Furthermore, this ensures that UC Davis does not have the ability to join PII (email/phone numbers) to the data provided by the companies

**Data Use and Analysis Methods**

We propose to analyze the data through a series of descriptive statistics, statistical models, and visualizations that directly reflect the research questions. For example, to analyze the variation in usage patterns by socio-economics and user type, we will use bivariate statistics. To answer more complex questions about lasting behavior change, mode switching, and vehicle miles traveled (VMT) substituted we plan to use multilevel generalized linear models. We will also conduct exploratory analyses (e.g. clustering, data reduction, machine learning) with the survey data, but we will onlyuse the individual aggregate user data in confirmatory hypothesis driven analyses that directly answer the research questions presented above. Our proposed analyses for the user data are as follows:

1. Model micromobility trip frequency as a multilevel (by person, city, and week) Poisson or gamma-Poisson (aka negative-binomial) process being a function of type of service, socio-demographics, attitudes, household VMT, ride-hail frequency and/or distance, and other survey-based variables. This model will describe the relative influence of these variables on micromobility trip frequency.
2. Model micromobility trip distance as a multilevel (by person, city, and week) linear or log-linear process being a function of type of service, socio-demographics, attitudes, household VMT, ride-hail frequency and/or distance, and other survey-based variables. This model will describe the relative influence of these variables on micromobility travel distance.
3. Model ride-hailing frequency as a multilevel (by person, city, and week) Poisson or gamma-Poisson (aka negative-binomial) process being a function of type of service, socio-demographics, attitudes, household VMT, micromobility frequency and/or distance, and other survey-based variables. This model will describe the relative influence of these variables on ride-hailing frequency.
4. Model ride-hailing distance as a multilevel (by person, city, and week) linear or log-linear process being a function of type of service, socio-demographics, attitudes, household VMT, micromobility frequency and/or distance, and other survey-based variables. This model will describe the relative influence of these variables on ride-hailing travel distance.
5. Model household VMT as a multilevel (by person, city, and week) linear or log-linear process being a function of type of service, socio-demographics, attitudes, micromobility frequency and/or distance, ride-hail frequency and/or distance, and other survey-based variables. This model will describe the relative influence of these variables on household VMT.
6. Model combined personal VMT and ride-hailing VMT as a multilevel (by person, city, and week) linear or log-linear process being a function of type of service, socio-demographics, attitudes, micromobility frequency and/or distance, ride-hail frequency and/or distance, and other survey-based variables. This model will describe the relative influence of these variables on total VMT.

**Research Impact**

This research should greatly help cities and micromobility service providers understand how current micromobility services impact car use at the individual level. This study is likely to show that micromobility users travel less by car than matched non-micromobility users. It may also show that micromobility users travel less by car when they travel more using micromobility services. The former is important for understanding what travel lifestyle micromobility affords, and the latter how much we can expect of micromobility services for reducing car dependence. However, these results may be in the contexts of cities with supply limited micromobility services. Because of the supply constraint, the results may be more ambiguous (i.e. people don’t have enough opportunities to use micromobility to substitute for car travel). In addition, car use over time is an understudied phenomenon. It is possible that people’s variability in their use of the car won’t allow us to see clear differences between users and non-users, or clear differences when micromobility service use changes. While we can’t quantify these effects before doing the study, preliminary evidence from retrospective counterfactual mode substitution questions in American cities suggest a large enough car substitution (~35%) where even at short trip distances, differences in car use should be apparent from frequent micromobility users. Even if the data is not adequate for us to quantify differences in objective measures of car use, we will still collect self-reported quantities through retrospective counterfactual mode substitution questions at the trip and day level. To our knowledge, micromobility surveys have only covered trip level substitution, so even just considering day level substitution (see Appendix A) will be a great benefit to cities and micromobility service providers. The added benefit of doing both retrospective counterfactual mode substitution questions and measuring objective travel data means we will be the first to compare the two measurement methods. This methodological comparison could have important ramifications for interpreting the array of findings from other micromobility user surveys.

We expect these impacts to come with minimal exposure of user privacy (by aggregating individual data over time and space) and minimal exposure to system performance, service demand, and other trade secrets due to the small sample size in each city. This data can in no way be used to evaluate any system level performance for any one provider in any one city or across multiple cities.