## Title

Disability, Transportation, Activity Performance, and Neighborhood Features in California: Conducting a Focus Group and Designing a Survey



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# Disability, Transportation, Activity Performance, and Neighborhood Features in California: Conducting a Focus Group and Designing a Survey

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A Research Report from the Pacific Southwest Region University Transportation Center

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PSR Pacific Southwest Region UTC University Transportation Center

ITS UCDAVIS Institute of Transportation Studies

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**16. Abstract**

People with disabilities often encounter more and different problems with transportation compared to their socioeconomic peers without disabilities, but their desires for transportation mode choices, usage frequencies, activity frequencies, and neighborhood features have been poorly understood. The authors have begun to rectify those deficiencies with this study, developed in close cooperation with disability advocacy organizations (DAOs). The authors conducted a focus group in 2021 November involving 20 adults with various disabilities across California, including rural, suburban, and urban parts of the major coastal metropolitan areas as well as areas in the interior of the state. Focus group participants' comments evinced a broad theme of problems for people with disabilities arising from car-oriented land use patterns, as they asked for more street lighting, seating, and shade, more frequent public transit service with more geographic coverage, and similar support for infrequent yet critical longer-distance trips. Based on focus group participants' suggestions and pre-testing as well as feedback from DAOs, the authors developed a survey of adults across California to capture how disability affects the choices and desires that people make for transportation mode frequencies, activity frequencies, and neighborhood features. The survey collected nearly 2,000 cleaned responses, reflecting the diversity in disability, geography, and socioeconomic conditions in California.

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# About the Pacific Southwest Region University Transportation Center

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The Pacific Southwest Region UTC conducts an integrated, multidisciplinary program of research, education and technology transfer aimed at *improving the mobility of people and goods throughout the region.* Our program is organized around four themes: 1) technology to address transportation problems and improve mobility; 2) improving mobility for vulnerable populations; 3) Improving resilience and protecting the environment; and 4) managing mobility in high growth areas.

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# Disclosure

Principal Investigator, Co-Principal Investigators, others, conducted this research titled, "Cross-Sectional Study of the Effects of Disability on the Mismatch of Desires versus Choices for Transportation Modes and Residential Location" at the University of California, Davis, Institute of Transportation Studies. The research took place from October 1, 2021, to September 30,

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# Abstract

People with disabilities often encounter more and different problems with transportation compared to their socioeconomic peers without disabilities, but their desires for transportation mode choices, usage frequencies, activity frequencies, and neighborhood features have been poorly understood. The authors have begun to rectify those deficiencies with this study, developed in close cooperation with disability advocacy organizations (DAOs). The authors conducted a focus group in 2021 November involving 20 adults with various disabilities across California, including rural, suburban, and urban parts of the major coastal metropolitan areas as well as areas in the interior of the state. Focus group participants' comments evinced a broad theme of problems for people with disabilities arising from car-oriented land use patterns, as they asked for more street lighting, seating, and shade, more frequent public transit service with more geographic coverage, and similar support for infrequent yet critical longer-distance trips. Based on focus group participants' suggestions and pre-testing as well as feedback from DAOs, the authors developed a survey of adults across California to capture how disability affects the choices and desires that people make for transportation mode frequencies, activity frequencies, and neighborhood features. The survey collected nearly 2,000 cleaned responses, reflecting the diversity in disability, geography, and socioeconomic conditions in California.

# Disability, Transportation, Activity Performance, and Neighborhood Features in California: Conducting a Focus Group and Designing a Survey

## Executive Summary

How does disability affect the choices and desires that people have for transportation mode usage frequencies, activity frequencies, and neighborhood features? This is the central question of this project. People with disabilities in the United States (US) tend to travel less and use various modes at somewhat different rates than their peers without disabilities, yet despite the close connection of transportation to land use, previous studies have not typically considered the desires of people with disabilities with respect to these issues. The implications of previous studies about the problems with specific modes facing people with disabilities seem to be that fixing specifically identified problems to a minimal degree could allow people with disabilities to travel and participate in society as fully as their peers without disabilities, but it has so far been unclear whether people with disabilities want to use different modes or live in different neighborhoods, whether the problems they experience are connected to their neighborhood features, and in which direction(s) causality points.

We developed a study, centered on a focus group and survey whose scope was restricted to California, that begins to answer the central question of this project. We consulted extensively with disability advocacy organizations (DAOs) which operate in various parts of California, including the San Francisco Bay Area, Greater Los Angeles Area, San Diego metropolitan area, and rural and industrial urban areas far from these major coastal metropolitan areas, and represent people with various disabilities. DAOs helped to shape the goals of the study, the focus group structure, the focus group questionnaire, the survey instrument, and the recruitment strategy for the focus group and survey, and they helped to recruit participants with disabilities across California for the focus group and survey.

The focus group, conducted in 2021 November, included 20 adults with disabilities across California. They were chosen to adequately represent different disabilities and different regions of California, including rural areas. We asked participants to share their experiences and thoughts about the challenges they have faced with transportation, how those challenges affect other aspects of their lives, and what places they would like to be farther or closer to where they live. Participants' responses, in various ways, evinced a broad theme of the ways in which car-oriented land use patterns negatively affect people with disabilities. Many of them wanted more street lighting, seating, and shaded spots even in rural and suburban areas, as these would allow them to see better, mitigate fatigue, and let them feel safer when traveling; however, these features are often sparse outside of urban areas due to concerns about costs in low-density areas. Many of them wanted more frequent public transit services and responsive paratransit services running for longer hours as well as more private transportation options usable by people who use wheelchairs, yet these services become more costly with longer

distances and bring lower revenues with lower densities in rural and suburban areas and are therefore less available in such areas. The majority of them ultimately wanted most activity places, especially those to which they travel regularly, to be much closer to their homes, suggesting demand for denser mixed-use development. Finally, many of the participants already actively help other people with disabilities in their communities, and all of them want to ensure that policymakers implement their ideas (instead of ignoring them) so that all people with disabilities can have more opportunities to travel independently outside of the home and engage with the world.

Participants from the focus group, DAOs, other stakeholders, and colleagues further shaped and pre-tested the survey, which was disseminated in 2022 April and collected responses for 3 months. We distributed the survey to more participants recruited through DAOs, participants with and without disabilities from previous surveys conducted by the 3 Revolutions Future Mobility research group at the University of California, Davis, Institute of Transportation Studies (3R group), and online opinion panelists with and without disabilities recruited through Qualtrics. The survey included questions capturing the variables needed to answer the central question of this project, including chosen transportation mode frequencies, activity frequencies, and neighborhood features, desires for relative changes in each of those things, and information about location, disabilities, and sociodemographic traits. With help from DAOs, we phrased questions to be as inclusive as possible given many people's sensitivity about the term "disability" as well as related terms. The survey collected over 2,000 responses, and after removing incomplete responses and cleaning responses that failed eligibility criteria (of being 18 years or older and living in California), were gibberish, or failed logical consistency (a specific example being that a participant may claim to perform activities outside of the house more often than could be accounted for by transportation mode usage frequencies), we were left with 1,898 responses. Of these, there were 809 respondents (43%) with disabilities, of whom 424 reported multiple disabilities; this is due to the targeted recruiting of people with disabilities, allowing us to surpass the statistic that approximately 25% of people in California have a disability. Additionally, respondents were generally statistically representative of the household income distribution in California, and there was adequate representation of different geographic regions, genders, ethnicities, Hispanic/Latino identifications, and ages, though imbalances in each of these usually reflected typical imbalances in online surveys.

In future stages of research, we will compile more descriptive statistics about other personal characteristics as well as choices and desires for transportation, activity, and neighborhood. We will then extrapolate such descriptive statistics to the population of California to better understand the extent to which different choices and desires exist in different parts of the population, including those with disabilities, and we will perform discrete choice modeling to control for other variables in service of answering the central question of how disability affects these choices and desires. Additionally, we will continue to work with our partners in Caltrans to ensure that focus group findings as well as future findings from the survey are seriously considered in future policymaking in the service of people with disabilities across California.

# Introduction

According to the 2017 National Household Travel Survey (NHTS), approximately 3.1 million people in California, constituting 8.5% of the population in California, have travel-limiting disabilities (FHWA, 2017). Transportation is critical to many life activities, including work, education, socialization, entertainment, medical appointments, religious engagement, and basic civic duties (Clarke et al, 2011; Martens, 2018; Paez & Farber, 2012; Lubin & Deka, 2012; Prescott et al, 2020; Ross & Buliung, 2018), yet people with disabilities often face chronic challenges with transportation that depress performance of these activities and lead to frustration, depression, and isolation (Clarke et al, 2011; Paez & Farber, 2012; Lubin & Deka, 2012; Velho, 2019; Velho et al, 2016; Rosenbloom, 2013; Jeekel, 2019; Pyer & Tucker, 2017; Steinfeld & Steinfeld, 2018; Middleton & Spinney, 2019). The population of individuals with disabilities will likely grow in the coming years due to correlations with age and health problems like obesity which are each growing in incidence in the US (Clarke et al, 2011; Martens, 2018; Jeekel, 2019; Sze & Christensen, 2017). Therefore, it is critical to fully understand the transportation needs of people with disabilities in the broader contexts and communities where they live.

To better frame discussion about transportation problems facing people with disabilities, through the rest of this report, we will consistently use the terms availability, immediate usability, and cumulative usability; using these terms will avoid confusion related to multiple meanings of the word “accessibility” with and without reference to disability. Immediate usability refers to barriers that may prevent a person with a disability from using a mode even when it is present, such as a transportation network company (TNC) sending a vehicle that cannot accommodate a user's wheelchair. Cumulative usability refers to problems that may not immediately prevent a person with a disability from using that mode but may arise over the course of a longer journey and thereby discourage that person from making as many trips using that mode as those without disabilities. Examples include the unwanted and discouraging attention attracted by an alarm sound signaling the deployment of a ramp on a bus, the physical and mental stresses of making bus transfers which may be unreliable or hard to understand, or the physical stresses of walking longer distances to train stations even when sidewalks are immediately usable. Availability refers to whether a transportation mode can be present in a large number of locations and times of day to allow people to complete trips when and where they want; in our formulation, availability can be considered independently of disability.

Despite the aforementioned urgency, work toward understanding the transportation needs of people with disabilities has been sparse and disparate. Most previous works reporting on surveys or qualitative studies of transportation challenges facing people with disabilities have focused on specific disabilities, specific transportation modes, specific metropolitan areas, or specific neighborhood types. Additionally, Velho (Velho, 2019), Pyer & Tucker (Pyer & Tucker, 2017), and Páez & Farber (Páez & Farber, 2012) show the need for moving away from top-down paternalistic policies serving people with disabilities in their homes and starting to empower people with disabilities by considering their desires for travel, but very few other previous

works have considered such desires or the desires of people with disabilities for the features of their neighborhoods, despite the deep connections between transportation and land use; most previous works have instead considered transportation improvements narrowly from the perspective of problems with immediate usability in specific modes. This report begins to rectify those gaps in research and policy by considering the choices and desires that people have for different transportation modes, activity levels, and neighborhood features, and considers people with different kinds of disabilities as well as those without disabilities across California, including rural, suburban, and urban areas.

# Literature Review

Each of the following quantitative or qualitative studies about the intersection of disability & transportation has at least one deficiency that our study aims to rectify. In what follows, we progress from studies that we see as having more severe deficiencies to studies that we see as closer to the goals of our study.

The 2017 NHTS was disseminated to approximately 300,000 people across the US (FHWA, 2017). It asked them about their individual characteristics, household characteristics, typical travel behaviors, problems with specific modes, and other issues through a survey, and it also asked them to complete a travel log for one day. It also asked respondents about the presence of disabilities that limit travel outside of the home. However, the phrasing of the question in terms of a "condition" or "handicap" may have put off respondents who do not see their disabilities on a day-to-day basis in such impersonal or dehumanizing medical terms and may have therefore underestimated the prevalence of travel-limiting disabilities. Furthermore, difficulty with traveling outside of the home may have more to do with problems with the immediate usability, cumulative usability, or availability of specific modes than with the respondent's disabilities from a biological perspective; while questions about problems with specific modes can separate these issues to some degree, these issues remain entangled with this phrasing. Additionally, the following question asks about the kind of disability not with respect to difficulty with basic tasks but with respect to the presence of assistive medical devices, which may underrepresent people with disabilities who do not use such assistive devices but nonetheless experience significant problems with transportation related to their disabilities. Furthermore, the survey did not consider respondents' desires to use different modes. Studies based on the 2017 NHTS about transportation & disability, including one by Cochran & Chatman (Cochran & Chatman, 2021) about how people with disabilities are less likely than people without disabilities to use TNCs even after controlling for age & income, will encode the same shortcomings.

The 2002 National Transportation Availability and Use Survey (Sweeney, 2011) was disseminated to approximately 5,000 people across the US. It more explicitly targeted people with disabilities with respect to recruitment, so people with disabilities comprised approximately half of the survey sample, and with respect to the questions asked. However, the fact that the survey was conducted 20 years ago means that some questions about immediate usability are less relevant now; for example, the survey was conducted just over a decade after the passage of the Americans with Disabilities Act (ADA), so many public transit agencies still had buses that people using wheelchairs or medical scooters could not immediately use due to a lack of ramps or lifts, but this problem has largely been resolved since then as public transit agencies across the US, even in different neighborhood types (urban, suburban, or rural) and with different levels of poverty, have had to buy buses that comply with ADA requirements when replacing older buses in their fleets. Additionally, it did not consider respondents' desires to use different modes.

Bezyak et al reported in 2017 about a study conducted in 2009 (Bezyak et al, 2017). This was a survey distributed specifically to people with disabilities across the US, and it included people with different disability identifications, including physical, vision, hearing, communication, mental, and other disabilities. It asked about the prevalence of specific challenges that respondents face with public transit as well as paratransit. However, it did not consider other modes or respondents' desires to use public transit or paratransit. Similarly, Bezyak et al reported in 2020 about a study conducted from 2015-2017. This was a survey distributed specifically to people with disabilities across the US, and it included people with different disability identifications, including physical, vision, hearing, communication, mental, cognitive, and intellectual (separate from cognitive, though the authors do not clarify this distinction, and neither does the American Community Survey which the authors cite) disabilities, as well as autism spectrum disorder and other chronic health conditions. It asked respondents about their primary transportation modes, but it then focused on problems with public transit or paratransit. In particular, it asked respondents about the frequency of problems using public transit or paratransit to get to specific activities, perceptions of differences in availability of public transit compared to people without disabilities, and general effects of public transit problems on tripmaking. While the connection of transportation modes to activities is similar to our study, that study does not consider respondents' desires beyond the implication that a respondent who reports not making as many trips using public transit as needed would in fact want to take public transit more often were it not for associated problems.

Clarke et al reported in 2009 about the Americans' Changing Lives longitudinal study conducted over 4 waves from 1986-2001 (Clarke et al, 2009). This was a survey distributed to adults across the US. Similarly, Clarke et al reported in 2008 and again in 2011 about the Chicago Community Adult Health Study conducted from 2001-2003 (Clarke et al, 2008; Clarke et al, 2011). This was a survey distributed to adults in Chicago. The authors analyzed data from each survey to understand how the prevalence of mobility disability, taken as a single dependent variable and measured through a Likert-type question about the difficulty of walking several blocks (which the authors said did not include clarification about assistive devices like walkers, medical scooters, or wheelchairs), depends on individual health, individual sociodemographic, individual economic, and built environment variables, and, in the case of the Americans' Changing Lives study, changes over time. However, both surveys did not consider other types of disabilities, other modes, or desires for using specific modes.

Lubin & Deka reported in 2012 about a study conducted from 2010-2011 (Lubin & Deka, 2012). This was a survey distributed specifically to adult job-seekers with disabilities across New Jersey, and it included people with different disability identifications, including physical, vision, hearing, communication, mental, and other disabilities. It asked respondents about their most frequently used modes for all purposes and their most frequently used modes specifically for commuting to work. It also asked all respondents specific questions about public transit and paratransit, including reliability, level of service, cost, environmental conditions, problems with public transit vehicles, perceptions of road-based and interpersonal safety along each part of the trip when using different forms public transit (especially bus versus rail), and ease of getting

information about public transit. However, it does not consider specific problems with other modes or desires for using specific modes.

Loukaitou-Sideris et al reported in 2019 about a comparison of measures of walkability in poor neighborhoods in Los Angeles between quantitative data sources, including but not limited to the 2010-2012 California Household Travel Surveys and the 2013-2017 American Community Surveys, and qualitative interviews of elderly residents in those neighborhoods (Loukaitou-Sideris et al, 2019). The authors found that residents were concerned about road safety, interpersonal safety, and other environmental conditions, so while typical metrics would rate the neighborhood as walkable, residents would only walk for needed trips and not as much for pleasure or in the presence of other modes. The authors also reported on residents' concerns with public transit, financial burdens to owning or using private vehicles, and rare use of paratransit, taxis, and TNCs. The authors did not specifically consider people with disabilities, although they noted that many residents would in principle be eligible for paratransit, or specific desires to use other modes if a few stated problems could be mitigated.

Páez & Farber reported in 2012 on the 2006 Participation and Activity Limitation Survey (Paez & Farber, 2012). The survey was distributed to adults and children with disabilities and chronic health conditions across Canada. It included people with different disability identifications, including physical, vision, hearing, cognitive, communication, mental, and other disabilities, as well as chronic pain, and it considered the needs of people who need help from attendants when performing activities outside of the home. It also asked about the frequency with which respondents performed different leisure activities, namely visiting friends, doing exercise, attending events, or visiting museums or parks, each specifically outside of the home, and unlike many other studies considered in this section, it asked respondents whether they wanted to do more leisure activities in their spare time; this would ensure that consideration of desires for performing activities and using different transportation modes would exclude activities that could be seen as more likely to evoke negative emotions, such as going to work or seeking medical treatment. However, it did not consider desires for specific activities or specific modes.

Wasfi et al reported in 2017 about a study conducted before 2007 (Wasfi et al, 2017). This was a survey distributed specifically to people with developmental disabilities, including autism spectrum disorder, cerebral palsy, and other cognitive disabilities in Hennepin County, Minnesota, and asked about living conditions, including whether respondents lived in group homes or with caregivers. The authors found that while respondents were able to travel somewhat regularly for work and leisure, close to a majority were unable to make trips for specific purposes, including work, shopping, socialization, or other recreation, as they wanted. They did not consider people with other types of disabilities. Additionally, while they did consider whether respondents used different modes at all, they did not report on chosen or desired mode use frequencies.

Remillard et al reported in 2021 about a study conducted from 2015-2019 (Remillard et al, 2021). This comprised a survey and an interview for each respondent, with respondents being

elderly people with physical disabilities across the US. The authors asked respondents details about their disabilities, their most frequently used transportation modes, and qualitative problems associated with different transportation modes. However, the study did not consider young or middle-aged adults with physical disabilities, people with other types of disabilities (like vision disabilities) except when they manifested as physical disabilities (like cerebral palsy in some cases), or the specific desires of respondents to perform activities or use modes at different frequencies from what they normally do.

Brewer & Kameswaran reported in 2019 about a study conducted before 2019 in an unspecified metropolitan area (Brewer & Kameswaran, 2019). This comprised interviews of people with vision disabilities who actively used Uber and Lyft services. The interviews qualitatively demonstrated the importance of such riders' trust in family and friends, drivers, and other strangers on the street, as well as of the technology of the app to hail rides, for riders to use such services effectively. However, the interviews did not consider people with other types of disabilities, the use of other modes, or desires to use TNC services more or less often than stated, and it is unclear whether the results are applicable to different parts of the US given the lack of information about the location.

Ripat et al reported in 2017 about a longitudinal study conducted from 2012-2014 (Ripat et al, 2017). This comprised extended observations of 3 adults using wheelchairs in Manitoba, each over the course of 12 consecutive months. The observations demonstrated how different living situations, ages, and activity patterns can affect the extent to which people who use wheelchairs can effectively participate in key activities even during predictably inclement winter weather. However, the study was clearly limited by the small sample with respect to disability types and generalizability of findings.

Pyer & Tucker reported in 2017 about a study conducted before 2017 (Pyer & Tucker, 2017). This comprised interviews of teenagers who use wheelchairs in the Midlands and Southeast regions of England, and in some cases of their parents and other caregivers. The interviews asked about usage of different modes, and respondents spoke of negative emotions associated with not being able to spontaneously join their peers without disabilities for social outings, with problems experienced using different modes, and with having to plan everything in advance; these implied desires to join social activities more frequently than respondents reported doing. However, the interviews did not ask about other types of disabilities, and generalizability of some results to the US may be limited, especially in the context of buses (as the passage of the ADA in 1990 has over the long time since then ensured that essentially every public transit agency in the US uses buses that are immediately usable by people in wheelchairs, whereas that might not be the case in England).

Velho reported in 2019 about a study conducted in 2015 (Velho, 2019). This comprised interviews as well as extended observations of adults who use wheelchairs in London, England. Interviews focused on problems that participants had experienced using public transit in London and briefly touched on problems with other modes. Respondents spoke of conflicts, embarrassment, and physical injuries when interacting with bus drivers, train station managers,

and other passengers, and of the need to be as prepared as public transit employees to quickly and dangerously resolve problems, using strategies like traveling with toolboxes, riding in a wheelchair on an escalator, and training themselves to cross big gaps between train floors & station platforms in wheelchairs even in the absence of ramps. Respondents also spoke of the high costs of taxis and personal vehicles, though they did not specifically connect these issues to problems with immediate usability of those vehicles. However, the study did not consider people with other types of disabilities, and while respondents reported negative emotions and feelings of isolation associated with problems with public transit, implying and in some cases specifically stating a desire to perform activities outside of the home more frequently if transportation options were more accommodating, the interviews did not specifically ask about respondents' desired changes to transportation mode usage patterns.

Cochran reported in 2020 about a study conducted in 2019 (Cochran, 2020). This comprised 32 interviews of adults with disabilities, including physical, vision, and hearing disabilities, chronic illnesses, and combinations of these, in the San Francisco Bay area, and found the following. Many participants expressed concern about traveling independently using transportation modes that require interactions with unknown drivers or other passengers (especially public transit, taxis, and TNCs) often due to lessened confidence preceding those interactions. Such lessened confidence as well as specific experiences of bad interactions can significantly decrease willingness to use those modes in the future. Those effects combine with concern about being seen as a burden on family or friends who help these participants with transportation to overall limit travel, which in turn compounds stress from feelings of social isolation. The author astutely pointed out that the number of years that the participant has had a given disability can have mixed effects on attitudes toward future travel, as having had a disability for longer could promote psychological resilience as well as burnout from repeated negative experiences. The study made clear that at least among the participants, there is a latent desire to travel, and that measuring such latent desires for specific existing modes may be confounded to some degree by the sense of burnout or fear of being seen as a burden. That said, the author acknowledged the limited extent to which study result can be extrapolated from a small non-random sample.

Verlinghieri et al reported in 2022 about a study conducted before 2022 (Verlinghieri et al, 2022). This comprised interviews in person and by email involving DAO representatives across the UK to inform focus groups involving people with different types of disabilities across the UK. These discussions focused on ways to ensure that policies promoting car-free or car-light urban development, in the service of improving public health and combating climate change, would include people with disabilities who could benefit from car-free or car-light development patterns as well as people with disabilities who would still require car use on a regular basis. Participants commented on bad conditions of pedestrian infrastructure, pros & cons for people with disabilities of built environment interventions that are typically seen as having no cons (like planting street trees, which can lower temperatures on hot days and improve air quality but compromise lines of sight), apparent indifference by public transit employees and policymakers to specific transportation challenges facing people with disabilities, problems with electric vehicle charging infrastructure with respect to immediate usability of chargers

themselves for drivers with disabilities as well as immediate usability of sidewalks that have charging cables strewn across them, concerns that vehicle electrification would not solve fundamental problems with transportation for people with disabilities in the contexts of immediate usability of vehicles, road safety for pedestrians, or car-oriented land use patterns, and concerns that some people with disabilities who can drive but experience other forms of societal marginalization may be subject to increased interpersonal violence if government policies prevent them from using cars. Participants brainstormed ideas to work toward car-light urban development, including improving public transit availability, making public transit more immediately usable, improving pedestrian infrastructure (including by adding outdoor public seating), repurposing street parking spaces for places for anyone to rest or socialize, and more political engagement of people with disabilities in such debates. These comments implied desires for specific modes and neighborhood features, but questions did not focus explicitly on desires in those contexts. Additionally, it is unclear how applicable these results are to the US given the arguably different development patterns in the urbanized areas of the UK.

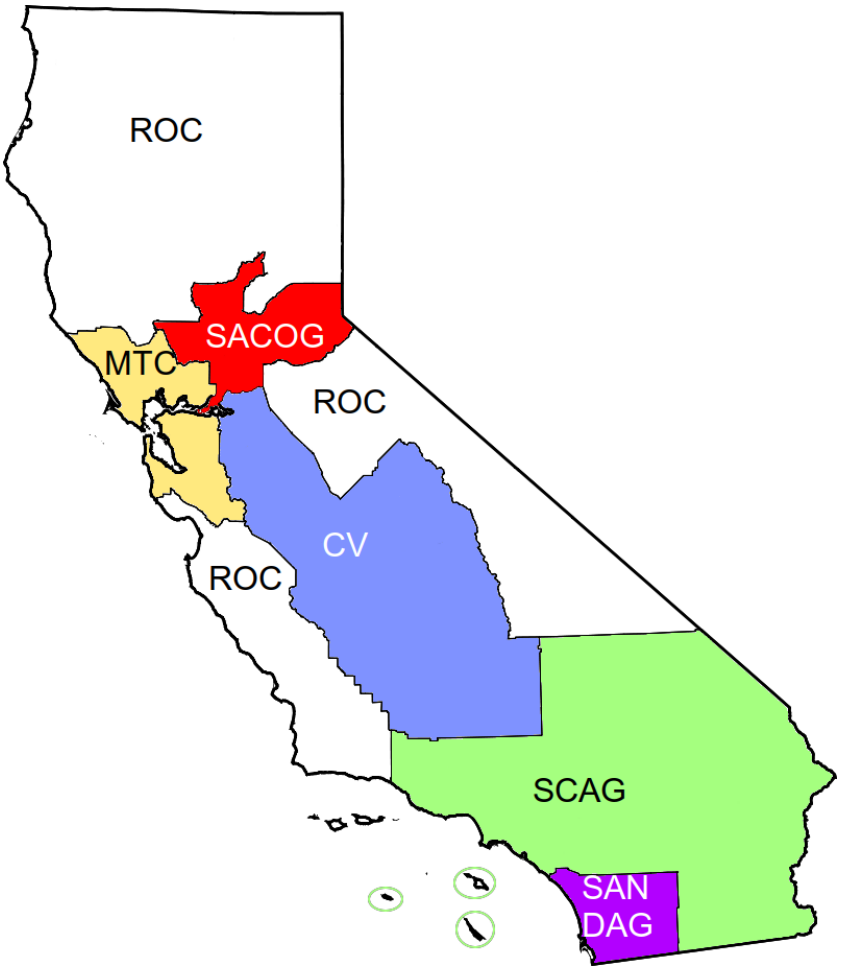
## Research Design and Execution

We designed this study to overcome the shortcomings of previous studies, such as those described in the previous section. In particular, we designed this study to capture the choices and desires that people have for transportation mode usage frequencies, frequencies of performing typical activities outside of the home, and features within one's neighborhood, and how disability may affect those choices, desires, and correlations among them after accounting for gender, age, ethnicity, income, and geographic location. We restricted the study area to the state of California to make the scope and scale of the study manageable. However, we did not narrowly focus on specific types of disabilities or on specific metropolitan areas, as we wanted to investigate whether there could be common experiences even among people who live in different parts of California, live in different neighborhood types (urban, suburban, or rural), and have different disabilities. We recruited study participants from different regions across California. The regions, adapted from previous work by Circella et al (Circella et al, 2016), were given by the jurisdiction of major metropolitan planning organizations, namely the Metropolitan Transportation Commission (MTC) in the San Francisco Bay area, the Sacramento Area Council of Governments (SACOG) in the Sacramento metropolitan area, the Southern California Association of Governments (SCAG) in the Greater Los Angeles area, and the San Diego Association of Governments (SANDAG) in the San Diego metropolitan area, as well as by one other well-defined region of California, namely the Central Valley (CV, although this only covers the southern portion of the Central Valley, namely the San Joaquin Valley), along with the rest of California (ROC). These regions are defined by county in Table 1 and pictorially on a map of California in Figure 1; the three islands circled in light green lie within the counties defining the SCAG region, the island containing the city of Coronado lies within San Diego County and therefore the SANDAG region, and the other islands lie within the counties defining the ROC region.

**Table 1. Definitions of regions in California by county.**

| Region | Counties |
|---|---|
| CV | Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare |
| MTC | Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma |
| SACOG | El Dorado, Placer, Sacramento, Sutter, Yolo, Yuba |
| SANDAG | San Diego |
| SCAG | Imperial, Los Angeles, Orange, Riverside, San Bernardino, Ventura |
| ROC | Alpine, Amador, Butte, Calaveras, Colusa, Del Norte, Glenn, Humboldt, Inyo, Lake, Lassen, Mariposa, Mendocino, Modoc, Mono, Monterey, Nevada, Plumas, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz, Shasta, Sierra, Siskiyou, Tehama, Trinity, Tuolumne |

**Figure 1. Geographic illustration of region definitions in California**



The focus of this study on people with disabilities required specialized recruitment of people with disabilities. To this end, we relied heavily on disability advocacy organizations (DAOs) operating locally within specific regions of California as well as DAOs operating across California; we included DAOs who work with people with different types of disabilities as well as DAOs who work with people with specific types of disabilities. Additionally, a key question to the survey central to this study would be the extent to which disability affects choices and desires for transportation, activities, and neighborhood features, so for the survey, we needed to ensure the presence of a "control" group (which we put in quotation marks because our recruitment was not random or fully controlled) of people without disabilities. To this end, for the survey, we recruited people who previously took surveys from the 3 Revolutions Future Mobility research group (3R group) at the UC Davis Institute of Transportation Studies, and we hired online opinion panelists through Qualtrics; many respondents in these channels also had disabilities, but the vast majority did not have disabilities and satisfied thresholds for representation of different sociodemographic variables.

To ensure that our study would accurately reflect the challenges faced by people with disabilities in California, we extensively consulted with external stakeholders, especially DAOs. We then conducted a focus group involving adults with disabilities across California to understand challenges facing people with disabilities in the context of transportation. The focus group yielded not only an inherently valuable source of qualitative data but also a group of participants interested in pre-testing and taking the survey. After having interested participants pre-test the survey, we iteratively made changes to the survey and disseminated it through various channels. Details about these aspects of the study are in the following subsections within this section; they are given roughly in chronological order, as the chronological development of this study also corresponds to its conceptual progression. Results from the focus group, details about the survey instrument, and results from the survey are given in the next section.

## Consulting Stakeholders

We consulted many external stakeholders about the project's overall goals, language surrounding the term "disability", concerns that people with disabilities in California may have with transportation, the best ways to conduct (including the script) a focus group involving ordinary people with disabilities, and the best ways to structure (including the questionnaire), recruit for, and disseminate a survey involving ordinary people with as well as without disabilities. Additionally, many of those stakeholders provided direct feedback about publicity materials and helped recruit for the focus group and survey. All stakeholders provided advice for this project pro bono.

DAOs would be critical for this project given how many of them work closely with people with disabilities in their local communities. We identified DAOs in California from a list maintained by the Independent Living Resource Utilization program, which is a national center of resources related to independent living for people with disabilities. Some entries in that list directly provided email addresses for directors or other key people in corresponding DAOs, so we used those where available, noting that in some cases, multiple related DAOs (often the same parent

organization serving multiple localities) had the same director with the same email address. For entries that did not provide such email addresses, we used those DAOs' websites to get the director's email address where available; otherwise, we sent email messages to those DAOs' generic information email addresses or using web forms on those DAOs' websites.

In addition to DAOs, we also consulted staff members from Caltrans and other professionals (including academic researchers). We identified these staff members from Caltrans and other professionals with the help of colleagues at UC Davis as well as DAOs, and those additional stakeholders helped us identify more DAOs and other stakeholders in turn.

Stakeholders responded positively to the goals of this project and the plan to collect data through focus groups and a survey. Stakeholders also almost uniformly agreed to share information about this project with other relevant stakeholders to further expand its reach across California. Many stakeholders noted that people with disabilities are often asked (though outside of the context of academic research) to take surveys about transportation or housing, so before asking people with disabilities to take more time & energy to participate in a study and divulge personal data, stakeholders wanted assurance, especially for this project funded by Caltrans, that results would be implemented in statewide policies.

Many stakeholders pointed out that transportation and housing needs vary even within metropolitan areas, so we should account for these variations in the study. They also emphasized that questions about disability identification need to be asked about with care as not everyone identifies as having a disability per se; for example, many people who identify as Deaf do not identify as having a disability (Chapman & Dammeyer, 2016). Furthermore, they consistently pointed to the need for live transcription in the online focus groups to accommodate people with different disabilities and needs. Additionally, many stakeholders pointed out that many people with disabilities experience homelessness (in some cases acutely, and in other cases chronically), so any study of transportation & housing challenges for people with disabilities must account for differences that may arise with respect to homelessness. We were able to implement these changes as applicable to the publicity materials, focus group, and survey.

Many stakeholders recommended that the study be conducted in languages beyond English. The most common suggestion was Spanish, and other common suggestions included Chinese (in writing, or Mandarin and Cantonese in speaking), Korean, and Tagalog, due to the demographics of California. Ultimately, we conducted every part of the study only in English as we did not have the resources to ensure accurate two-way translations of questions and of people's responses with respect to choices, desires, and challenges faced in transportation and housing; we considered using a paid translation service for developing and disseminating the survey but ultimately chose to not pursue it because of questions about reliability with specialized and sensitive vocabulary. This likely hampered our ability to recruit people with disabilities for the focus group and survey given the correlations among disability, low income, and (especially in California) marginalization from the English language. That said, we did allow survey participants to have trusted family members or friends take the survey on behalf of the

desired respondents, and we asked questions to verify the reasons why proxy responses may arise (including language barriers) as responses to those questions may benefit the design and dissemination of future surveys. Additionally, some of the prospective focus group participants were English-speaking DAO representatives whose clients include those who do not speak English.

Many stakeholders encouraged us to allow participants to join focus group videoconferencing calls by telephone, but different stakeholders, even within the same metropolitan areas, had different opinions about the need for options to participate in the survey separate from using the online platform. Some stakeholders felt that even with the correlation of disability to low income, enough people with disabilities have Internet access that recruitment for an online survey should not be a problem. Other stakeholders felt that the correlations among disability, low income, and low levels of Internet access or familiarity were too significant to ignore; they typically recommended conducting the survey by telephone too in addition to the online platform, and some DAO representatives offered to have their staff members conduct the survey by telephone for those DAOs' clients with disabilities. Separate from this issue, different stakeholders had different opinions about including people with cognitive disabilities; some stakeholders expressed concerns about the capacity of respondents with different severities of cognitive disabilities to respond to the survey, the reliability of survey responses if the caregiver is responding on behalf of a desired participant with a disability (especially regarding questions about desires for transportation or neighborhood features that may conflict with the caregiver's own desires or the caregiver's perceptions of the person who needs care), and the ability of caregivers to respond given the potential for fatigue after a full day of giving care, while other stakeholders expressed hope that people with cognitive disabilities would be fully included and that we would not perpetuate patterns of paternalistic marginalization or exclusion of people with cognitive disabilities in academic research. Ultimately, we were able to include participants by telephone in the focus group videoconferencing call and we included people with cognitive disabilities in the focus group as well as the survey; for the survey, we allowed participants to get partial or full help to respond just as in the case of language barriers and we asked appropriate corresponding questions to understand whether answers by caregivers would pose any further concern in the data analysis. We were not able to conduct the survey by telephone not only because of a lack of resources but also because Institutional Review Board (IRB) requirements for anyone outside of the research team to interact with survey participants by telephone were so onerous as to effectively preclude the possibility of conducting the survey by telephone within the project period of 12 months (and the possibility of hiring more undergraduate or graduate students internally was precluded by the aforementioned lack of resources). The correlations of disability, low income, and low levels of Internet access meant that we knew ahead of time that we would likely be unable to recruit many people with disabilities as well as many people of low income without disabilities, but we proceeded as we had no alternative for this project.

Stakeholders committed to helping this project in various ways beyond giving the aforementioned advice and forwarding information about the project to other relevant stakeholders. They helped us develop realistic timelines for each stage of the project. Many of

them offered to share publicity materials for the focus group as well as the survey, at the appropriate time for each, using their professional or organizational email accounts (through mass mailing or mailing lists), websites, social media pages, and telephones. Some of them reviewed publicity materials as well as early draft versions of the survey to make specific suggestions about language, structure, and content. Some initially offered to put printed versions of publicity materials in community spaces and help with computer access, but the challenges of the COVID-19 pandemic prevented us from pursuing this further; this likely meant that we were not able to include as many participants who may have struggled with computer access at home as we would have if this study had happened before the COVID19 pandemic, but DAO representatives noted low levels of in-person visits to DAO locations due to safety concerns surrounding the COVID-19 pandemic, so this was likely a moot point.

## Recruiting focus group participants

We recruited focus group participants through DAO partners. Specifically, we asked DAO representatives to share publicity materials for the focus group with their clients through their email lists, websites, social media pages, and telephone. Some DAO representatives helped to refine the publicity materials too, specifically suggesting the use of big sans-serif fonts for easy readability even at the expense of having the flyer and information sheet each spill into a second page. These materials were approved by the UC Davis IRB before dissemination. The flyer and information sheet are included below, with the flyer coming first.

# Having Trouble with Transportation in Your Area? Join a Focus Group!

## Looking for Adults in California with Disabilities

**What is this study about?**

We want to know what makes transportation hard for people with disabilities.

**Why join?**

- Your answers can help researchers and elected officials learn about and improve transportation for people with disabilities.
- If you are selected and you join, you'll get a $50 gift card of your choice.

**Who can join?**

- You must be 18 years or older and live in California.
- We encourage people to join if they have trouble with any of the following:
  - Walking, climbing stairs, lifting things, or other physical activities
  - Seeing, hearing, or talking
  - Remembering or learning things
  - Managing fears or anxieties

**Interested?**

- The focus group will be one and a half hours.
- You can join by phone or online.
- Learn more about this from the included information sheet. (There's more information on the next page!)
- You can help pick the date and time! Possible dates are November 6 through November 21, and possible times are 8:00am through 8:00pm (Pacific Time).
- Contact Dr. Prashanth S. Venkataram at pvenkataram@ucdavis.edu or call or text 240-428-8086 to suggest a date and time and for more information on how to be part of this.
- Make sure to call or send a message before October 31 if you want to suggest a date and time for the focus group!

Do you get around outside as much as you want? Does your neighborhood have the things you want it to have close by? We invite you to take part in a research project which involves a group meeting run by the University of California, Davis. The group meeting will be a chance for you and others to share your thoughts about getting around and about your neighborhood. The information you give us can help policymakers and transportation providers make changes to transportation and other services in your neighborhood according to your needs and wants.

Joining this meeting is completely up to you. No one can force you to join if you don't want to. The meeting will take about one and a half hours and **will be recorded**. You should join only if you're OK with being recorded. The recording will only be used within the research team, and no one else can see it afterwards. We hope you can stay the whole time, but you are welcome to join even if you have to join late or leave early.

We hope you'll have fun at the meeting. We want to know about challenges from everyone, whether you get outside your home **or you don't**. If you can be in this meeting by yourself, please do that. If you need help from a family member or friend to understand this meeting, they can join too. Your answers will be confidential. This means that we won't share any identifying personal data, like your name, with anyone outside of the research team.

We will pick only 20 people total for the meeting. If you join this meeting, you will get **a $50 gift card of your choice** (Amazon, Walmart, Target, or Starbucks). If you want to have a chance to be in the meeting and you want to suggest a date and time for the meeting, please send an email to Dr. Prashanth S. Venkataram at pvenkataram@ucdavis.edu or call or text the phone number 240-428-8086 by October 31. Please suggest a date between November 6 and November 21, and a starting time between 8:00am and 8:00pm. If you are picked to join the meeting, we will let you know later, and we will tell you how to join by phone or Zoom.

Thank you for participating in this important study! If you have any questions or need accommodation to join the meeting, please send a message to me at the email address pvenkataram@ucdavis.edu or call the phone number 240-428-8086.

Sincerely,

Dr. Prashanth S. Venkataram, Project Director
Institute of Transportation Studies
University of California, Davis

We did not specifically track which respondents came through which DAO. In any case, over 100 people with disabilities expressed interest in participating. We asked each prospective participant questions to verify that the prospective participant is 18 years or older, lives in California, has a disability, and understands and consents to the terms of the study. We asked questions apart from those about disability in a single email message as follows:

> Hi [Prospective Participant's Given Name],
>
> I want to confirm that you're eligible for the study, so I'd appreciate if you could answer the following yes/no questions.
>
> 1. Are you 18 or older?
> 2. Do you live in California now?
>
> I also want to check that we're on the same page about expectations if you join the focus group, so I'd appreciate if you could mark the following statements as true or false.
>
> 1. Joining is completely up to you.
> 2. We won't share your personal information with anyone outside of the research team.
> 3. Your answers could help policymakers make transportation better near where you live.
> 4. The meeting will be recorded.
> 5. It is OK if you leave at any time.
>
> Thanks,
>
> --
>
> Prashanth S. Venkataram
> University of California, Davis: Postdoctoral Researcher

In some cases, prospective participants only responded to a subset of these questions, so we sent follow-up messages as appropriate to ascertain responses to the remaining questions. Also, in some cases, prospective participants expressed confusion about some questions, so we provided clarification as needed. We ultimately excluded prospective participants who, after repeated clarification and prompting, could not definitively answer all of these questions in the affirmative. We included prospective participants who could definitively answer all of these questions in the affirmative, but as there were many more than 20 qualifying prospective participants, we asked further questions about geographic location and disability to choose a focus group composed of people representing diverse disabilities and geographic locations in California. We did so through an additional email message as follows:

> Hi [Prospective Participant's Given Name],
>
> The focus group will have 20 people, but more than 20 people have shown interest. I'll let you know if you're ultimately picked. If you are picked, I'll let you know how to join then.
>
> Also, I'd like to ask a couple other questions in order to make sure that the focus group is representative enough. Please let me know if you're not comfortable answering either or both of them; if you're uncomfortable, you don't have to answer.
>
> 1. Where in California are you? (You can tell me a general area; you don't have to give a more specific address.)
>
> 2. What do you have trouble doing? (You can tell me generally things like walking, seeing, climbing stairs, and so on; you don't have to be too specific.)
>
> Thanks,
>
> --
>
> Prashanth S. Venkataram
> University of California, Davis: Postdoctoral Researcher

Prospective participants who correctly answered the questions about eligibility and consent generally did not have any problems answering the questions about location and disability. We also asked all eligible and consenting prospective participants what dates and times would work for them to potentially join the focus group. From this list, we chose 20 participants to represent different disabilities and different regions of California such that all participants could join the focus group on a single date and time. Specifically, we ensured representation from all of the major forms of disability, namely physical, vision, hearing, cognitive, mental, and communication disabilities (and we considered other disabilities too) as well as from all of the 6 major planning regions of California, namely MTC, SACOG, SCAG, SANDAG, CV, and ROC.

## Conducting the focus group

**Table 2. Summary data of focus group participants. Glossary for disability is as follows: P = physical, V = vision, H = hearing, Co = cognitive, Cm = communication, Mn = mental, O = other.**

| Participant | Region | Types of Disabilities |
|---|---|---|
| **P1** | SACOG | P, Cm, O |
| **P2** | CV | V |
| **P3** | MTC | V |
| **P4** | SANDAG | O |
| **P5** | SCAG | P |
| **P6** | SANDAG | P |
| **P7** | ROC | P |
| **P8** | SACOG | Co |
| **P9** | MTC | V |
| **P10** | SCAG | P |
| **P11** | SANDAG | Mn |
| **P12** | SANDAG | P |
| **P13** | MTC | V |
| **P14** | SACOG | P |
| **P15** | SCAG | P, H |
| **P16** | SACOG | P |
| **P17** | SCAG | P, V, Mn |
| **P18** | SANDAG | O |
| **P19** | MTC | V |
| **P20** | SCAG | P, Co, Mn |

The focus group was semi-structured and ran 90 minutes. The organizers conducted it virtually using the Zoom videoconference software with 19 participants; participants were encouraged to get help or take breaks as needed through the session, and a hired transcriptionist ensured that participants with hearing impairments were fully included. The organizers asked open-ended questions as prompts and encouraged participants to speak freely. Another participant did not join the meeting and did not have access to the recording but sent responses to the same open-ended questions by email. These questions were as follows and were asked in this order.

1. What are some places that you go to regularly? These could be family members' or friends' homes, grocery stores, a place of work, a doctor's office, a park, restaurants, places for concerts, or other things.
2. Where would you like to go more often? These could be places that you go to regularly but want to go to more often, or they could be places that you don't go to at all but wish you could go to more easily.
3. For places that you would like to go to more often, what challenges do you face with transportation or with the places themselves?
4. Is there anywhere that you wish you could go less often than now?
5. What kinds of places do you wish were closer to where you live, and why?
6. Are there any places that you wish could be farther from where you live? If so, why?
7. Do you have any other thoughts to share about the area around where you live and transportation in that area?

Participants were limited to five minutes of continuous speaking time on each topic, but in practice, no one tried to speak longer. Time constraints meant that not every participant could respond to every prompt; the organizers made participants aware of this at the beginning. When the organizers saw no new responses for a given prompt, they moved onto the next prompt. The organizers attempted to ensure that every participant contributed substantively to at least one prompt and no individual participant dominated the discussion. The organizers encouraged participants to build upon each other's comments too. Even so, participants P2, P12, P14, P18, P19, and P20 made the most comments and were the only ones primarily contributing orally. The other participants in the live focus group, who participated only via the text chat, made relatively more brief comments of substance (while participant P6 only provided cursory comments of agreement and did not contribute more substantively even when asked); only participants P5, P15, and P16 elaborated further in their text comments. All participants, including the one who responded by email, were given $50 gift cards of their choice (Amazon, Target, Walmart, or Starbucks, and by either physical mail or email).

## Pre-testing the survey

At the end of the focus group, the organizers invited all of the participants who joined the focus group at that time to pre-test the survey; the organizers also extended the same invitation to the participant who responded by email. Pre-testers were given approximately 7 weeks to pre-test the survey and leave comments. Ultimately, seventeen of the twenty focus group participants pre-tested the survey. After pre-testing, all pre-testers were given $50 gift cards of their choice (Amazon, Target, Walmart, or Starbucks, and by either physical mail or email).

Analysis of the pre-test results shows that the survey skip logic and display logic worked as intended, as there were no inconsistent answers. Most pre-testers took 30-45 minutes to finish the survey. Responses did not show evidence of respondent fatigue, though this may be an artifact of the sample, as focus group participants who also pre-tested the survey may, by virtue of previous activism for people with disabilities, evince a greater willingness to take the survey seriously and answer its questions with greater care compared to the general population.

The survey allowed for respondents to provide general comments at the end. Of the seventeen pre-testers, four had no comments, nine explicitly liked the survey, and three complained that the survey was too long. One asked for a progress bar; although the use of survey skip logic precluded implementing this (as it may mislead respondents), we incorporated this request by creating headers for each section of the survey. Two asked for a button to go back to previous questions in the survey, which we included. Two had several suggestions for the content and layout of the survey, including the structure of questions about features of one's chosen neighborhood, the appearance of questions structured as matrix tables, and clarification about the effects of the COVID19 pandemic on answers to survey questions. We implemented many of these suggestions in the survey too.

## Finalizing, recruiting for, and launching the survey

We went through several iterations of changing the survey before finalizing it for dissemination. Ultimately, we estimated that the survey would take a typical respondent 25 minutes to complete. Additionally, we copied the survey into two versions based on the recruitment channel.

We disseminated version NQ of the survey to respondents from past surveys developed by the 3R group who indicated interest in taking future surveys as well as to DAO partners. To recruit participants through DAO partners, we asked DAO representatives to share publicity materials for the survey with their clients through their email lists, websites, social media pages, and telephone. Some DAO representatives helped to refine the publicity materials too. These materials were approved by the UC Davis Institutional Review Board (IRB) before dissemination. The flyer and information sheet are included below, with the flyer coming first.

ITS UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

# Having Trouble with Transportation in Your Area? Take a Survey!

## Looking for Adults with Disabilities in California

**What is this study about?**

We want to understand how the things that people find hard with transportation relate to where they live, their abilities, and other factors.

**Why join?**

- Your answers can help researchers and elected officials learn about and improve transportation for people with disabilities.
- If you take the survey, you could win one of ten $100 gift cards or one of five hundred $10 gift cards of your choice.
- Email Dr. Prashanth S. Venkataram at mobilitystudy@ucdavis.edu if you want to enter the drawing but don't want to take the survey.

**Who can join?**

- You must be 18 years or older and live in California.
- We encourage people to join if they have trouble with any of the following:
    - Walking, climbing stairs, lifting things, or issues like that
    - Seeing, hearing, or talking
    - Remembering or learning things
    - Managing fears or anxieties

**What else do I need to know?**

- The survey will probably take you about 25 minutes, but you can take longer if you want.
- You can close the survey and come back later, up until July 31.
- You can still enter the drawing even if you don’t finish the survey.
- Learn more about this from the included information sheet.
- Email Dr. Prashanth S. Venkataram at mobilitystudy@ucdavis.edu for more information on how to be part of this.

Do you get around outside as much as you want? Does your neighborhood have the things you want close by? We invite you to take a survey run by the University of California, Davis to better understand the connections between how often you travel, how often you want to travel, what your neighborhood is like, and what you want in your neighborhood. The survey will ask for your opinions about travel and your neighborhood. The information you give us can help policymakers and transportation providers make changes to transportation and other services in your neighborhood according to your needs and wants.

Doing this survey is completely up to you. No one can force you to do it if you don't want to. The survey will take about 25 minutes to do, but you can take longer if you want, and you can come back to it later if you can't finish it in one go. We think you'll find this survey to be fun and interesting, and we hope you'll do it, **even if you don't travel much or you have trouble getting around outside**. If you can do this survey by yourself, please do that. If you need help from a family member or friend to understand or do the survey, please get those people to help you with the survey. Your answers will be confidential. This means that we won't share any identifying personal data, like your name, with anyone outside of the research team.

By doing the survey, you can have a chance to win **one of ten $100 gift cards or one of five hundred $10 gift cards, each of your choice** (Amazon, Walmart, Target, or Starbucks). You can have a chance to win even if you don't want to do the survey. If you want to have a chance to win but don't want to do the survey, please send an email to Dr. Prashanth S. Venkataram at mobilitystudy@ucdavis.edu.

To make sure that your responses are included in the study on time and that you are included for a chance to win a prize on time, please start the survey before July 31, 2022. You'll still have a chance to win a prize even if you don't feel comfortable continuing the survey or don't finish for any other reason.

Thank you for participating in this important study! If you have any questions, please send an email to Dr. Prashanth S. Venkataram at mobilitystudy@ucdavis.edu.

Sincerely,

Dr. Prashanth S. Venkataram, Project Director
Institute of Transportation Studies
University of California, Davis

We collected prospective participants' email addresses over time to generate the full list of invitees for the survey in conjunction with past survey participants. For each prospective participant (including past survey participants), we generated a unique link to the survey. With this information, we sent the following invitation by email:

> Dear survey participant,
>
> We invite you to take this survey because you showed interest in this study or you took a previous transportation survey from our research team at the University of California, Davis and you said you would be willing to participate in follow-up surveys.
>
> We would greatly appreciate your participation in this study to help understand transportation and housing needs in California. As a token of our appreciation for your time, you will be entered into a drawing to get an online gift card worth either $10 or $100. If you win, you can choose whether it is from Amazon, Walmart, Target, or Starbucks, and you should get the gift card 2-3 weeks after the survey is done.
>
> To participate in the study, please click on this link: [LINK HERE]
>
> Doing this survey is completely up to you. No one can force you to do it if you don't want to. Your answers will be confidential. This means that we won't share any identifying personal data, like your name, with anyone outside of the research team. If you decide to give us your contact details, which is completely optional, we will never put your identity out in public.
>
> If you want to pause the survey and continue later, you can do so by clicking the survey link above. You can do this until July 31, 2022. If possible, we recommend you take this survey using a desktop or laptop computer as some questions might not show up well on a smartphone.
>
> Sincerely,
>
> Dr. Prashanth S. Venkataram, Project Director
> Institute of Transportation Studies
> University of California, Davis
>
> If you want to unsubscribe from this mailing list, please reply to this email message and we would be happy to accommodate your request.

After sending these email messages, we soon saw replies from several respondents pointing out that the links were not clickable. While this may have been an annoyance for some respondents, for many others who had trouble using computers or who were trying to take the survey on a mobile device, it was a serious hindrance to taking the survey. Therefore, we made the links clickable and sent a follow-up message as follows:

Dear survey participant,

We invite you to take this survey because you showed interest in this study or you took a previous transportation survey from our research team at the University of California, Davis and you said you would be willing to participate in follow-up surveys.

We would greatly appreciate your participation in this study to help understand transportation and housing needs in California. As a token of our appreciation for your time, you will be entered into a drawing to get an online gift card worth either $10 or $100. If you win, you can choose whether it is from Amazon, Walmart, Target, or Starbucks, and you should get the gift card 2-3 weeks after the survey is done.

To participate in the study, please click on this link: [LINK HERE]

Doing this survey is completely up to you. No one can force you to do it if you don't want to. Your answers will be confidential. This means that we won't share any identifying personal data, like your name, with anyone outside of the research team. If you decide to give us your contact details, which is completely optional, we will never put your identity out in public.

If you want to pause the survey and continue later, you can do so by clicking the survey link above. You can do this until July 31, 2022. If possible, we recommend you take this survey using a desktop or laptop computer as some questions might not show up well on a smartphone.

If you have already gotten a link to this survey, we apologize for the confusion. The link for you is the same, so you can use the link in this email or the previous email to start or continue the survey.

Sincerely,

Dr. Prashanth S. Venkataram, Project Director
Institute of Transportation Studies
University of California, Davis

If you want to unsubscribe from this mailing list, please reply to this email message and we would be happy to accommodate your request.

After the follow-up message (with the clickable link and apology) was sent, respondents for version NQ had 3 months to complete the survey. Many invitees asked to be removed from the mailing list or said that they no longer live in California, so we removed them from the contact list. Additionally, approximately six weeks after sending the publicity materials to DAO partners (which was six weeks before version NQ was closed), we recontacted those DAO partners to ask them to re-post the same publicity materials (flyer and information sheet) so that more of their clients may see the survey and ultimately take it.

Caltrans requires that any study involving a financial incentive drawn from a lottery (I.e. not guaranteed to all participants) must allow people to compete for the incentive without

participating in the study. Six people wanted to compete for the incentive without taking the survey, so we included them in the drawing. Ultimately, over 1,000 people took version NQ of the survey, so after version NQ closed, we were able to randomly choose winners for the 10 gift cards each worth $100 and the 500 gift cards each worth $10. All gift cards would be electronic, but winners are able to choose the store (Amazon, Target, Walmart, or Starbucks); as of this writing, we are still soliciting winners' store preferences. We sent the following email messages respectively to participants who won one of the $100 gift cards, participants who won one of the $10 gift cards, and participants who did not win a gift card.

> Dear survey participant,
>
> Thank you for taking our survey about transportation and housing needs in California. We really appreciate your time and thoughtful responses. Your answers will help answer important questions in research and will help policymakers develop better policies to address these pressing needs. Your answers will remain confidential, so we won't share any identifying personal data, like your name, with anyone outside the research team.
>
> We are happy to tell you that you have won a $100 online gift card! You can choose whether it is from Amazon, Walmart, Target, or Starbucks. Please reply to this message to tell us your choice. It will be sent to the same email address where you are reading this message. It may take a few weeks for us to send out gift cards, because we need to collect information from all of the gift card winners before we can send them. If you haven't heard from us by September 30, please reply to this message, and we will do our best to give you a status update.
>
> Once again, we thank you for your time and effort in participating in this study. We hope the study was interesting, and we hope you will consider participating in future studies with the University of California, Davis.
>
> Sincerely,
>
> Dr. Prashanth S. Venkataram, Project Director
> Institute of Transportation Studies
> University of California, Davis
>
> If you want to unsubscribe from this mailing list, please reply to this email message and we would be happy to accommodate your request.

Dear survey participant,

Thank you for taking our survey about transportation and housing needs in California. We really appreciate your time and thoughtful responses. Your answers will help answer important questions in research and will help policymakers develop better policies to address these pressing needs. Your answers will remain confidential, so we won't share any identifying personal data, like your name, with anyone outside the research team.

We are happy to tell you that you have won a $10 online gift card! You can choose whether it is from Amazon, Walmart, Target, or Starbucks. Please reply to this message to tell us your choice. It will be sent to the same email address where you are reading this message. It may take a few weeks for us to send out gift cards, because we need to collect information from all of the gift card winners before we can send them. If you haven't heard from us by September 30, please reply to this message, and we will do our best to give you a status update.

Once again, we thank you for your time and effort in participating in this study. We hope the study was interesting, and we hope you will consider participating in future studies with the University of California, Davis.

Sincerely,

Dr. Prashanth S. Venkataram, Project Director
Institute of Transportation Studies
University of California, Davis

If you want to unsubscribe from this mailing list, please reply to this email message and we would be happy to accommodate your request.

Dear survey participant,

Thank you for taking our survey about transportation and housing needs in California. We really appreciate your time and thoughtful responses. Your answers will help answer important questions in research and will help policymakers develop better policies to address these pressing needs. Your answers will remain confidential, so we won't share any identifying personal data, like your name, with anyone outside the research team.

Unfortunately, we could not pick you to win a gift card this time. Other studies from the University of California, Davis may include gift card drawings or other incentives, so there may be more opportunities for you to win in the future.

Once again, we thank you for your time and effort in participating in this study. We hope the study was interesting, and we hope you will consider participating in future studies with the University of California, Davis.

Sincerely,

Dr. Prashanth S. Venkataram, Project Director
Institute of Transportation Studies
University of California, Davis

If you want to unsubscribe from this mailing list, please reply to this email message and we would be happy to accommodate your request.

We developed version Q of the survey to disseminate to opinion panelists hired by Qualtrics. We also developed quotas for Qualtrics to recruit opinion panelists. Therefore, the survey instrument for version Q differed only marginally from that of version NQ by the ordering of specific sociodemographic and socioeconomic questions to ensure that opinion panelists not working toward fulfillment of the quotas would not be considered. Quotas were specified as follows. Quotas by region are given in Table 3; these were specified as hard quotas. All other quotas were specified as soft quotas (+/- 5% for each quota) separate from geographic region quotas. In particular, Table 4 gives quotas by age. Within each age range, we specified the same quotas for gender, household income, and race (whose quotas are independent of each other); thus, in Table 5, quotas within each category (gender, household income, or race) add to the 250 total specified for each age range. We chose each set of quotas to balance representation according to statistics from the 2020 US Census with adequate representation of underrepresented geographic and demographic groups in California. Qualtrics offered the option of quotas for people with disabilities, but we ultimately did not pursue that offer as we could not come to an agreement about how to best screen for people with disabilities in the opinion panel quotas.

**Table 3. Geographic quotas for version Q.**

| Region | Quota |
|---|---|
| **CV** | 100 |
| **MTC** | 250 |
| **ROC** | 100 |
| **SACOG** | 100 |
| **SANDAG** | 100 |
| **SCAG** | 350 |

**Table 4. Age-based quotas for version Q.**

| Age range (inclusive) | Quota |
|---|---|
| **18-33** | 250 |
| **34-49** | 250 |
| **50-65** | 250 |
| **66+** | 250 |

**Table 5. Other quotas for version Q.**

| Category | Value | Quota |
|---|---|---|
| **Gender** | Female | 125 |
| | Male | 125 |
| **Household income** | $0-14,999 | 30 |
| | $15,000-34,999 | 40 |
| | $35,000-49,999 | 30 |
| | $50,000-74,999 | 45 |
| | $75,000-99,999 | 40 |
| | $100,000-149,999 | 40 |
| | $150,000+ | 25 |
| **Race** | Black or African American | 13 |
| | Native American or indigenous | 13 |
| | Asian or Pacific Islander | 50 |
| | White or Caucasian | 99 |
| | Other | 75 |

# Results

## Focus group

Among the participants, ten spoke of going often to the grocery store, six spoke of going to medical appointments, and three spoke of going to work. However, this may reflect the original phrasing of the first question, which initially only included those three general activity places as examples; later, the question was rephrased to include examples of other activity places too, which prompted further discussion. Similarly, no participant mentioned any issues related to service animals; we did not specifically ask about that, so it is unclear if this is a sampling artifact or reflects the lack of an explicit prompt about the topic.

Participants commented on a variety of topics related to transportation modes, activities, and disabilities. Their comments show the problems that car-oriented land use patterns create for people with disabilities. As the following subsections will show, participants experience problems, especially over longer trips, with the immediate usability and financial costs of alternatives to public transit as well as of availability of public transit. Participants experience separate problems of availability and cumulative usability with paratransit. Walking long distances presents problems with cumulative usability for trips made solely by walking and by public transit. Inadequate street lighting and seating hamper tripmaking for people with disabilities using different modes. Therefore, participants uniformly wish that their routine destinations could be closer to where they live. Many participants echoed each other's remarks despite living in very different parts of California and experiencing different disabilities, supporting the idea that broader implementation of land use changes and universal design can help people with different disabilities. Each of the following subsections features quotes from various participants; these quotes have been lightly edited after transcription for spelling, grammatical clarity, and brevity.

### Usability, availability, and financial costs of non-pedestrian modes

Three participants spoke of problems with immediate usability in services apart from public transit or paratransit. P14 spoke of a specific example in Davis: "[For] a while, they had a bus run for drunks at night that also had a wheelchair lift on it, so when I got out of a concert too late at night for paratransit then I would take that bus to get home; [now] they've got a new vehicle and it's not wheelchair accessible." P15 generically spoke of "sometimes poor vehicle design". P20, who uses a wheelchair, elaborated on problems with immediate usability of friends' vehicles as well as TNC vehicles.

> *I have to plan everything because I'm a wheelchair user, so I need a vehicle that's accessible to me, which [hampers] trying to do things on the spot. If I'm invited out to a friend's, I'm kind of concerned, "OK, does my wheelchair fit in the car or whatever method of transportation I'm using", and when I've had to use something like Lyft which has wheelchair-accessible [vehicles] in Southern California, [sometimes] they'll send a vehicle that's not accessible, so it [makes me] feel so much anxiety that I don't do it.*

*I had used Lyft in the past and was [once] extremely uncomfortable because my wheelchair would not unfold correctly, [so] I was [stuck]. The driver, without permission, just literally lifted me up and took me inside my house. While it was helpful, I also consider that to be a very severe invasion of space. There was no communication; [it] was just, "let me help you, I'm just gonna lift you up and take you where you need to go", without making sure that's OK first.*

These three participants, who all have physical disabilities, spoke of such similar problems despite living over 300 miles apart. Separate from problems with TNC vehicles, P12 said, "I'm not comfortable with accessing stuff [like TNCs] via devices; I'd rather do face to face or talk to people in person."

Participants, including P11, also described problems with costs of various transportation modes and means. P12 and P14 spoke of the high costs of taxis. P14 specifically discussed multiple long rides to faraway medical appointments: "It still cost me $100 each trip to Sacramento, so I spent about $700 for just transportation to get it done." P19 said as someone with a vision impairment who drives, "I need to alter my own automobile to have brighter lights, but of course that costs a lot."

Together, these comments suggest that people with disabilities experience problems with immediate usability and financial costs of driving, taxis, TNCs, and other alternatives to public transit and paratransit. An easy retort may be that such people should use public transit. However, participants pointed to problems with availability of public transit; car-oriented land use patterns lead to long and circuitous rides as well as delays, which can depress travel due to infrequent service patterns and discouraging conditions. Three participants cited a lack of availability hampering tripmaking. As P2 described, "[The] bus that brought me into town [from the rural area] comes in like at 10:30 and it takes me back at 3:20 and that's it! So I'm kinda left to dry because of the lack of access.'' P18 had the most to say about availability problems affecting tripmaking in the rural areas of the SANDAG region.

*The most difficult thing [about] public transportation is they don't cover all areas of the city. It would be like a mile away or there are huge sections of the city that don't have public transportation. [If] you have to go to those places, it's kind of hard to find any availability to access those locations.*

*We have three bus routes that are called rural routes which go to places like the boonies east of [San Diego]. [One bus] comes into the city one morning and another bus [goes] in the afternoon, but they only [run] on certain days. [For] people that live in places like Campo, if they need to take public transportation, they have to literally time what days they want to go into the city.*

P14 spoke of how lack of availability of public transit near concert venues depresses travel to concerts.

> *[Buses go] a route that is best for picking students up, which is a very odd route, so there are places you would think a bus would go to that it doesn't. [One] example of something that I like to do a lot is go to concerts, and we do have the Mondavi Center, but it's [to the] south of town, and at night there's not a good route that goes there on the bus, and paratransit doesn't run at night. [Concerts are among] the things that I'd really like to go to that I'm limited by because of transportation.*

These three participants expressed similar concerns despite living hundreds of miles away from each other in California. Additionally, P20 complained about having to spend so much time on public transit. "I spend a *lot* of time on transportation and doing it daily is fine [to] commute to and from work or things like that, but it just contributes personally for me to depression because I spend more time on transit than around the people that I want to be around. [It] also affects my family; they live pretty far away from me, and so whenever we want to go out we end up planning [for several] hours of traveling [so] I really don't want to do it."

For these reasons, participants agreed that transportation for people with disabilities could improve by thoughtfully moving away from car-oriented land use patterns, but haphazard policies that financially burden drivers without adequate alternatives would further harm people with disabilities. P18 said, "The problem with California is the state is technically built around car culture and public transportation takes second place," adding, "In San Diego, they want to build this 'BART system'. They also want to tax all people who drive cars, and it doesn't work because public transportation doesn't go everywhere. It takes forever. I know you're trying to take more cars off the highway but they're not doing anything because you don't have buses everywhere." P12 concurred with "what [P19] is saying; I'm here in San Diego as well and they want to start taxing [the] number of miles that you drive, which is a little ridiculous. [Also, with] the transportation that they're trying to push on us, it's not available 24 hours; there's a cutoff time. If you're working graveyard [shifts] you might be stuck, you can't get home because there's nothing running after midnight, so they need to keep that in mind as well. People work different shifts, different times, need different availabilities for transportation."

Participants also showed how paratransit exhibits similarly circuitous routes and delays in car-oriented areas as public transit, even though paratransit is a point-to-point demand-responsive service. P1 spoke of how problems with paratransit motivated owning a van with hired drivers: "I would use paratransit to get everywhere in the community and it gave me anxiety because I was worried [of being] late to everything." P20 spoke of the problems with circuitous paratransit routing when combining pooled rides with point-to-point service in the Greater Los Angeles area.

> *[Too] many people [use] the service. Being a wheelchair user, I've been picked up at 5pm from work and I don't get home until 9:30, and that's happened on three separate occasions! That in itself is an issue when it comes to having a*

*disability, because they're not accounting for that. They're just saying, "We're providing a service to get from A to B", but they're not accounting for any issues that may arise during the transportation of an individual. I think that's one of the key parts that they're missing.*

Additionally, P14 described being injured from *using* paratransit, which is an extreme example of a problem with cumulative usability.

*A lot of the paratransit systems have bought these huge vans, [and] they supposedly say they're going to transport a lot of people at once, go around and pick up several people, but they don't. There's hardly ever more than one person on the bus at a time. With our [paratransit] buses, the wheelchairs are loaded on the very back and the shocks are really bad. [I] was actually injured when they hit a bump; in the back you get the most bumping, and I was slammed back down, [hit] my spine really hard, and was injured. I try to avoid riding paratransit in Davis. They won't get a smaller van like the little taxi-vans, because supposedly they have to buy all the same buses from the same fleet. I assume that's for repair. Paratransit is not a solution the way it's been incorporated into the cities.*

The aforementioned findings, per our intent, focus on routine local travel, but the focus group prompts were broad enough to allow responses about less-frequent longer-distance trips that participants still believe to be important. We include those findings in this work with the understanding that further investigation must be the subject of future research.

Most complaints were about trips to infrequent but necessary medical appointments that are farther away than routine destinations. P5 said, "[A] long drive to the doctor's office tends to increase my waist pain. [The] medical appointments that I go to are what I've always wished I could stop going to. I encounter a lot of stress in going and coming back. Whenever I return from my appointments, I take a lot of rest because I'm always exhausted after that." P14 spoke of problems with managing longer-distance transportation for multiple consultations and preparatory appointments before a surgery: "I was looking at having to ride the [Amtrak] train [from Davis] into Sacramento and catching the ground bus there and then getting to the place I had to go. Especially for the day of the surgery, I was not looking forward to that, so I was gonna have to get a hotel on the days of the surgery." P17 similarly said, "My medical appointment is not close by, so I have to get a cab to meet [my] doctor. It really is stressful. [I] wish medical appointments could have been closer". P2 said, "[The] doctor's appointment is far away and there's a waiting time." P3 said, "Going for medical appointments with my doctor is quite difficult for me, and it makes me feel [as if] I had never existed." P19 spoke of how even with the comfort and convenience of driving a car, driving long distances for appointments scheduled late in the day can create safety problems.

*Sometimes I have to make my medical appointments later in the evening [because] of work or x, y, and z reasons. [Whereas] my normal clinic is 5 minutes away, I have to [go] 30-45 minutes to get the evening appointment,*

*and it sucks because by the time [I] leave it's dark. I can't see well at nighttime [and] I need more light. It's scary, because I live in the Bay Area, [and] there's not a lot of light. It's scary. It's unsafe for me to be driving. I shouldn't be on the freeway, but that's what I have to do to make it to my medical appointments. [I must] risk my life.*

P12 more broadly spoke of the connections among long trips, road safety, and tripmaking by driving: "I have been in car accidents before, so I have anxiety [driving] long distances because of the amount of people on the road." Additionally, P18 spoke of how long trips for pleasure are hard to plan with just public transit.

*I used to visit [my brother] for his birthday every year on the Greyhound [from San Diego to] Costa Mesa. It was such a hassle! I had to get up early, get on the Greyhound, [and ride for] an hour [or] two hours. [I] didn't get to my brother's place until like twelve and I could only visit for an hour. Sometimes, in my mind, I really didn't want to do it because it's just such a hassle, but I [did] because he's my brother and it [was] his birthday. [I] liked doing it [but] it's kinda hard on you and it takes forever.*

These participants have diverse disabilities and live in urbanized as well as rural parts across California, yet they all spoke of similar problems with longer-distance transportation across modes. These are problems with cumulative usability for drivers and public transit users with disabilities as well as availability of public transit, which can significantly hamper tripmaking even relative to a small expected usage frequency. The fact that participants most often expressed negative emotions in the context of infrequent long-distance tripmaking, especially for medical appointments, suggests that cumulative usability problems are most acute for such trips using any mode.

### Problems for pedestrian tripmaking

The problems facing people with disabilities who drive or use public transit, paratransit, TNCs, or other specialized options suggest that people with disabilities may need to take transportation into their own hands as pedestrians. However, many participants cited difficulties in traversing their neighborhoods on foot or using mobility devices intended for sidewalks. P2 summarized the lack of availability of pedestrian infrastructure in rural parts of Fresno simply: "no curbs, no sidewalks". Similarly, P15 described their neighborhood's walkability by its "lack of accessible curbs, crosswalks, and sidewalks", suggesting problems with immediate usability similar to rural Fresno despite being much farther and more urbanized. Additionally, longer distances can depress travel due to problems with cumulative usability. P13 emphasized this point: "I'd love to have the supermarket a bit closer [to] avoid walking long distances, which leads to fatigue."

While the presence and quality of pedestrian infrastructure significantly affect the tripmaking decisions of people with disabilities as pedestrians, they are not the only notable factors. P2 explained how fear of violent crime can depress pedestrian tripmaking: "Fresno has a lot of

gang shootings. I am fearful at times," also saying, "I wish my doctor's appointment was closer. I don't feel safe because of the shootings; we have 33 pedestrians killed every year in Fresno." P2 affirmed the organizers' summary that P2 wants typical activity places to be closer even in an area with high levels of street crime because P2 believes that shorter trips lessen exposure to such crime.

Participants also shared that not all efforts by cities to provide alternatives to driving would benefit pedestrian tripmaking. P14 mentioned living in Davis (in the SACOG region) and said that bicycling infrastructure in Davis makes it harder for pedestrians with disabilities to get around.

> *Some people have mentioned street travel; [in Davis, we] have some unique problems for wheelchairs and for blind people. The city of Davis designs things here for bicycles, [so] there are a lot of problems for wheelchair users and even blind people because of where they position things, like for bicycles to push the button to cross traffic, and I could go on. It's not a car culture here so much as a bike culture, and that culture creates problems for us.*

P18, who lives in the SANDAG region (nearly 500 miles south of the SACOG region), expressed similar sentiments, saying that "[for] bike lanes there are intersections that have crossings for bikes and pedestrians on the sidewalks". Thus, cities that design infrastructure to enhance the safety and mobility of cyclists should ensure that these enhancements do not come at the expense of pedestrians with disabilities.

### Getting to public transit as a pedestrian with a disability

Participants identified problems with standing or walking outdoors affecting their use of public transit beyond tripmaking purely as pedestrians. Cumulative usability problems with pedestrian infrastructure due to topography can compound problems with buses themselves to depress public transit use among people with disabilities. As P12 said, "Currently, I'm blessed to have a car, but when I had to use the bus, it [is maybe] 1-2 blocks. I do use a cane but when it's [on] a hill, [I] have to be careful walking down hills."

Three participants identified the need for bus stops to have shelters to mitigate the effects of rain or intense summer sunshine on riders waiting for buses. P2 said, "We suffer in the heat also. [Can] you imagine waiting an hour for the bus in 110 [degrees Fahrenheit]? It's really brutal out here!" P14 said, "[When] the weather starts getting too hot or too cold, I can't take the bus any longer, because I have to walk a couple blocks in my wheelchair to get to the bus stop, and then the heat or the cold is too much for me. So [we] don't have enough covered and enclosed [stops] with heat and light." P19, despite currently primarily driving an individual vehicle, used to use public transit regularly and empathized with bus riders: "Currently, I live in Concord/Antioch and it gets to be 100 degrees [Fahrenheit] out here. [I] see my people sweating because they're out there waiting [for] public transportation while I'm in [my] car with [A/C], and that's not OK." These participants expressed similar concerns despite living hundreds of miles apart in very different neighborhood types (respectively rural, small town, and urban).

## Inadequate street lighting and seating

Five participants identified inadequate street lighting as a reason for depressed travel as a driver, pedestrian, or bus rider. P9, P12, and P19 specifically spoke of limiting almost all travel to daylight hours, with P19 elaborating, "The light that the public streets provide is just not enough for me to feel comfortable, let alone feel safe to even drive." P2 elaborated on causes of inadequate street lighting in the CV region.

> *I'm visually impaired. The lighting is huge. I like to go to soccer games or football games, but the lighting prevents me from going. The lighting [problem] is huge around Fresno County [and in] the [CV region] where I live. It's due to funding, [because] everything goes up north or down south, and we get maybe the 20% that's left. I've been going to so many meetings and [asked], "Why [don't we] have lighting? Why [don't we] have lighting?"*

P13, like P2, also spoke of lighting preventing enjoyment of live sports matches: "I love football so much, but I can't really go to the pitch to watch the teams play because my eyesight doesn't favor me, and I feel left out a lot."

Additionally, five participants identified lack of seating on sidewalks as a reason for depressed travel. Three participants tied seating specifically to bus stops and shelters. P2 gave an example complaint: "It's just sad that it's 2021 and we don't have a bus seat. I have to stand while I wait for the bus and it's raining today!" P19 echoed this: "It's exactly like [P2] said, it's the year 2021 and you need to stop with the stupid little poles, and every location needs to have its proper shelter and seating area to be properly equipped." P12 said, "Usually when I get to the bus stops, a lot of them don't have seating, so then I'm standing when I'm waiting for that transportation." Two participants asked for seating on sidewalks to help people with disabilities experiencing fatigue using other modes, including driving. P5 said, "Seats are critically important so people with any form of disability could easily take a rest after a long journey of driving." P20 added, "I think it's 100%, without question, [necessary] to have somewhere that somebody can rest while they're traveling." These participants expressed similar concerns about street lighting and seating despite living hundreds of miles apart in very different neighborhood types (respectively rural, small town, and urban).

## Wanting to have activity destinations closer to where they live

For the reasons discussed in previous subsections, of the 20 participants, ten specifically said they wanted their routine destinations to be closer to where they live. P9 said, "It's not easy moving around, I wish my workplace was near." P3 specifically spoke of lost economic opportunities due to the burdens of traveling far.

> *Going to meet my clients is quite often a task to me, considering the fact that I can't drive all alone or walk alone at daytime, [and] I have lost [a lot of] work [because of] that. [Places] are so far away and I [can't] help but work from home.*

P19, P15, and P1 all wanted grocery stores or shopping centers to be closer.

No participant wanted any routine destinations to be farther away. P19 specifically said, "For far away, I really don't know." The only specific suggestion for having *anything* farther away came from P14 regarding an industrial site that was not a destination for that participant, and P14 further suggested destinations that could be closer instead.

> *I live near [where] the city of Davis has an industrial place where they park all their big trucks and sometimes they do some loud noisy stuff. I would love to have them move somewhere else and instead move in some medical appointment places in there because right now all of my medical appointments are on the other side of town. [I'd] also like nice medium-costing restaurants in the neighborhood; we only have 1 restaurant which is an expensive one, especially for breakfast [on] Sunday morning.*

## Working toward change

Every participant expressed thanks for the focus group and hope that it would lead to improvements in transportation for people with disabilities in California. Additionally, many participants emphasized how they are not merely passively waiting for improvements but actively work in their respective communities toward such change. P2 spoke of being to many transportation agency meetings and said, "I'm a huge advocate for people with disabilities and veterans like myself as a civilian." P19 spoke of being an in-home support services (IHSS) provider and of the challenges that people with disabilities, like P19, face when trying to become IHSS providers in California just to help other people with disabilities, especially in the context of transportation. P20 spoke of meeting with Los Angeles Metro agency officials "as a [professional] advocate". P14 summarized the situation thus.

> *Transportation is really key to people with disabilities getting out into the world. [The] more we're out into the world, the more we can change the other problems [related] to how people perceive us and how people feel about us. [When] it's just a small number of people [with disabilities] going out, [other] people don't get [that] there's a large number of us. [We] are from all kinds of backgrounds and the more they see us [out] the more people are really going to see us as people, so transportation is what gets us out there.*

We recognize that people with disabilities who are already advocates for other people with disabilities may be more likely to participate in focus groups like this one, but among the people with disabilities whom we recruited through DAOs, we did not specifically limit recruitment to only DAO employees or volunteers, and most participants had no formal relationship with those DAOs.

## Discussion

Whether discussing problems with transportation modes, frequent activity destinations, suggestions for improvements, or desired changes to neighborhood features, participants' responses were strikingly similar, despite their diverse disabilities, geographic locations, and neighborhood types; many participants explicitly referred to responses by previous participants by name. Thus, we fulfilled our goal of using a focus group to observe deeper commonalities, facilitated by group discussion, in the experiences of people with disabilities in California.

Participants consistently wanted destinations to be closer to them, and six cited inconvenient long-distance transportation as a problem. We see these as problems resulting from car-oriented land use patterns that push destinations apart from one another. Participants have experienced significant negative consequences from these land use patterns due to aforementioned factors like financial burdens from vehicle ownership or modification, inability to drive a car, and pain or discomfort from driving, as well as problems with fatigue or unreliability when using other modes. Problems with car-oriented land use patterns cut across modes too, as inadequate street lighting or seating can hurt tripmaking among people with disabilities who are pedestrians, public transit users, or drivers, yet greater sprawl may make denser placement of street lighting and seating less economical, which may in turn especially harm poorer rural communities outside of the major coastal metropolitan areas of California.

Participants made clear that not every problem they face would be solved by moving away from car-oriented land use patterns. Five participants shared problems with the immediate usability of public transportation vehicles. P4 and P12 wished for better designed spaces for people with physical disabilities who use mobility devices apart from wheelchairs. P4 said, "I do wish there were more comfortable areas for people with crutches like me in public buses". P12 similarly said, "I have severe arthritis that is [worse] in the right knee where I can't bend it. [In] public buses, I try to sit on the front seats, but then my leg, because it won't bend, [blocks] passengers coming in. [It's] hard for me to sit in the regular seats because I [need] to sit at the end where I can bend the leg." P5, P7, and P15 expressed more general desires for better designs to improve cumulative usability for people with physical disabilities aboard buses. P5 said, "When going out, especially to my doctor's place, I encounter a lot of difficulty before getting into my car or public transport. [I] always fall or sit down to a grip of myself before making any other movements; that's really painful and sometimes embarrassing when in public transport". P7 said, "I wish there's like an assistant on buses that helps with onboarding." P15 said, "I love going to the grocery store. [I face challenges] if the bus or transport medium is not easily accessible or the design is not comfortable for me to sit. It gives me a turn down from going to where I want to go." Two other participants also shared feelings of embarrassment in other public places apart from public transit. P7 said, "As much as I enjoy the open, my condition doesn't really favor me." P16 said, "Going to [grocery stores] is hard for me because I experience falls and staggering; sometimes it is hard to imagine how people see me and how they will judge me. [Also, I] have to pick my child up from school and drop them off every day. Sometimes I feel like I embarrass them.

Participants hoped that the focus group would yield tangible action by policymakers in the areas discussed throughout this work. Participants across California, including those outside of major coastal metropolitan areas, wanted denser mixed-use development and ultimately broader participation of people with disabilities in their communities. However, participants in suburban and rural areas also wanted assurance that they would not be financially penalized for driving before improvements to transportation and land use that move away from car dependence could be fully implemented. We hope that policymakers will carefully consider these findings for the benefit of people with disabilities in California and beyond. Furthermore, participants' numerous comments about infrequent critical longer-distance tripmaking suggests the need for further research and creative policymaking about this issue for people with disabilities.

## Survey structure

As described in previous sections, we disseminated the survey after extensive pre-testing by UC Davis personnel as well as 17 of the 20 focus group participants. The structure of the survey was finalized after pre-testing and before dissemination. The survey has an introduction followed by 7 sections with questions, and every respondent would have to complete at least one question in each section. Almost all questions were structured as individual Likert-type questions or as Likert-type matrix tables. The survey makes extensive use of display and skip logic, though the progression through each section was the same for each respondent (I.e., there was no skip or display logic that sent a respondent back to a previous section). The use of extensive display and skip logic across sections means that we cannot show a full flowchart representing the questions in each section, but we will show abbreviated flowcharts where appropriate, and we will summarily describe each question in the main text. Additionally, we will point out specific questions to illustrate pros, cons, and tradeoffs in designing those and related questions in the survey. We will focus primarily on version NQ; as we discuss at the end of this section, version Q differs only in the placement (not even in the wording) of a few sociodemographic questions to allow Qualtrics to fill quotas appropriately.

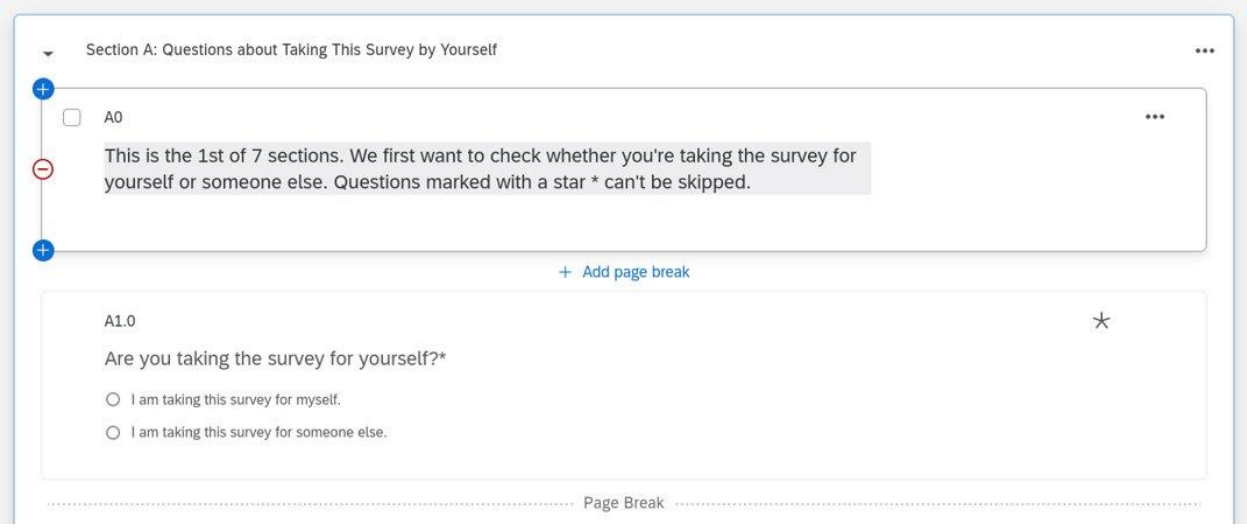
### Introduction

The introduction has no questions. It consists of a plain text version of the information sheet for the survey as well as a brief set of instructions for navigating the survey using buttons to go forward and backward. Those final instructions make clear that anyone who continues with the survey has read the information sheet and consents to taking the survey.

### Section A: Questions about Taking This Survey by Yourself

This section and every following section have a brief introduction numbering the section, summarizing the purpose of the section, and clarifying which questions cannot be skipped. The first question asks whether the person physically taking the survey is the desired respondent or is taking the survey on behalf of the desired respondent; it is phrased to be unambiguous. These features are illustrated in Figure 2

**Figure 2. Illustration of the introduction and unambiguous question wording in Section A.**




Of the two questions following the first, the respondent will only see one depending on the answer to the first question. Those taking the survey for themselves are asked whether they are getting help. Those taking the survey on behalf of others are asked why, with the option of selecting multiple choices. These display logic features are illustrated in Figure 3. These questions will help us better design and disseminate surveys for people with disabilities and people from other marginalized groups in the future.

**Figure 3. Illustration of display logic in Section A.**

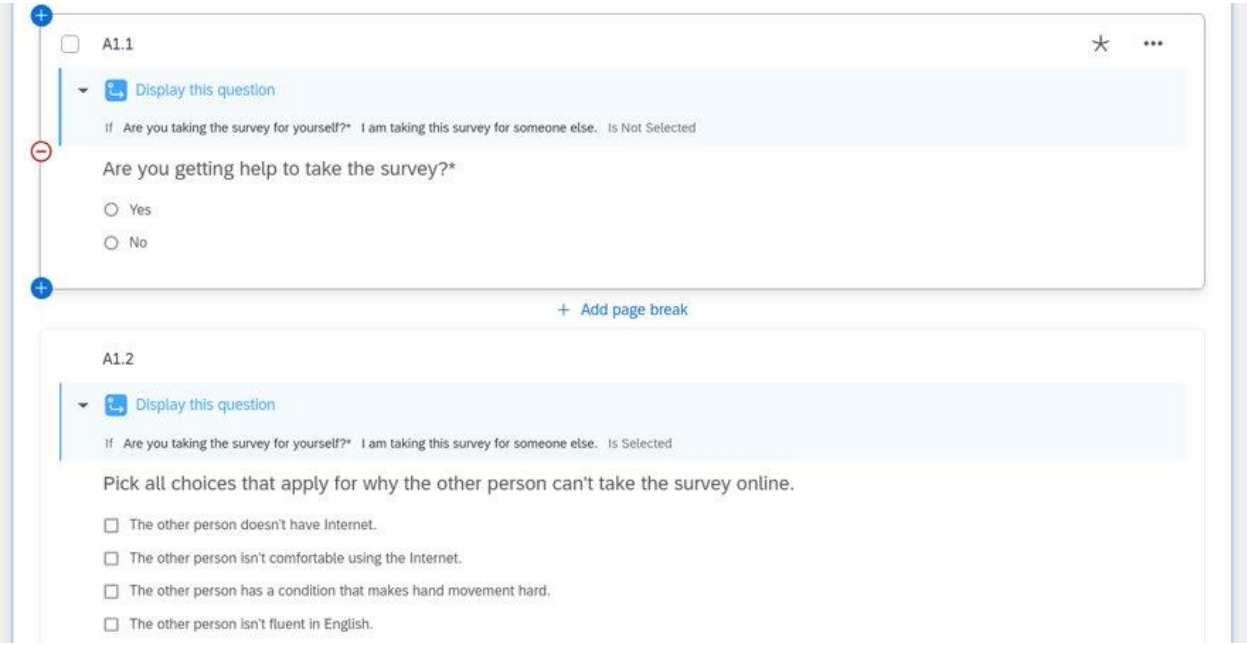
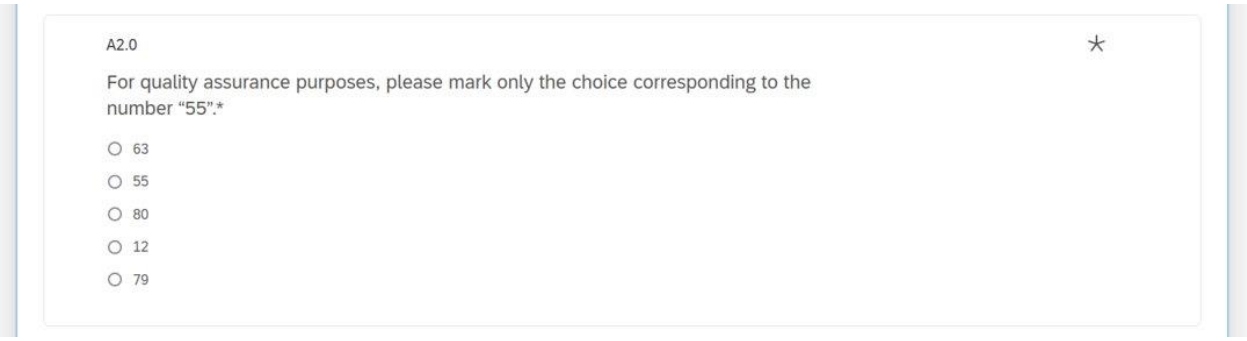


**Figure 4. Illustration of quality assurance in Section A.**



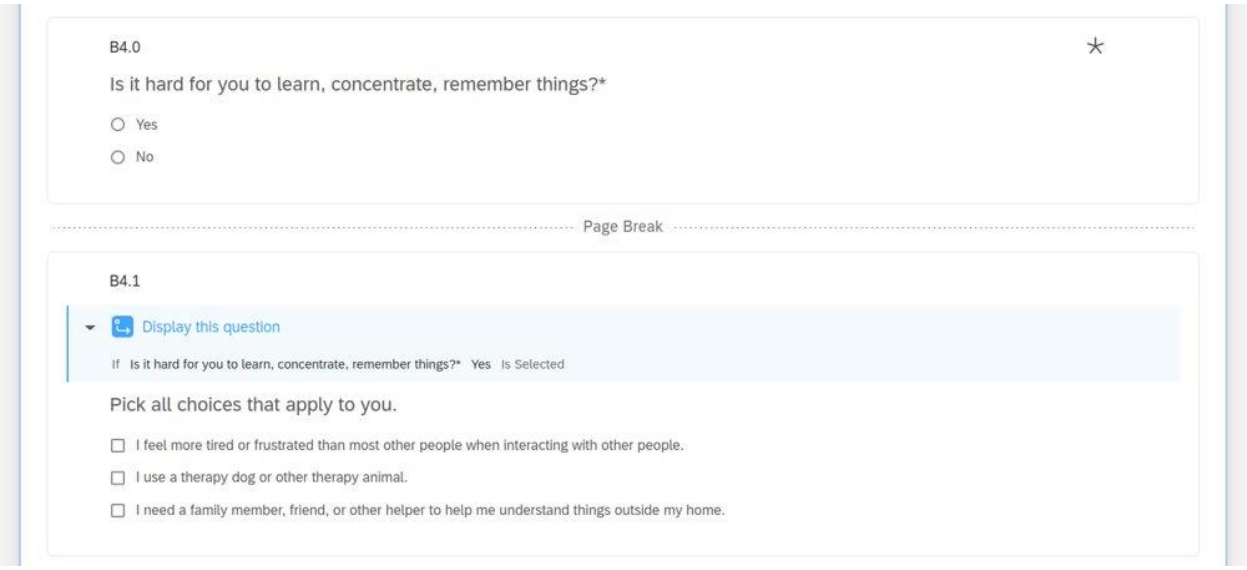

After that question, every respondent will see a question about residency in California, as illustrated in Figure 5. It is worded simply for clarity about proxy responses. However, there may be ambiguity about how the word "now" should apply to temporary visitors in California or to people who reside long-term in California but may be temporarily visiting another state or country. Following that, every respondent will see a question about being 18 years or older. That question is also worded simply for clarity about proxy responses. These two questions establish eligibility for taking the survey.

**Figure 5. Illustration of question about residency in California in Section A.**


## Section B: Questions about Everyday Challenges

This section and every following section clarify in their respective preambles that for anyone answering on behalf of another desired respondent, questions will refer to the desired respondent (not the person actually entering the answers as a proxy). Apart from the last question in this section, this section is structured to have pairs of questions, in which the first question in the pair (which every respondent must answer) asks about the presence of a broad type of disability, and the second question in the pair, displayed only if the answer to the first question in the pair is "yes", asks for more details about how that disability affects the respondent's day-to-day life in the context of assistive devices, service animals, assistance from people, and things like those. We illustrate an example of such a pair in Figure 6, demonstrating the clear, inclusive language (that does not require identifying as "disabled" or "having a disability" per se) developed in conjunction with DAOs as well as detailed information that can be useful for developing and disseminating future surveys to people with disabilities.

**Figure 6. Illustration of question about disability in Section B.**




The last question in the section (which every respondent must answer), as shown in Figure 7, asks specifically about other medical conditions that may legally prevent driving. We ask this because of how important driving is to mobility in California. However, we recognize that the use of the term "medical condition" may discourage respondents with an undue focus on the medical view of disability. Additionally, the use of a single example, namely epilepsy, may have unintentionally excluded responses from people with other qualifying conditions that are not epilepsy. We did not observe problems in this regard from pre-testing, but we are aware that such problems could arise in bigger samples.

**Figure 7. Illustration of question about other disabilities in Section B.**


Answering "yes" to the last question or to the first question in any of the pairs in this section would qualify a respondent as having a disability. This would be noted for the purpose of data analysis and for questions in later sections of the survey, as many such questions have choices or rows that only apply to people with disabilities and therefore would only be displayed for people with disabilities.

## Section C: Questions about Neighborhood Type

This section focuses on the features of the respondent's chosen neighborhood as well as desired changes to those features. The first question, which every respondent must answer, asks about the type of housing that best describes the respondent's current living situation.

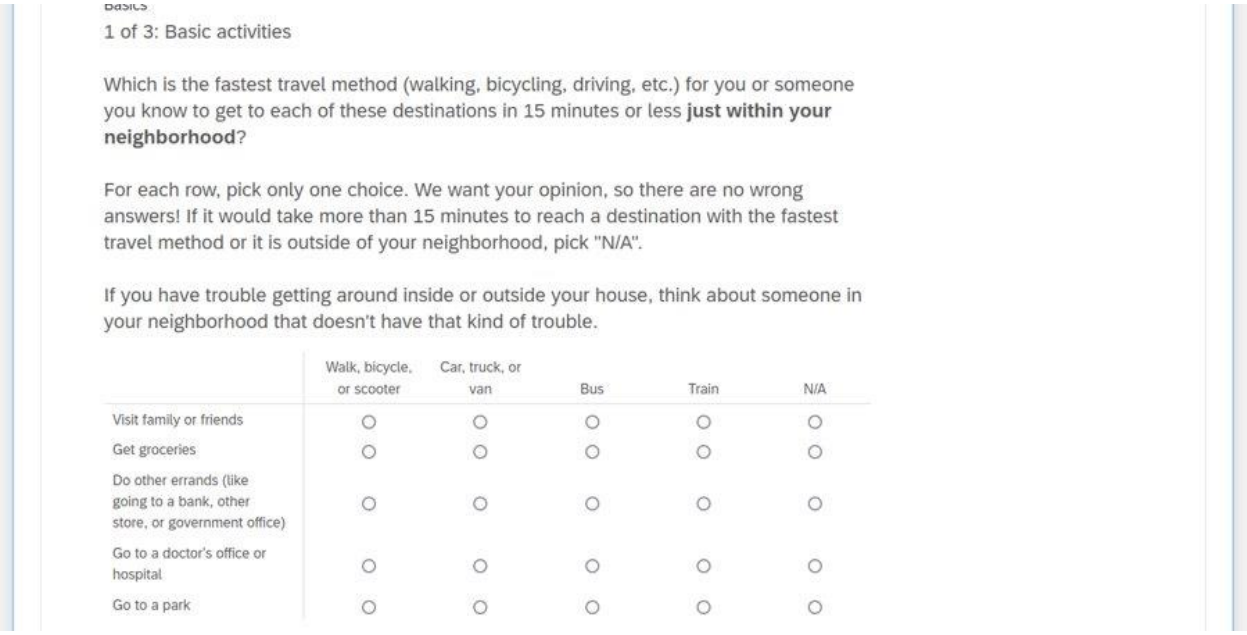
Respondents are asked to pick only one choice that best applies to them, and one of those choices is "unhoused/homeless". The second question, which every respondent who does *not* pick "unhoused/homeless" for the first question must answer, is whether the respondent ever leaves home; this affects display logic for later questions in this section as well as later sections, and it is not asked of those who pick "unhoused/homeless" for the first question because we characterize those experiencing homelessness as always "leaving home" for the purpose of performing activities "outside the home" or using different transportation modes (so those characterizations are accounted for in the display logic of later questions too).

Following these two questions, many questions in this section have display logic that depend on the answers to these first two questions in this section as well as to questions from previous sections. Furthermore, many questions in this section are structured as matrix tables. These questions are about the relative locations of activity places outside of the home in the respondent's neighborhood, pros and cons of those activity places, chosen and desired frequencies of performing such activities outside of the home, and chosen and desired changes in those activity place locations relative to the respondent's home. We found through pre-testing that grouping all activity places together would make it hard for respondents to see the full matrix table for a given question, especially when taking the survey on a mobile device. Each question about activity places involved the same 15 activity places, so we split matrix tables into 3 groups of 5 activities, where each group would involve similar types of activities. The first group involves "basic" activities that we anticipate respondents would do with reasonable regularity, namely visiting family or friends, getting groceries, doing other errands (like going to a bank, other store, or government office – these examples of activities were enumerated in the corresponding matrix table row), going to a doctor's office or hospital, and going to a park. The second group involves activities related to work and school, namely going to work outside of the home, volunteering outside of the home, going to school, college, or university outside of the home (with these three enumerated and grouped as a single row in each corresponding matrix table), taking children to school, and taking children to daycare. The third group involves activities that we think respondents feel are related to quality of life, namely going to a restaurant, going to a bar, going to church or another place of worship, going to a sports field or stadium, and going to a concert hall; the content and structure of these activities were heavily informed by pre-testing. Each group of activities appears in a corresponding matrix table in the same order, and each question about a different aspect of activities or activity locations is split into three matrix tables in the same order.

The third set of questions, which every respondent must answer, asks respondents to think of which mode an average person in the respondent's neighborhood could use to get to an activity place fastest within 15 minutes; respondents are instructed to mark "N/A" if the activity place does not exist within the neighborhood or cannot be reached within 15 minutes using any of the stated modes. We illustrate an example for one group of activities in Figure 8. The use of different modes and the prompt to select the fastest one within 15 minutes were heavily influenced by pre-testing. We anticipated that the structure of this question may give a better sense for the walkability or public transit service in a neighborhood than simply asking if a neighborhood is urban, suburban, or rural, and we found that using the term "fastest" would be

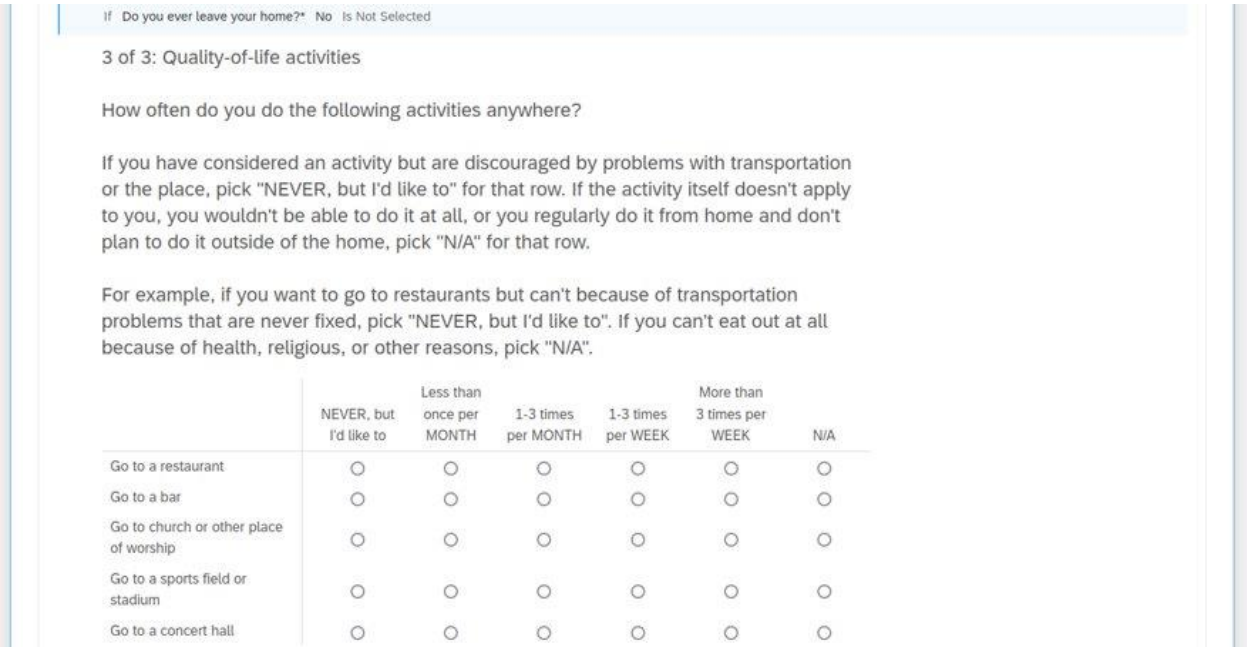
less subjective than “most convenient”. However, it remains to be seen whether this would yield meaningful results if it turns out that cars are always fastest even in walkable neighborhoods outside of Manhattan.

**Figure 8. Illustration of question about fastest travel modes in a neighborhood in Section C.**



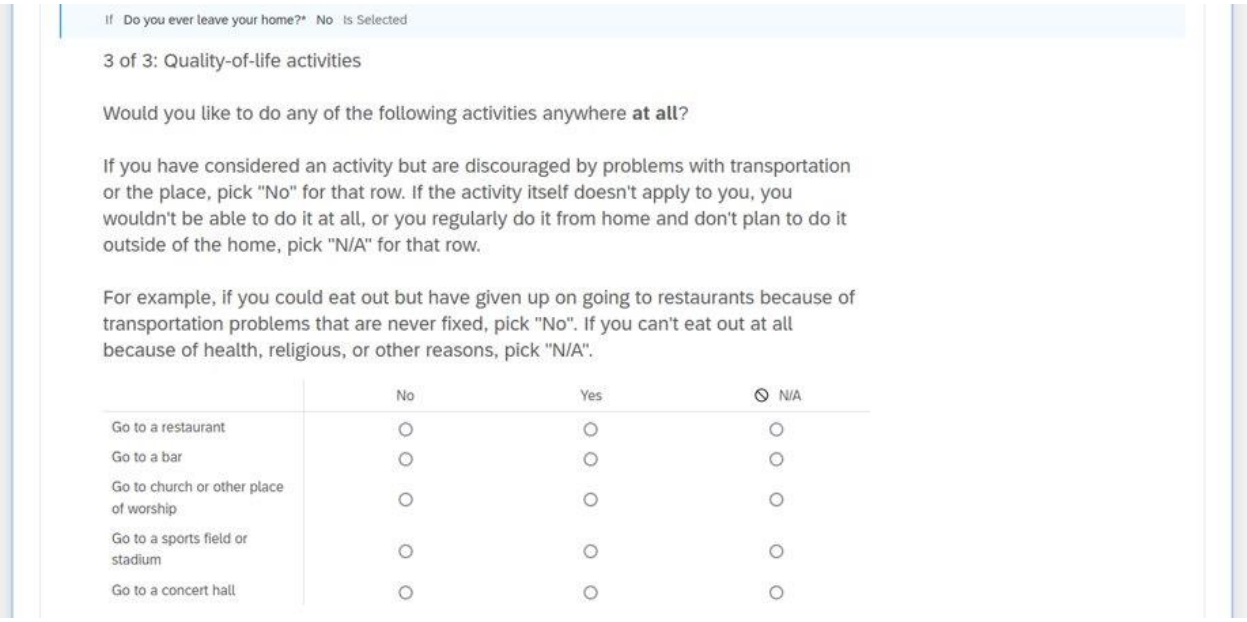

The fourth set of questions is about how often the respondent chooses to do certain activities. The phrasing of each activity with the word “go” should make clear that travel outside of the home is implied. With this in mind, the fourth set of questions is only for respondents who leave their homes. We show an example of this set of questions in Figure 9. We distinguish “NEVER, but I’d like to” from “N/A” with instructions in the prompt. However, we could not concisely convey "NEVER, and I don't want to specifically because transportation is discouraging" distinctly from "N/A". Perhaps in a future survey with similar questions, we may have a single “NEVER” choice and then have follow-up questions to ascertain the reason with simple answer choices.

**Figure 9. Illustration of questions about activity frequency choices for respondents who leave their homes in Section C.**



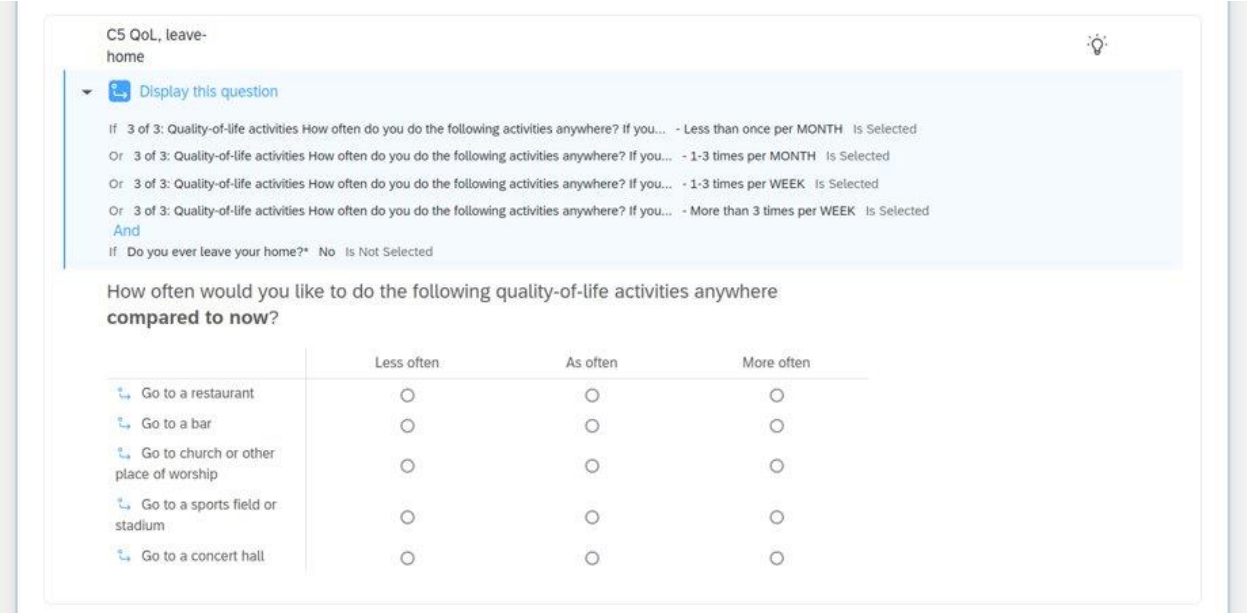

The fifth set of questions is about how often the respondent would *like* to do certain activities, with phrasing only minimally altered from previous questions about activities. This set of questions has two versions. The first version uses display logic to show this set of questions only to those who never leave their homes. We show an example of the first version of this set of questions in Figure 10. We have specifically put “no” in the first column of the matrix table to avoid the possibility of respondents lazily saying “yes” as the first choice. Additionally, the prompt more carefully distinguishes “no” from “N/A”. Furthermore, the prompt makes clear how a respondent should answer if the respondent is interested in the activity but never does it specifically because of transportation problems, although this may be less clear if the respondent picks a nonzero activity frequency that is also influenced by transportation problems.

**Figure 10. Illustration of questions about activity frequency desires for respondents who never leave their homes in Section C.**



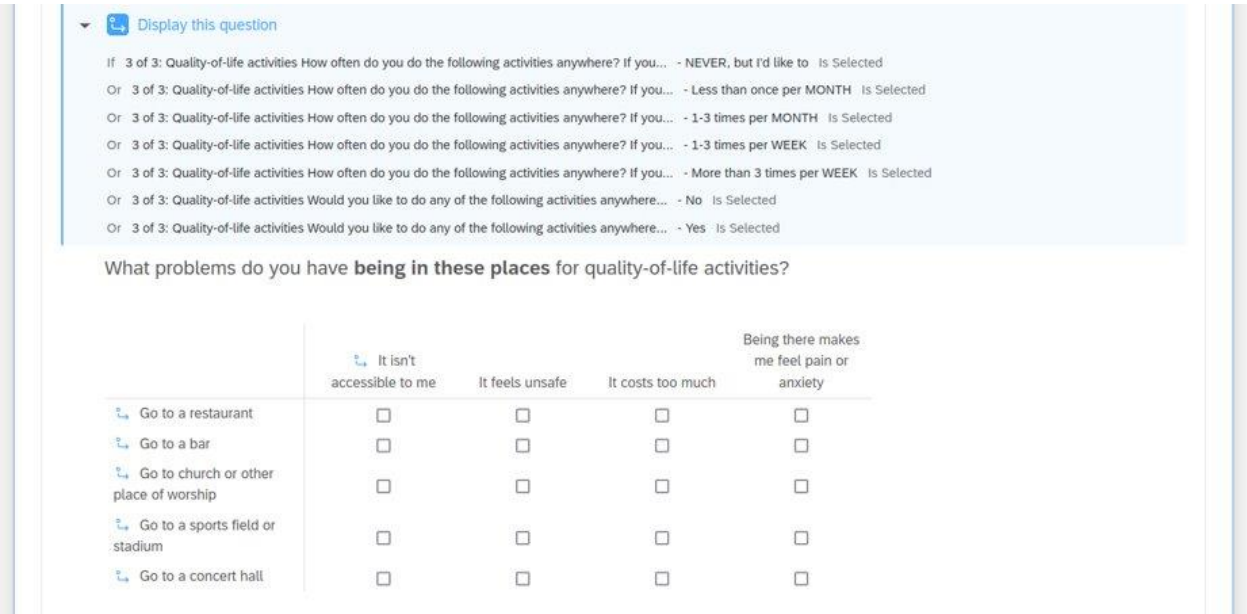

The second version uses display logic to show this set of questions only to those who leave their homes. Additionally, the display logic is more complicated. The question corresponding to a given group of activities will only be displayed if the respondent specifically picks a nonzero frequency for choosing to do any activity in that group from the fourth set of questions. Additionally, each row corresponding to a specific activity will only be displayed if the respondent specifically picks a nonzero frequency for choosing to do that specific activity. It is not enough for the respondent to just not pick "NEVER, but I'd like to" or "N/A", because if the respondent leaves the row corresponding to a chosen activity frequency blank, that row will not be displayed in this question, and if the respondent leaves all rows for the chosen activity frequencies in a given group blank, the corresponding question for desired activity frequencies will not be displayed at all. That said, unlike the first version, the second version does not provide clarification about whether respondents should answer “more often” if they want to do corresponding activities more often but are hampered by transportation problems. Thus, while desired changes to activity frequencies in either direction could indicate problems with transportation, specific information can only be validated through follow-up interviews, and such data might not otherwise reliably indicate latent demand for such activities. We show an example of the second version of this set of questions in Figure 11.

**Figure 11. Illustration of questions about activity frequency desires for respondents who leave their homes in Section C.**



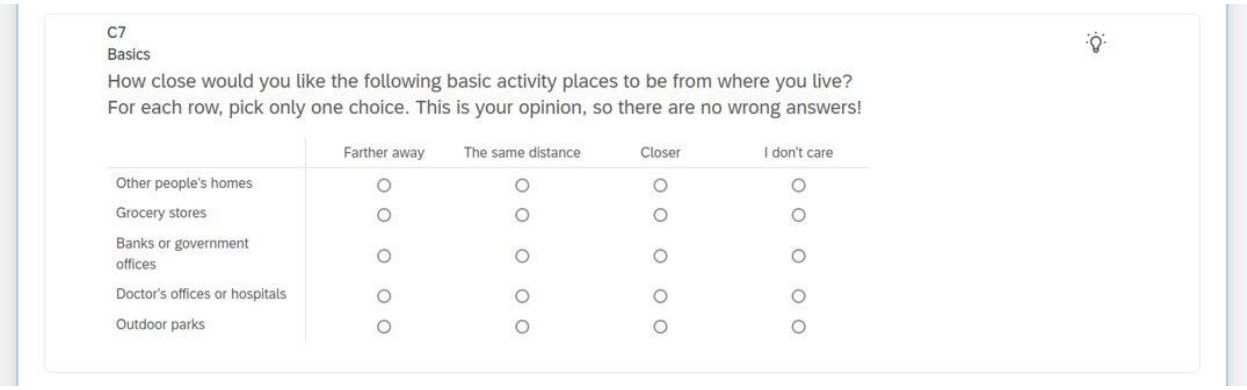

The sixth set of questions is about the problems a respondent may face when being in a given activity place. Each question is displayed to respondents who specifically pick an answer other than “N/A” (so leaving the row blank does not count) for at least one row in the corresponding question in the fifth set of questions (whether the respondent leaves home or not), and each row is displayed to respondents who specifically pick an answer other than “N/A” (so leaving the row blank does not count) for the corresponding row in the corresponding question in the fifth set of questions (whether the respondent leaves home or not). Additionally, the column “it isn’t accessible to me” is only displayed for respondents who said “yes” to at least one of the questions about disability from Section B. We show an example of these questions in Figure 12. Information about problems with activity places can benefit future research by clarifying when low levels of chosen activity frequencies have more to do with problems with transportation versus problems with the activities or locations themselves. However, we found during pre-testing that more participants than we expected reported feeling pain or anxiety in different locations. We were surprised to see several participants report pain or anxiety when visiting family or friends, which may reflect dysfunctional relationships combined with a sense of social obligation. We also recognized that participants reporting pain or anxiety in healthcare facilities may reflect general negative feelings about bad health more than specific problems with those facilities. These findings made us concerned that placing questions about problems with activity places may unintentionally bias answers to later questions, especially those about desired relative changes to activity locations. We did not find compelling evidence for such bias in pre-testers answers to later questions, but the issue may be more visible with bigger samples.

**Figure 12. Illustration of questions about problems with activity places in Section C.**




The seventh set of questions, which every respondent must answer, is about whether respondents want certain activity places to be farther from or closer to where they live. The same activities (rephrased as needed to be more generic as places – as examples, “visiting friends and family” becomes "other people's homes", while “get groceries” becomes “grocery stores”) are used and grouped in the same ways as in the previous sets of questions. The inclusion of separate columns for the choices “the same distance” as well as “I don’t care” were heavily influenced by pre-testing, and the placement of the column for “farther away” as the first choice ensured minimization of lazily agreeing to have things closer. We show an example of these questions in Figure 13.

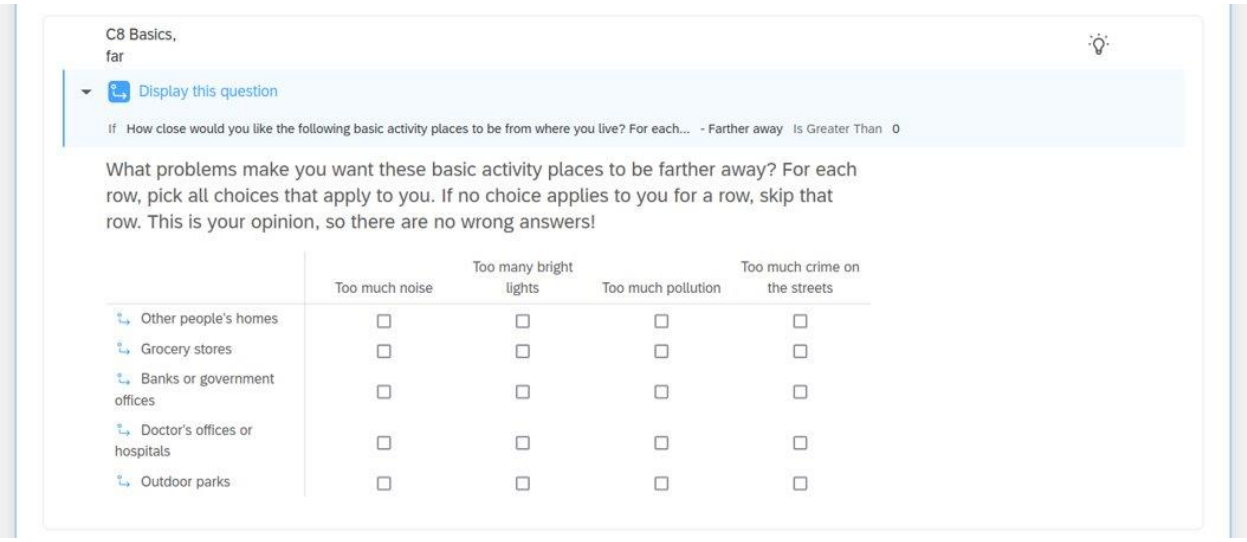
**Figure 13. Illustration of questions about desired changes to activity location distances in Section C.**




The eighth set of questions asks about the reasons that respondents want certain activity places to be farther away or closer. Because respondents can only answer the seventh set of questions with a single exclusive choice for each activity place, reasons for wanting certain

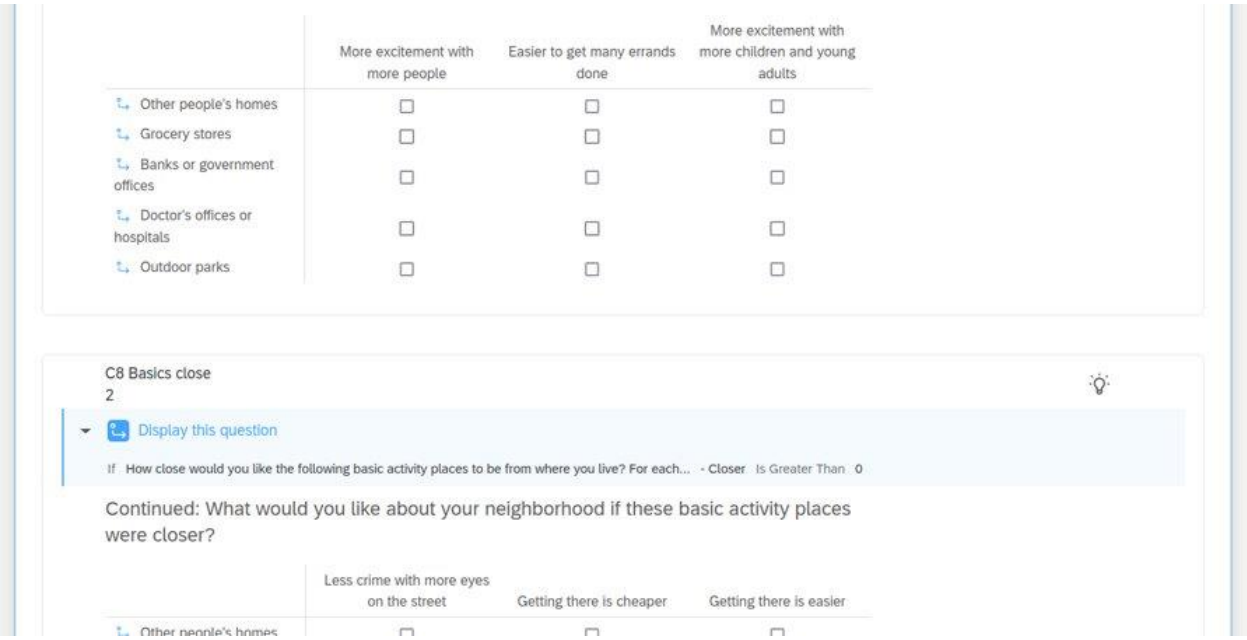
activity places to be farther away will not be shown for activity places that the respondent wants to be closer, and vice versa; furthermore, neither will be shown for activity places for which the respondent answers "the same distance" or "I don't care". We use similar display logic as in previous sets of questions to ensure that this set of questions and corresponding rows are only displayed where relevant. We show an example of these questions in Figure 14for respondents who answer that they want corresponding activity places to be farther away.

**Figure 14. Illustration of questions about reasons for wanting activity locations to be farther away in Section C.**




Matrix tables for questions about the reasons that respondents want certain activity places to be closer are further split into pairs with 3 columns each for better readability on a variety of devices. Each pair is kept together for a given group of 5 activity places, and the ordering of each pair is kept consistent among each of the 3 groups of 5 activity places. We show an example of these questions in Figure 15.

**Figure 15. Illustration of questions about reasons for wanting activity locations to be closer in Section C.**

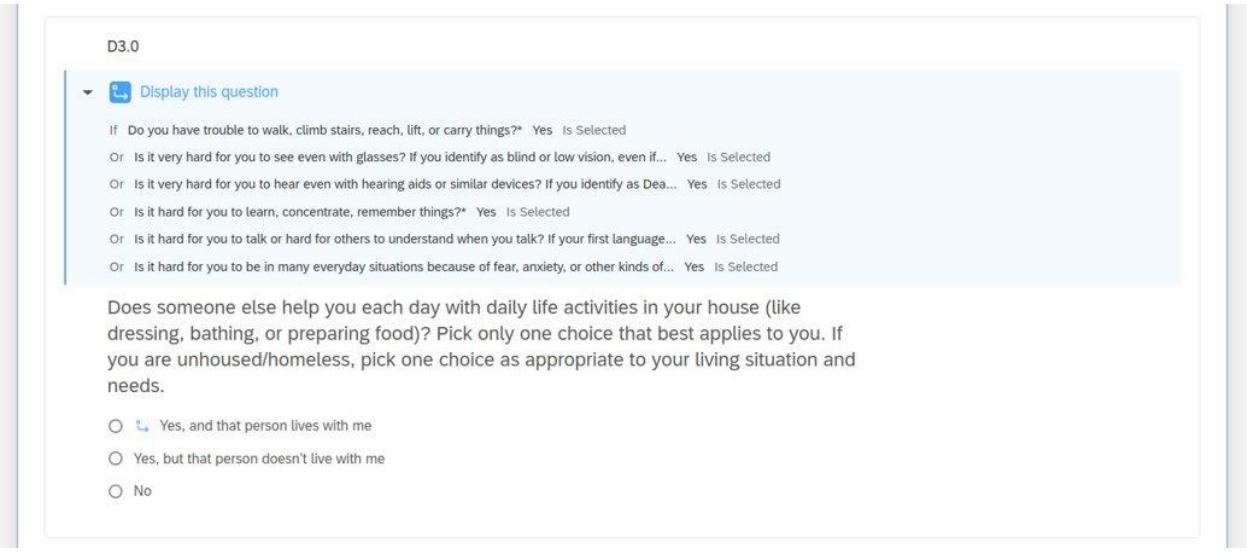



## Section D: Questions about Housing

This section focuses on challenges that the respondent may experience within the home. The first question, which every respondent is asked, is about how hard it is for the respondent to get around within the home and perform basic activities within the home independently; the prompt includes clarification for people experiencing homelessness. This could benefit future research and policymaking by giving information about the relationship between the forms of support that people need and where housing with such support exists or is being built. The second question, which respondents are asked if they do not identify as currently experiencing homelessness, is about whether the respondent or someone living with the respondent owns the respondent's home. The third question, which every respondent is asked, is about whether the respondent lives alone; the prompt includes clarification for people experiencing homelessness. The fourth question, which respondents who do not live alone are asked, is about who lives with the respondent. Respondents are allowed to pick multiple answer choices, and answer choices include those particularly relevant to people with disabilities. Furthermore, choices of "at least one roommate or housemate who is not in my family", "my own hired caregiver or personal care assistant", and "at least one hired caregiver or personal care assistant for someone else in my family" are only displayed for people who are not experiencing homelessness; we now recognize that restricting the answer choice "at least one roommate or housemate who is not in my family" may not capture instances where friends who are not blood relatives may also experience homelessness, stay close to the respondent, and help the respondent in significant ways, though this issue did not come up during pre-testing.

The fifth question, which is displayed only to respondents who said "yes" to at least one of the questions about disability in Section B, is about whether someone else helps with daily life activities within the home; the prompt includes clarification for people experiencing homelessness. We included it because of its importance to people with disabilities and the way that such relationships may subtly affect choices and desires for transportation even though the question technically focuses only on help within the home (or within the respondent's living area if experiencing homelessness) separate from help with transportation. Additionally, the answer choices are worded unambiguously and the answer choice "yes, and that person lives with me" is only displayed for respondents who also live with at least one other person. We show this question in Figure 16.

**Figure 16. Illustration of question about help around the home in Section D.**




## Section E: Questions about Transportation

This section focuses on choices and desires for transportation. The first through fourth questions, which are each asked of every respondent and do not include further display logic, respectively ask if the respondent is a licensed driver, owns or leases a vehicle (including a motorbike or mo-ped – this could also extend to someone living with the respondent), owns a bicycle or tricycle (including one adapted for the respondent's needs), and owns a scooter (including one adapted for the respondent's needs, though the prompt uses the word "stand" to distinguish from medical scooters).

The next three sets of questions are sets of matrix tables that each group 4 or 5 related transportation modes. For each set of questions, the 4 groups are as follows. The first group consists of private vehicular modes, namely vehicles that the respondent or others with whom the respondent lives owns or leases which the respondent drives, vehicles that the respondent or others with whom the respondent lives owns or leases which the respondent uses as a passenger, relatives' or friends' vehicles which the respondent drives, and relatives' or friends' vehicles which the respondent uses as a passenger. The second group consists of public transportation modes, namely regular public buses, paratransit buses or minibuses, paratransit

cars or vans, ambulances or medical vans, and trains. The third group consists of for-hire vehicles, namely taxis, TNC vehicles (in which we only consider the respondent as a passenger), Zipcar or other carsharing vehicles which the respondent drives, and Zipcar or other carsharing vehicles which the respondent uses as a passenger. The fourth group consists of active modes, namely walking (include use of a manual or motorized wheelchair or medical scooter – we included language clarifying this point in the prompt to minimize the possibility of confusion for respondents who use such devices), riding a bicycle or tricycle that the respondent owns, riding a bicycle or tricycle from a bikesharing service, riding a scooter that the respondent owns, and riding a scooter from a scooter-sharing service. In each of these 3 sets of questions, rows corresponding to ownership are only displayed if the respondent answers yes to the respective questions from the first four questions in this section, rows corresponding to driving are only displayed if the respondent is a licensed driver, and rows corresponding to paratransit or ambulances are only displayed if the respondent said "yes" to at least one of the questions about disability in Section B because people without disabilities are typically not eligible to use such modes; we considered making paratransit or ambulances visible to respondents without disabilities as there may be respondents without disabilities who accompany family members or friends with disabilities on such modes, but we decided against this because of the greater possibility of confusion among respondents who not only do not have disabilities but may be confused by terminology around paratransit or ambulances (as ambulances in the context of regular transportation refer to non-emergency medical transportation). The fifth set of questions, which are asked of respondents who leave their homes, is about chosen transportation mode frequencies; we show an example of these questions in Figure 17. The sixth set of questions, which are asked of respondents who leave their homes, is about desired relative changes in transportation mode frequencies, and each question uses similar display logic for the question as a whole and for each row as some of the questions from Section C; we show an example of these questions in Figure 18. This set of questions does not attempt to distinguish desired relative changes in mode frequency depending on problems with immediate usability of those modes. As works by Velho (Velho, 2019) as well as Verlinghieri et al (Verlinghieri et al, 2022) show, problems with immediate usability could manifest in responses as desires for more use based on hope for improvements or as less use based on frustration with the status quo. That said, we felt when designing the survey that prompting respondents to answer with either "less often" or "more often" for problems with immediate usability would unduly discount respondents' opinions, as some may answer optimistically by wanting to use a mode more often if problems with immediate usability could be fixed, while others may answer pessimistically by wanting to use a mode less often because of extant problems. Thus, the compromise is that while desired changes to mode frequencies in either direction could indicate problems closely related to disability, specific information can only be validated through follow-up interviews, and such data might not otherwise reliably indicate latent demand for such modes. The seventh set of questions, which are asked of respondents who never leave their homes as well as those leave their homes but never use specific modes, is about desires to use specific transportation modes, and each question uses similar display logic for the question as a whole and for each row as some of the questions from Section C; we show an example of these questions in Figure 19. This set of questions prompts respondents to

answer “yes” if the only problem preventing respondents from using those modes is immediate usability.

**Figure 17. Illustration of questions about chosen transportation mode frequencies in Section E.**

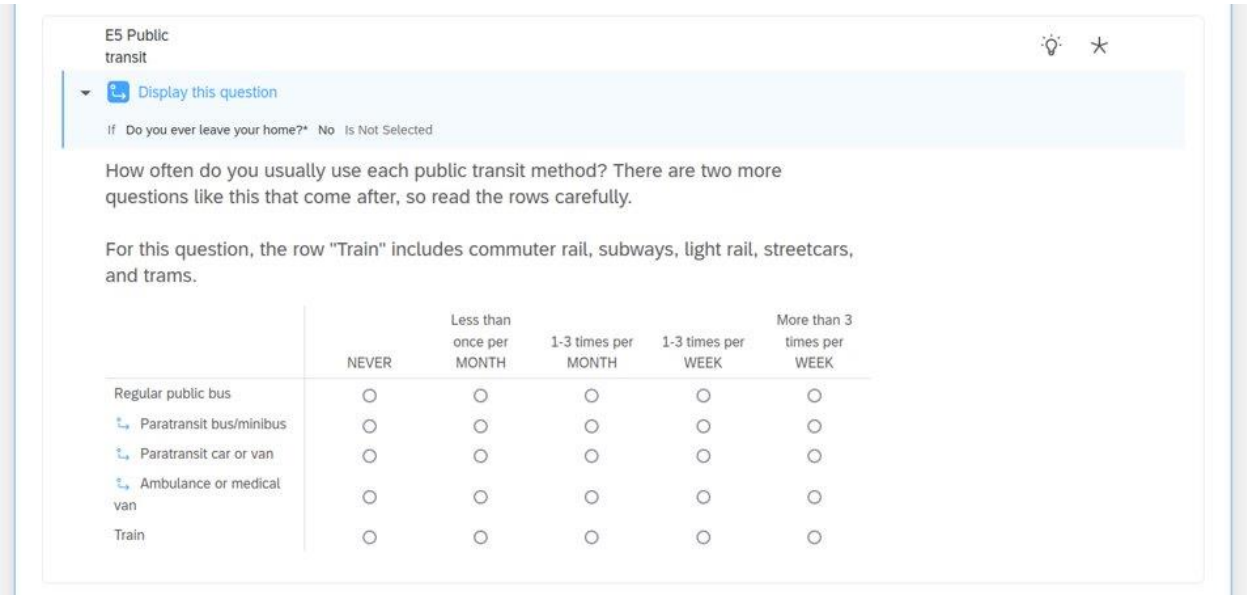



**Figure 18. Illustration of questions about desired relative changes to transportation mode frequencies among respondents who leave their homes in Section E.**

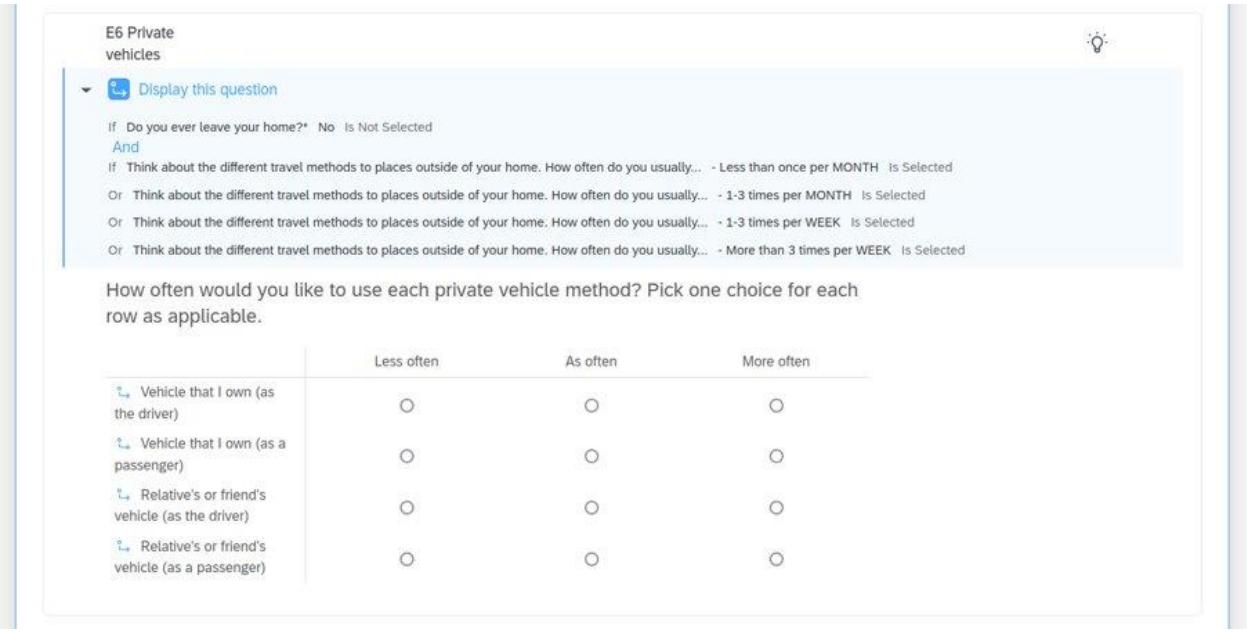
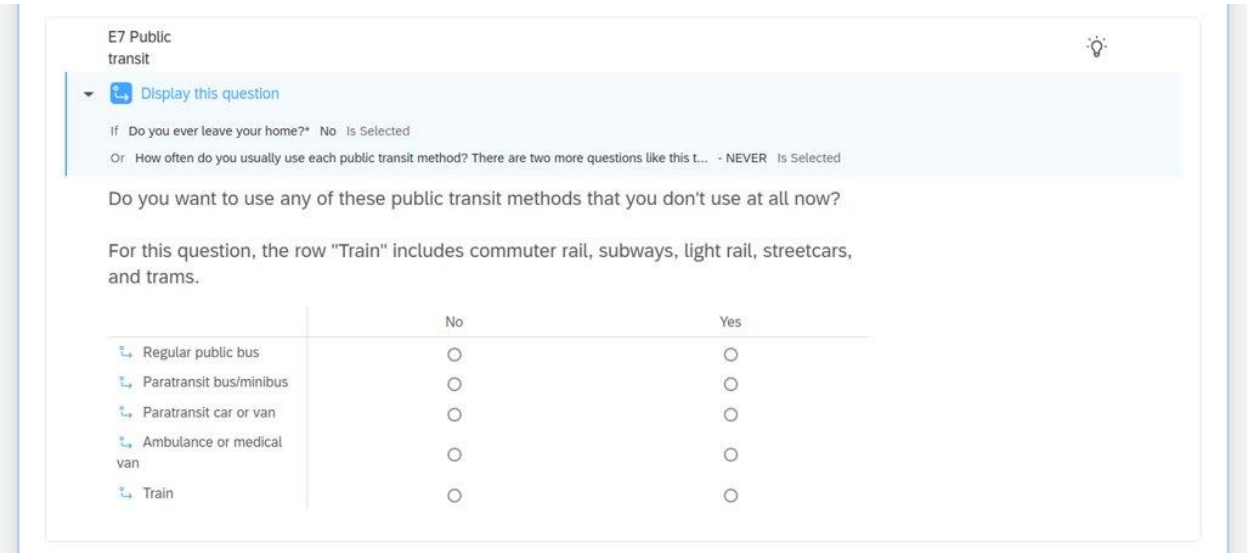


**Figure 19. Illustration of questions about desires to use specific transportation modes among respondents who do not use them or never leave their homes in Section E.**

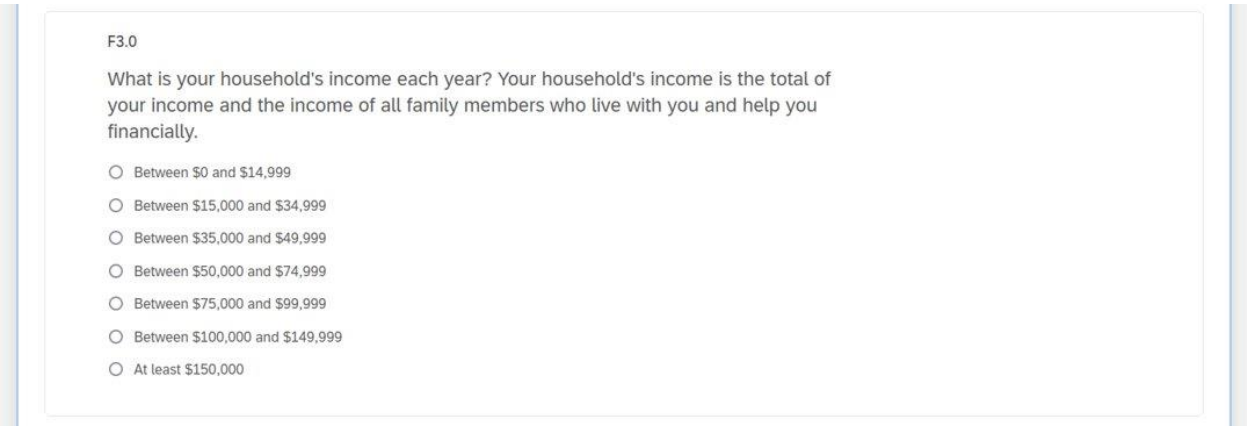



The eighth question is the second quality assurance, which has different answers and different placement of the correct answer compared to the first quality assurance in Section A; we anticipate that more respondents will answer this incorrectly due to respondent fatigue, so the incidence of this could help gauge appropriate lengths of future surveys. The ninth question, which is displayed only to respondents who said "yes" to at least one of the questions about disability in Section B and also leave their homes, is about whether someone else helps with transportation; the prompt includes clarification for people experiencing homelessness. We included it because of its importance to people with disabilities and the way that such relationships may subtly affect choices and desires for transportation. Additionally, the answer choices are worded unambiguously and the answer choice "yes, and that person lives with me" is only displayed for respondents who also live with at least one other person.

## Section F: Questions about Employment and Income

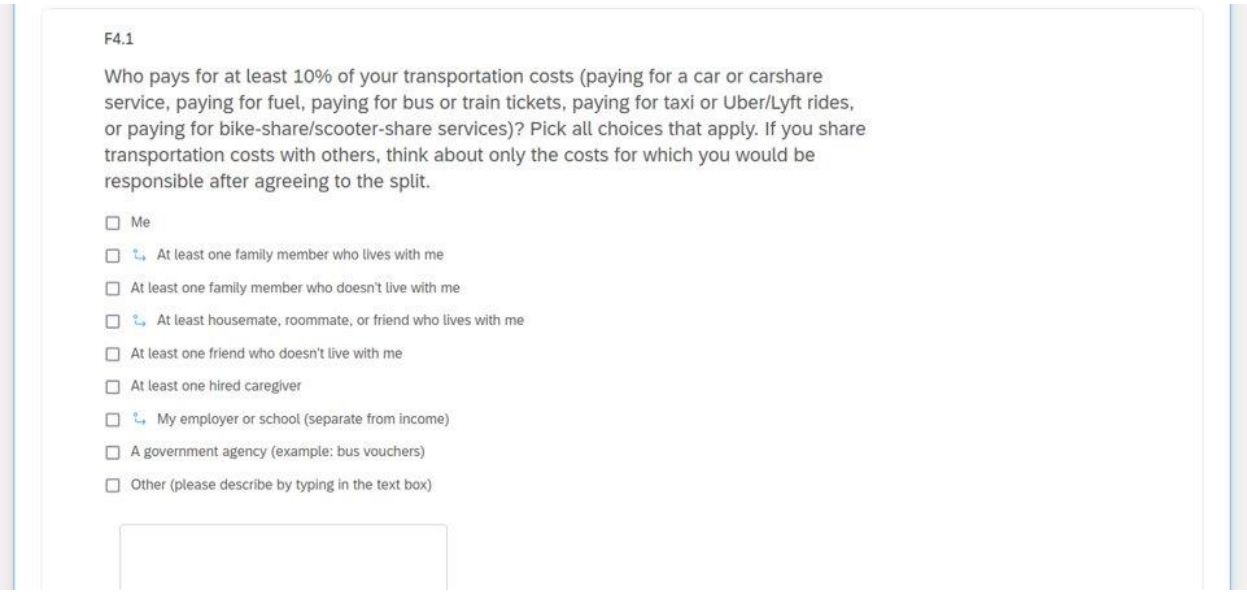
This section focuses on the economic characteristics of the respondent. The first question, asked of all respondents, is about student status and distinguishes full-time students from part-time students. The second question, which all respondents must answer, is about employment status. It includes answer choices about part-time jobs, multiple jobs, unpaid jobs, and unpaid caregiving, and the prompt includes clarification for retirees, but it requires respondents to pick one answer choice. The third question, asked of all respondents, is about household income. We show this question in Figure 20. We recognized that the prompt may confuse respondents regarding the definition of household income, but we did not see any problems in pre-testing. In any case, we asked about household income instead of individual income to account for the possibility that people with disabilities may individually have zero or low nonzero levels of income but may live with and be supported by richer family members with respect to day-to-day activities inside and outside of the home.

**Figure 20. Illustration of question about household income in Section F.**




The fourth question, asked of respondents who pick a specific housing answer choice in Section D that is not homelessness, is about who pays for at least 10% of the respondent's housing costs; the prompt clarifies that the relevant costs are those for which the respondent would otherwise be responsible after splitting with anyone who lives with the respondent. Respondents are allowed to pick multiple answer choices. Answer choices involving other people living with the respondent are only displayed if the respondent lives with other people. The answer choice about the respondent's employer or school paying is only displayed if the respondent is a student or has a paid job. The answer choice about a hired caregiver is especially relevant to respondents with disabilities. The fifth question, asked of all respondents, is about who pays for at least 10% of the respondent's transportation costs. It is structured identically to the fourth question. We show it in Figure 21. We included these two questions because they can shed light on the extent to which choices and desires for transportation and housing may come from individual cost burdens separate from individual disabilities or other factors.

**Figure 21. Illustration of question about who pays for 10% of transportation costs in Section F.**




## Section G: Questions about Background

This section asks respondents about sociodemographic characteristics. It starts with an encouraging message that the respondent is almost done with the survey. The first question, which all respondents must answer, is about the city or town that the respondent lives in. The second question, asked of all respondents, is about the respondent's address or, if preferred for the sake of privacy, two intersecting streets near where the respondent lives or stays. The third question, which all respondents must answer, is about the respondent's birth year. We set up the question to force the respondent to enter a number that is at least 1900 and at most 2005, though we later recognized that this may encourage respondents who are not eligible for the survey by being less than 18 years old to lie about their ages.

**Figure 22. Illustration of question about birth year in Section G.**


The fourth question, asked of all respondents, is about how long the respondent lived in the US between the ages of 5-18; we included this question because it may help researchers understand respondents' attitudes about transportation and neighborhood features, but we chose to not force a response and we included an "I don't want to answer this" answer choice because of the sensitive nature of the question (especially in the context of undocumented immigration status). The fifth question, which all respondents must answer, is about how long the respondent has lived in the US in total, for which we forced numerical responses of at least

zero but did not force a maximum number based on the respondent's age as we were unable to implement such a condition in Qualtrics. We included this question because it may help researchers understand respondents' attitudes about transportation and neighborhood features, but we later recognized that the sensitive nature of this question may have made it problematic to require respondents to answer this question. The sixth question, asked of all respondents, is about the type of neighborhood where the respondent grew up; the prompt asks respondents who grew up in multiple neighborhoods to think of the one they remember best. We defined the terms "city", "small town", "suburb", and "rural area", and we later recognized that this may be a better way to ask about the organization of respondents' current neighborhoods than complicated matrix tables in Section C about the fastest mode to go to specific activity places within a neighborhood (especially for future surveys, though for this survey, those questions may still be useful to compare with respondents' chosen and desired mode frequencies and activity frequencies). We show this question in Figure 23.

**Figure 23. Illustration of question about childhood neighborhood type in Section G.**


The seventh question, asked of all respondents, is about Hispanic/Latino identity, and includes an "I don't want to answer this" answer choice. The eighth question, asked of all respondents, is about ethnic background; it includes many synonyms for "Native American" and groups "Alaskan Native" as well as an "I don't want to answer this" answer choice, and it allows respondents to pick multiple answer choices, but we later recognized that respondents who identify as Native Hawaiian may not consistently pick either Native American or Asian/Pacific Islander. Furthermore, the separation of Hispanic/Latino identity from ethnicity is consistent with the 2020 US Census as well as other national-level population counts in the US, but a small percentage of respondents to the survey either found this confusing or insisted on identifying only as "Other" with the entry "Hispanic/Latino" even for ethnicity. The ninth question, asked of all respondents, is about gender identity, with a non-binary answer choice that includes many synonyms as well as an "I don't want to answer this" answer choice. The tenth question, asked of respondents who did not pick the non-binary answer choice for the ninth question, is about LGBTQ+ identity, with an "I don't want to answer this" answer choice; respondents who picked the non-binary answer choice for the ninth question are presumed by that answer

choice have an LGBTQ+ identity. The eleventh question, asked of all respondents, is about the desire to participate in future studies about transportation from UC Davis. The twelfth question, asked of all respondents, is about further comments about the content and structure of the survey.

## Conclusion

The survey ends with a message thanking respondents for their time. It encourages respondents to send an email message with any questions or concerns and asks respondents to share information about the survey (including our email address for contact about the survey) with others whom they think might be interested in taking the survey.

## Deleted questions

In the many iterations of developing this survey, we included many questions that we deleted before disseminating the survey. We will not detail every single question that was ultimately deleted, but we will discuss 4 main categories of questions.

First, we previously included questions about specific pros and cons of using different modes. These questions were present for each of the 18 modes that we considered. This ultimately made the survey unmanageably long and its scope unmanageably big, so we cut those questions to focus on capturing more basic statistics about chosen and desired frequencies of using different modes. Specific questions about specific modes will be the subject of future work and will likely be disseminated in multiple surveys, with each survey focusing on one or a few related modes (instead of all 18 modes at the same time).

Second, we previously included questions about desires for housing types because we thought that people with disabilities may be forced into housing types that are not suited for them simply because of more pressing needs to be closer to jobs, loved ones, or social services in specific neighborhoods. We later recognized that housing type availability would be very strongly correlated with neighborhood type, and this correlation may affect people's desires by affecting what they see and are familiar with; for example, it is unusual to see a high-rise apartment building in a rural area or a big single-family home in an urban core due to differences in land values and land use policies, so it might not make sense to anticipate that someone who wants to live in a rural area also wants to live in an apartment. Thus, we cut those questions. Understanding correlations among transportation, neighborhood type, and disability is the subject of this work as well as future work, and we expect that will inform the development of a future survey that may more coherently and accurately capture the effect of disability on choices and desires for housing types.

Third, we previously included questions about problems with transportation to activity places. These questions were structured similarly to questions about problems with activity places themselves in Section C, but we recognized that problems with transportation may be more specific to modes, so we cut those questions.

Fourth, we previously included questions about respondents choosing to travel with family or friends to social events because, based on other previous work (Pyer & Tucker, 2017), we saw that people with disabilities may feel left out from fully experiencing social events because they cannot spontaneously travel with family or friends without disabilities using the same modes; we wanted to capture an aspect of group transportation for people with disabilities that implies voluntary choice rather than dependence. These questions made the survey too long, so we cut them, though we plan to include questions like these in future surveys as appropriate.

### Version Q

Compared to version NQ, version Q only differs in the following way. Between Sections A and B, a new section is present containing sociodemographic questions relevant to filling quotas for Qualtrics to hire opinion panelists. The first through fifth questions are respectively about birth year, gender, Hispanic/Latino identity, ethnic background, and household income. These questions are otherwise identical to their counterparts in Sections F or G of version NQ but do not appear again in Sections F or G in version Q. That said, the question about birth year has a different validation condition in version Q compared to version NQ; while that question in version NQ simply requires a birth year of 2005 or earlier, that question in version Q forces termination of the survey for respondents who put a birth year after 2004 in order to ensure that hired opinion panelists are eligible. Similarly, the questions in Section A about quality assurance, residency in California, and being 18 years or older differ in version Q from version NQ only by forcing termination if the respondent answers incorrectly or in a way that implies that the respondent is not eligible. Additionally, the questions about birth year, gender, ethnic background, and household income force respondents to answer because of the quotas associated with version Q, although the question about ethnic background, by allowing multiple choices, gives rise to the possibility that quotas for some ethnicities could be overfilled by individual respondents reporting multiple ethnicities.

In the new section, the sixth question, which is unique to version Q, asks about the county of residence as a long drop-down menu because of the quotas associated with version Q. On the one hand, this provides additional information relative to version NQ with which we can verify that respondents really live in California and are therefore eligible to take the survey. On the other hand, the design of the long drop-down menu may make respondents more prone to mistakenly selecting the wrong county, suggesting limits to the usefulness of this information to validate the respondent's location.

## Survey data cleaning

For versions Q and NQ, we performed most data cleaning after the survey closed. However, for version Q, we performed additional data cleaning while the survey collected data to ensure that we would not pay Qualtrics for problematic responses from online opinion panelists (as Qualtrics would remove such problematic responses and attempt to replace them with new respondents at no charge to us). We will first describe data cleaning procedures for version Q while the survey remained open and then describe data cleaning procedures for versions Q and NQ after the survey closed. Finally, we will describe the numbers of respondents from each version after cleaning.

## Data cleaning for version Q while the survey was open

We used 3 criteria for removing responses from version Q while the survey was open. First, we removed any responses that exhibited gibberish when answering the questions about the respondent's city or street address. Second, we removed any responses that exhibited gibberish in other questions' text response fields. Third, we removed any responses in which the text answer to the question about city of residence corresponded to a city or state clearly outside of California, as only residents of California would be eligible for the survey; that said, for version Q, we could not identify every response outside of California right away, so we could only remove those responses upon further scrutiny after the survey closed and therefore could not get replacements for those responses.

## Gibberish in text responses

In versions Q and NQ, a few questions allowed for text responses, either as the whole response or as part of a single- or multiple-choice response along the lines of "Other (please specify)". We planned to remove responses that exhibited gibberish in these text responses, but we ultimately did not find any responses that needed removal for this reason after the survey closed (after accounting for such issues in version Q while the survey was open).

## Incomplete responses

For consistency in future data analysis, we removed every response (from versions Q and NQ) which was not 100% complete by the time the survey closed. There were 293 incomplete responses in version Q and 67 incomplete responses in version NQ, so we removed all of these.

## Residency outside of California

As only respondents residing in California would be eligible for the survey, we flagged responses suggesting residency outside of California and removed responses that we could not unambiguously connect to a location in California. This required the use of three items of information from each respondent, namely the city of residence, street address (or two nearby intersecting streets, per the prompt in that question), and spatial coordinates (latitude-longitude pairs, which we will henceforth refer to as lat-long pairs for short). Both versions Q and NQ required respondents to provide a city of residence, but respondents were allowed to skip providing a street address or two nearby intersecting streets; additionally, Qualtrics automatically generated lat-long pairs based on each respondent's Internet protocol (IP) address.

We flagged responses with latitude values outside of the range of 32.5-42.0 degrees north as a rough approximation of California's southern- and northern-most boundaries respectively, and longitude values outside of the range of 114.1-124.4 degrees west as a rough approximation of California's eastern- and western-most boundaries respectively. We did not necessarily remove responses flagged in this way as there could be many innocuous reasons for lat-long pairs outside of the accepted ranges. Specifically, the respondent could have been traveling outside of California when taking the survey, or the respondent could have disguised the IP address by using a virtual private network or through other means. Thus, we used lat-long pairs to

corroborate suspicions of residency outside of California based on other reasons, but we did not use invalid lat-long pairs as prima facie evidence for removing responses.

We flagged any responses in which the city of residence did not obviously correspond to a place in California. We immediately removed responses like "Las Vegas, NV" and "Houston, TX". For other cities, we used Google Maps or Apple Maps to look up unfamiliar city names to see if they were in California. Many unfamiliar names corresponded to neighborhoods in large cities, like the Tujunga neighborhood of Los Angeles that several respondents listed, so we kept such responses.

For more ambiguous cases, we used the street address or cross streets when provided; in their absence or as supplementary information in their presence, we also used the lat-long pairs to make the determination. For instance, we removed a response that listed the city as “Orlando.” Since Orland is a city in California and the respondent might have accidentally typed the wrong thing, we used the provided cross streets and lat-long pairs to attempt to determine in which location the respondent lives and found that they indicated Orlando, Florida. We also used this method to determine a respondent’s location in cases where the city given could indicate one of two places in California, such as the independent city of Brentwood in Contra Costa County versus the Brentwood neighborhood in Los Angeles (in Los Angeles County).

We included responses with missing street addresses or street names in the data set as long as we could verify that the specified city or county was within California. We removed responses that simply wrote “California” for the city or left the city blank (without providing a county name). We also removed responses that specified a city by itself or a combination of city and streets that we could not unambiguously locate in California, especially if the specified city by itself or combination of city and streets did correspond less ambiguously to a location outside of California when matched with the lat-long pair. Furthermore, we removed responses that specified a combination of city and two streets in which both streets existed within the city but each existed far away and in a very different neighborhood type from the other, as that would complicate data analyses related to neighborhood types and lead to further confusion in that context. We retained responses in which the street names corresponded to streets in a different city within the same metropolitan or rural area especially if corresponded by the lat-long pair, but we removed responses in which the stated city, city implied by the lat-long pair, and city implied by the street names were too far apart from each other. We retained responses in which the responded stated a combination of building number and street name that we could not find within the stated city but we could find an unambiguous combination with a similar street name (for example, “123 First Avenue” instead of “123 First Street”), but we removed responses in which there were ambiguities due to multiple similar possibilities in or near the stated city but in very different neighborhood types unless those ambiguities could be resolved using the lat-long pair.

Version Q of the survey also featured a drop-down menu to select the county of residence, which provided another tool to validate respondents who live in California. However, if we found that the provided city and street address were inside of California and were consistent

with each other (meaning that the street address is valid in the specified city), we kept the response and ignored a non-matching county selection because the design of the drop-down menu made it easy to accidentally select the wrong county entry, while it would be much more difficult to type the wrong city or address purely by mistake.

## Age under 18

Respondents would also have to be 18 years or older to be eligible for the survey. Thus, both versions Q and NQ asked whether the respondent is 18 years or older and asked for the birth year. Version Q went further by terminating the survey for any respondent who answered “no” to being 18 years or older or answered with a birth year after 2004, so we were not left with ineligible responses in version Q purely due to age. Thus, we only had to remove ineligible responses due to being less than 18 years for version NQ.

For responses to version NQ, we flagged any responses which answered “no” to being 18 years or older, but we did not remove them as we anticipated that the respondent may have mistakenly clicked the wrong button. We only removed responses that both answered "no” to being 18 years or older and either did not give a birth year (as we would not have any further information to suggest the respondent made a mistake instead of genuinely being ineligible) or gave a birth year strictly after 2004. We kept responses that answered "yes" to being 18 years or older but did not give a birth year. No respondents answered “yes” to being 18 years or older but gave a birth year strictly after 2004.

## Failed quality assurance checks

Both versions Q and NQ contained two quality assurance checks asking the respondent to pick the number 55 from a set of two-digit numbers in a single-choice question; the other numbers as well as the position of the correct answer differed between the two questions, though they were not random per respondent and for both checks the correct answer was not the first choice. We flagged responses with failed quality assurance checks. We did not consider failed quality assurance checks to be a sufficient reason to remove a response, but we used failed quality assurance checks to inform our decision-making for edge cases where other problems were also present. For instance, if a respondent showed signs that they were blazing through the survey as quickly as possible, but it was not flagrant enough to warrant removal on its own, we would remove the row if the respondent also failed one of the quality assurance checks. However, all of the failed quality assurance checks were simple mistakes and did not indicate the need to remove a response. None of the respondents failed both quality assurance checks.

The second quality assurance check appears near the end of the survey, where respondents are more likely to experience fatigue. Understanding the prevalence of response fatigue would help with the design of future surveys for similar samples. The higher likelihood of response fatigue near the end of the survey means the second quality assurance check has less value for flagging responses, so we did not use it to remove any responses.

## Time to complete survey

With a targeted time to completion of 25 minutes, we decided that responses completed in under 6 minutes were unusually fast. We flagged those responses but did not necessarily remove them because some respondents may naturally finish very fast, so a low completion time did not indicate a low-quality response in and of itself. We used completion time only to make decisions on edge cases where responses had been flagged under other criteria.

## First choice for every basic activity

To determine if respondents were blazing through the survey as quickly as possible (beyond considering the response time), we determined if they answered with the first choice for all or most questions. In particular, we flagged responses which picked the answer choice "less than once per MONTH" for the frequencies of performing all 5 basic activities. These responses might have been removed if any of them had continued to select the first choice for all of the other responses, but no such responses were recorded. We also removed responses with a large number of identical choices and an unusually low response time, such as under 6 minutes; we identified and removed one such response.

## Activity-mode frequency mismatch

For every activity, respondents could report a chosen frequency of “less than once per MONTH”, “1-3 times per MONTH”, “1-3 times per WEEK”, or “more than 3 times per WEEK”, and for activities related to work or school or to quality of life, respondents had more choices in the form of “NEVER, but I’d like to” and “N/A”. For every mode, respondents could report a chosen frequency of “NEVER”, “less than once per MONTH”, “1-3 times per MONTH”, “1-3 times per WEEK”, or “more than 3 times per WEEK”. We use the term “zero frequencies” to refer to “NEVER, but I’d like to” or “N/A” for activities or “NEVER” for modes; we refer to all other frequencies as "nonzero frequencies”.

Because all stated activities are phrased to imply travel outside of the home, we flagged responses where an estimate for total travel based on the sum of the upper bounds of chosen mode frequencies was significantly less than an estimate for total activity performance based on the sum of the lower bounds of chosen mode frequencies. Additionally, we flagged responses where the highest chosen activity frequency among all activities was 2 or more steps (along the Likert-type scale of zero and nonzero frequencies, with all zero frequencies treated equally for this purpose) bigger than the highest chosen mode frequency among all modes.

We recognized that respondents could chain trips or perform multiple activities in one location outside of the home without traveling outside between them or could use modes that we did not consider, so we did not necessarily remove responses that exhibited this inequality, but we subjected them to further scrutiny. We did remove responses where these differences were particularly egregious, such that no hypothetical arrangement of activities and travel legs could consistently account for the responses in our view. For example, we removed a few responses which answered “more than 3 times per WEEK” for multiple activities but only answered “less than once per MONTH” for a few modes and “NEVER” for the remaining modes.

## Respondent numbers after cleaning

We show, in Figure 24 and Table 6, statistics about the number of initial (raw), complete, and cleaned responses in versions Q and NQ, as we removed all incomplete responses and then performed data cleaning as we described in the previous section. (We are not counting the responses to version Q that we removed while the survey was still open.) Thus, our set of valid data included 1,896 responses, almost equally represented by versions Q and NQ. After cleaning the data, we concatenated the responses to version Q to the responses to version NQ, as the two versions were almost identical and we are not using the recruitment channel (online opinion panelists versus others) as a variable for data analysis; therefore, through the rest of this report, we will not refer to versions Q or NQ separately except when justified for other reasons.

**Figure 24. Number of responses in versions Q (blue bar on the left-hand side of each pair) and NQ (orange bar on the right-hand side of each pair) initially, then after removing completed responses, and finally after cleaning the data.**

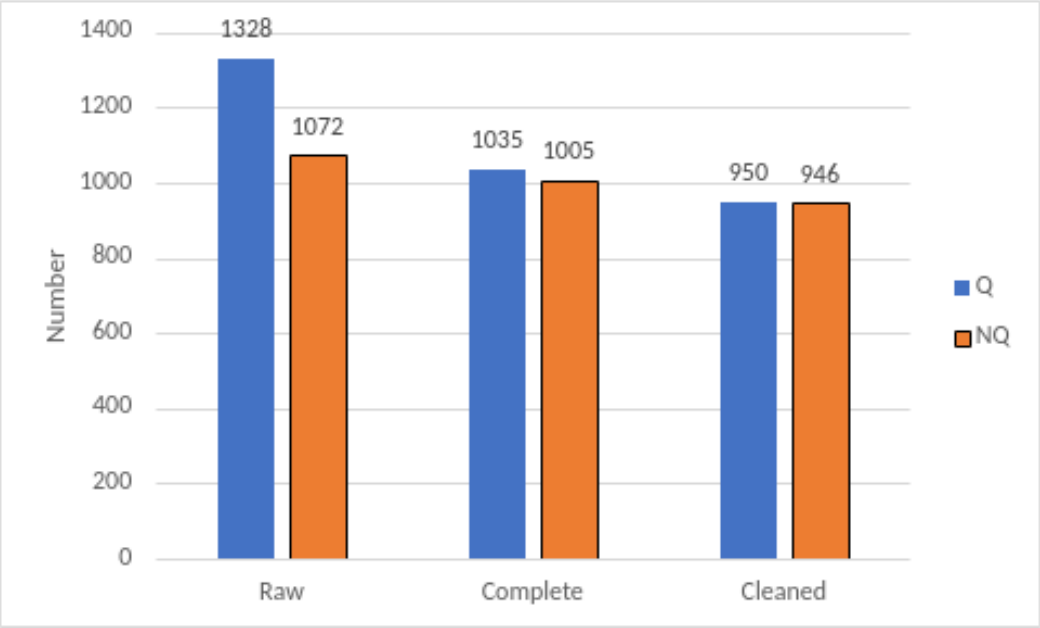



**Table 6. Number of responses in versions Q and NQ initially, then after removing completed responses, and finally after cleaning the data, in tabular format.**

| Processing stage | Number for version Q | Number for version NQ |
|---|---|---|
| **Raw** | 1,328 | 1,072 |
| **Complete** | 1,035 | 1,005 |
| **Cleaned** | 950 | 946 |

## Survey data

All statistics presented in this subsection will refer to numbers of respondents in our survey sample (combining versions Q and NQ). To the extent possible, we will duplicate or nearly duplicate presentation of data in graphs and tables for readers to understand information through different forms and to accommodate screenreaders. Finally, to clarify terminology, we classify any response in which the respondent picked an available choice worded similarly to "I don't want to answer this" as a refusal and any item nonresponse to that question as blank (leaving the question blank).

### Disability

Because our sample consisted of people both with and without disabilities, the survey had a series of questions in Section B to determine whether respondents had one or more disabilities, as well as details about how these disabilities may limit travel inside or outside the home. We show statistics about the presence of disability in Figure 25 and the number of people with one versus two or more disabilities in Figure 26, showing that 807 respondents reported at least one disability; we also put these statistics in a consolidated form in Table 7. Additionally, we show statistics about reported disability types in Figure 27 and Table 8; numbers add to more than 809 due to respondents reporting multiple disabilities. People with disabilities (I.e., with at least one disability) constitute 43% of our sample, which is higher than the commonly quoted statistic of approximately 25% of Americans having a disability; this overrepresentation may reflect our outreach through DAO partners and the inclusive nature of the questions, as we used the word "trouble", but never used the word "disability", in those questions. Furthermore, we were not surprised to see that the most frequency reported disability was physical disability, but we were surprised to see almost the same number of responses reporting mental disability as well as cognitive disability; the latter results may reflect the inclusive nature of the questions, as many respondents may experience anxiety or memory problems but do not associate themselves with mental or cognitive disability, respectively.

**Figure 25. Number of people without versus with disabilities.**

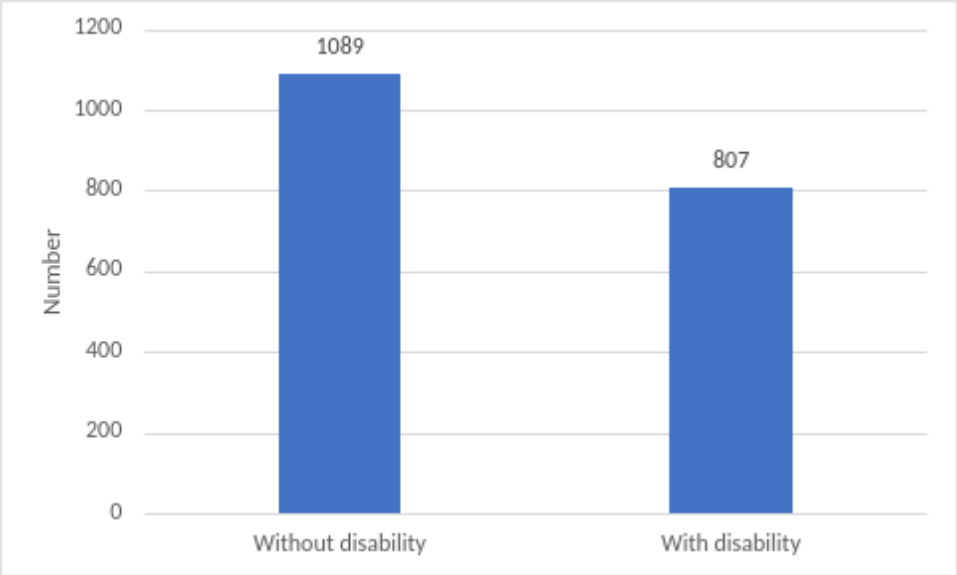



**Figure 26. Number of people with one versus two or more disabilities.**

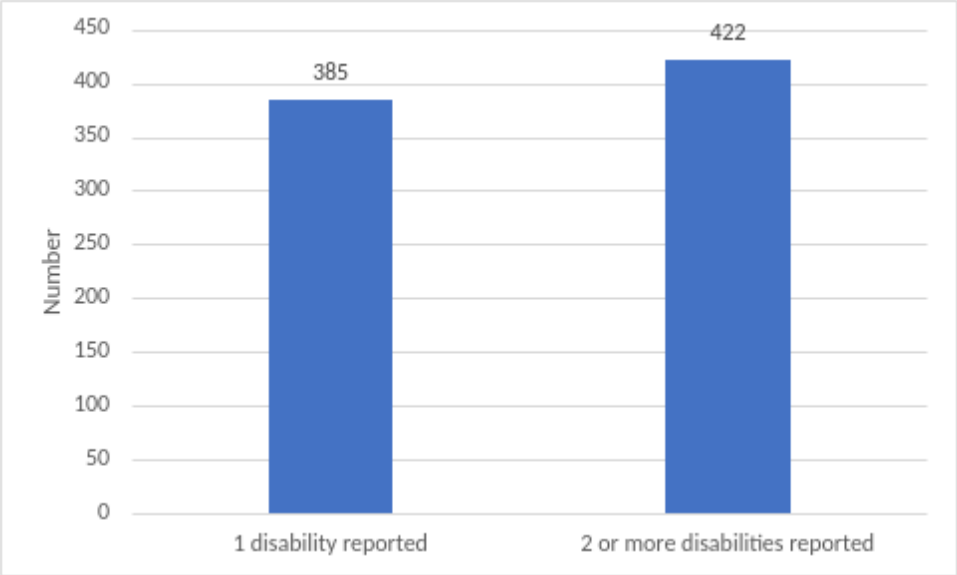



**Table 7. Number of respondents without a disability or with at least one disability, as well as with exactly one versus two or more disabilities (adding to at least one disability).**

| Reported disabilities | Number |
|---|---|
| **None** | 1,089 |
| **At least one** | 807 |
| **Exactly one** | 385 |
| **Two or more** | 422 |

**Figure 27. Prevalence of reported disability types. Numbers add to more than 809 as respondents could report multiple disabilities.**

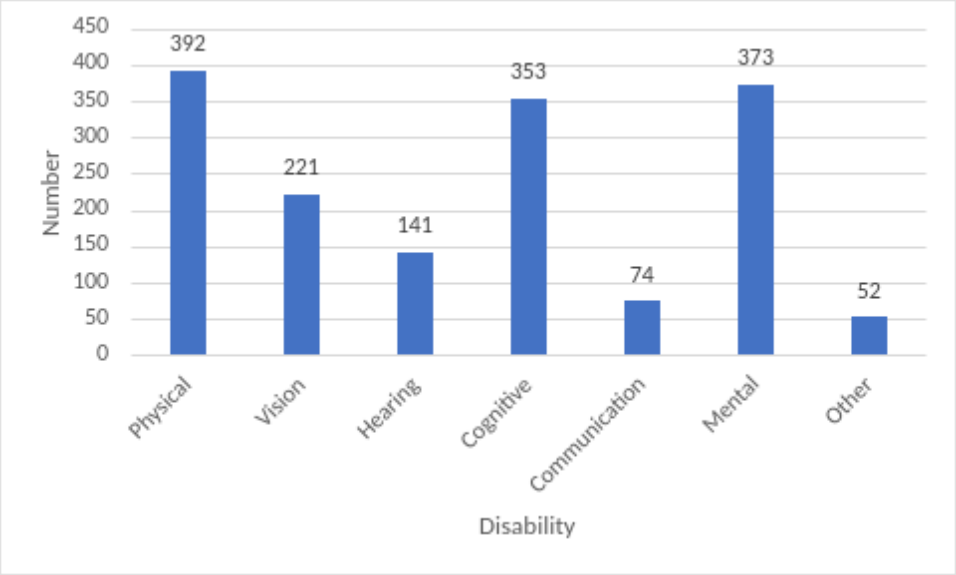



**Table 8. Number of respondents reporting different disability types. Numbers add to more than 807 as respondents could report multiple disabilities.**

| Reported disability types | Number |
|---|---|
| **Physical** | 392 |
| **Vision** | 221 |
| **Hearing** | 141 |
| **Cognitive** | 353 |
| **Communication** | 74 |
| **Mental** | 373 |
| **Other** | 52 |

## Geographic Region

Through Qualtrics for version Q and through DAO partners as well as our existing bank of prior respondents for version NQ, we recruited respondents from the 6 regions we have defined across California. We show in Figure 28 the number of respondents from each region in version Q, version NQ, and both together. We also show in Table 9 the percentages of respondents from each region in version Q, version NQ, and both together, along with the percentages of the population of California in each region as well as the percentages corresponding to the desired region quotas for version Q (taken from Table 3). We compare versions Q and NQ for recruitment by geographic region, but not by other characteristics, because the only hard quotas in version Q were for geographic region and such a comparison may shed light on improved recruitment practices for future studies.

For version Q, the total number of responses was 950 after data cleaning, which was close to the desired total of 1,000. Additionally, the percentage from each region corresponded closely to the desired quotas; only the ROC region was somewhat underrepresented due to marginal overrepresentation of every other region. For version NQ, the total number of responses was 946 after data cleaning, which was very close to that of version Q. That said, the geographic distribution of respondents was quite different for version NQ compared to version Q. In particular, while representation of MTC was almost identical and representation of SANDAG was slightly lower in version NQ compared to version Q, representation of SCAG was much higher in version NQ compared to version Q, and this came at the considerable expense of representation of CV and ROC in version NQ compared to version Q.

We structured the quotas in version Q to account for the greater difficulty in recruiting respondents from the CV and ROC regions, and those turned out to be critical for getting such respondents in the survey at all, as most respondents to the survey from the CV and ROC regions came through version Q. This in turn suggests that representation in version NQ from each region was affected by our partnerships with DAOs in each region. In particular, we partnered with several DAOs in the MTC, SACOG, SCAG, and SANDAG regions, and as those regions had more urbanized areas with better Internet access, many prior respondents from our contact bank as well as many new respondents recruited through DAOs likely had less trouble getting to version NQ. By contrast, we partnered with very few DAOs in the CV region, so any future study targeting people with disabilities that is meant to include participants from the CV region should be more mindful of reaching out to DAOs that serve people in the CV region. Additionally, even potential participants with disabilities from the CV region may have been discouraged by problems with Internet access, given greater levels of poverty and lesser access to Internet infrastructure in the CV region; DAO employees from other regions pointed out similar problems in their communities, so it is reasonable to expect more severe problems along these lines for residents of the CV region. Separately, although we did partner with a few DAOs from the ROC region, their employees pointed out that those communities are fire-prone and were severely harmed by the fires in 2021 due to inadequate infrastructure before the fires and inadequate funds to rebuild after the fires; thus, even with proper outreach to those communities, recruiting people, especially but not exclusively those with disabilities, from the ROC region for studies going forward may remain challenging, and perhaps become even more so, with increasing frequency & intensity of fires and corresponding cumulative damages.

**Figure 28. Number of respondents from each region in version Q (blue bar on the left-hand side of each triplet), version NQ (orange bar in the middle of each triplet), and both together (gray bar on the right-hand side of each triplet).**

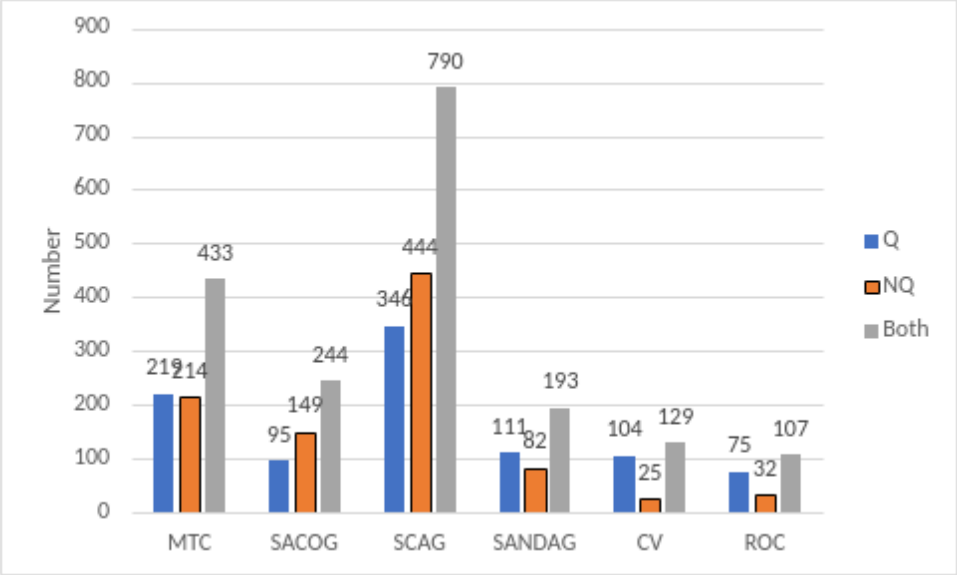



**Table 9. Percentages of respondents from each region within versions Q, NQ, and both together. For reference, we also provide percentages corresponding to the population of California as well as to the desired quotas for version Q (Table 3).**

| Region | Percentage within version Q | Percentage within version NQ | Percentage within overall survey | Percentage within California population | Percentage within version Q desired quotas |
|---|---|---|---|---|---|
| **MTC** | 23.1% | 22.6% | 22.8% | 19.6% | 25.0% |
| **SACOG** | 10.0% | 15.8% | 12.9% | 6.5% | 10.0% |
| **SCAG** | 36.4% | 46.9% | 41.7% | 47.6% | 35.0% |
| **SANDAG** | 11.7% | 8.7% | 10.2% | 8.3% | 10.0% |
| **CV** | 10.9% | 2.6% | 6.8% | 10.9% | 10.0% |
| **ROC** | 7.9% | 3.4% | 5.6% | 7.1% | 10.0% |

## Ethnicity and Hispanic/Latino identity

Following the rules of the US Census, which considers that people of any ethnicity can consider themselves Hispanic or Latino, we asked respondents about Hispanic/Latino identity before asking their ethnicity, of whom 467 said “yes”, 1,394 said “no”, 30 refused, and 5 were blank. The survey logic allowed respondents to answer “no” or leave a blank answer to the question of Hispanic/Latino identity but then pick "other” and write “Hispanic”, “Latino”, or a similar answer to the question of ethnicity, so we checked later for such mismatches. We specifically did not impute Hispanic/Latino identity for any respondent who picked “other” for ethnicity

and then wrote the name of a nationality that might typically correspond to Hispanic/Latino identity due to the complexities of ethnic and Hispanic/Latino identification, especially in the contexts of indigeneity and immigration in the Americas. However, all 92 respondents who provided picked "other" for ethnicity and wrote “Hispanic”, “Latino”, or something similar did, in fact, answer “yes” to the question of Hispanic/Latino identity. This suggests that those 92 respondents see Hispanic/Latino identity as the only relevant commonly used marker of their ethnic identities too. This also means that no respondent mistakenly picked “no” or left blank the question about Hispanic/Latino identity and only provided such information to answer the question about ethnicity.

We show the final results in Figure 29 and Table 10, showing that approximately 25% of our sample identified as Hispanic/Latino; this is lower than US Census statistics of approximately 37% in California, which may reflect the lack of a Spanish-language survey as well as the survey instrument being online thereby excluding many poorer people in California who identify as Hispanic/Latino.

**Figure 29. Statistics about Hispanic/Latino identity.**

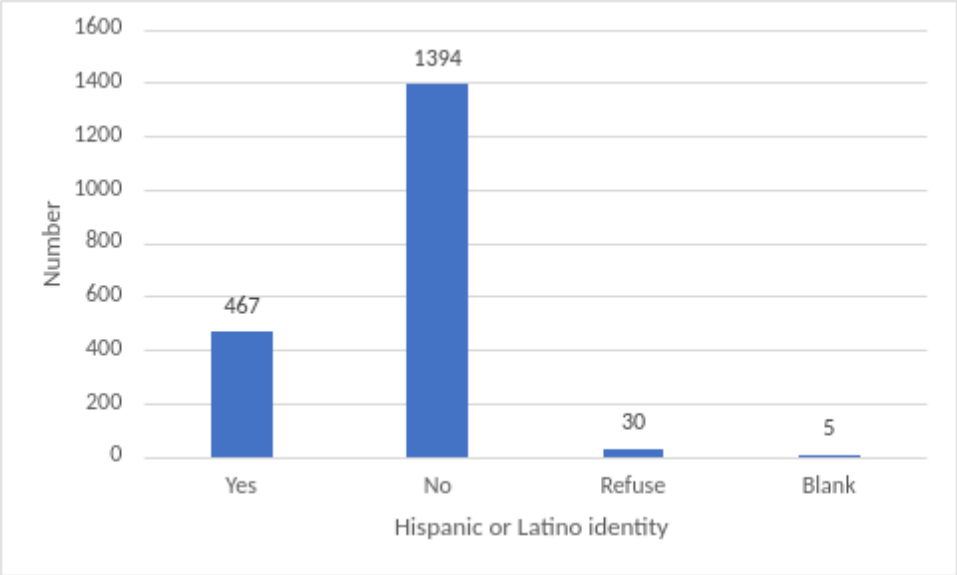



**Table 10. Statistics about Hispanic/Latino identity.**

| Hispanic/Latino identity | Number |
|---|---|
| **Yes** | 467 |
| **No** | 1,394 |
| **Refuse** | 30 |
| **Blank** | 5 |

We applied a similar philosophy to the question about ethnicity separate from Hispanic/Latino identity. Because ethnicity can be so complex and personal, we did not impose our own prejudices on respondents' self-reported ethnicities, and we only imputed ethnicities in 9 cases where a respondent selected ”other” and then wrote text that clearly corresponded to at least one of the existing categories as we specifically wrote them. One respondent, for instance, wrote “Half Black and Half Native American (Creek Indian),” which we imputed as the two categories “American Indian, Native American, First Nations, or Alaskan Native” and ”Black or African American”. We imputed the “American Indian, Native American, First Nations, or Alaskan Native” category because the respondent wrote “Native American” before “(Creek Indian)”. If the respondent had simply written ”Creek Indian”, we would only have imputed the “Black or African American” ethnicity and retained the “other” answer, because we could not know for sure whether the respondent considered themselves part of the broader category of indigenous Americans. Similarly, we kept the ethnicity of a respondent who picked ”other” and wrote ”South Asian” as ”other” because the respondent specifically did not pick the ”Asian or Pacific Islander” category as written in this survey. We did this even though government statistics and broad-based surveys in the US tend to categorize South Asians under the same racial or ethnic category as people with origins in other parts of Asia because a respondent to one of those surveys could make a similar choice (of picking something like ”other” instead of ”Asian”). Additionally, the answer choice “I don’t want to answer this” could be selected simultaneously with other choices due to limitations in the Qualtrics online survey software; we imputed the ethnicity as a refusal (“I don’t want to answer this”) for any respondents who picked that and at least one other choice, throwing away information about the other choices that may have been picked. Finally, we point out that respondents to version Q were forced to answer the question about ethnicity for quota purposes, so only respondents to version NQ were able to leave the question blank.

We show these results in Figure 30 and Table 11, showing that people who identify as only white or Caucasian were significantly overrepresented among survey respondents compared to the population of California (57% compared to 41%), people who identify as only black or African American were marginally underrepresented among survey respondents compared to the population of California (5% versus 6%), people who identify as only American Indian, Native American, First Nations, or Alaskan Native were marginally overrepresented among survey respondents compared to the population of California (3% versus 2%), people who identify as only Asian or Pacific Islander were represented among survey respondents similarly to the population of California (17%), people who identify as only "other" were considerably underrepresented among survey respondents compared to the population of California (10% versus 21%), and people who identify with 2 or more ethnicities were considerably underrepresented among survey respondents compared to the population of California (4% versus 15%); these results may reflect the exclusion of many poorer people in California due to the survey instrument being online, and these results reflected the demographics of respondents to version NQ which, by featuring more responses from people identifying as white or Caucasian, somewhat diluted the quotas specified for version Q which aimed to overrepresent people who identify as only American Indian, Native American, First Nations, or

Alaskan Native, or with 2 or more ethnicities, in each case compared to the population of California.

**Figure 30. Statistics about ethnicity(using common short forms and abbreviations of the full forms used in the survey). All ethnicity labels are for those who only selected that ethnicity unless otherwise specified.**

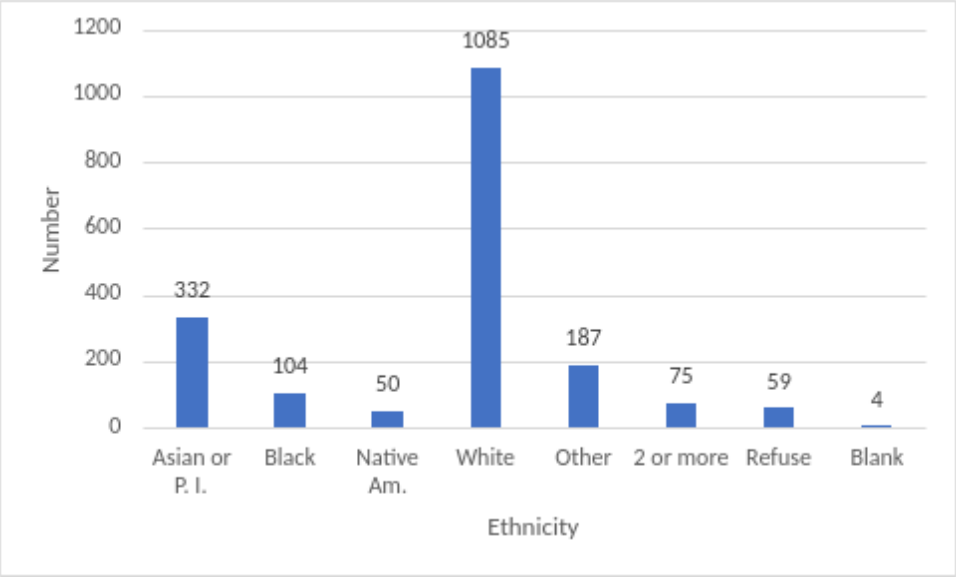



**Table 11. Statistics about ethnicity.**

| Ethnicity | Number |
|---|---|
| **Only American Indian, Native American, First Nations, or Alaska Native** | 50 |
| **Only Asian or Pacific Islander** | 332 |
| **Only Black or African American** | 104 |
| **Only White or Caucasian** | 1,085 |
| **2 or more** | 75 |
| **Refuse** | 59 |
| **Blank** | 4 |

## Gender

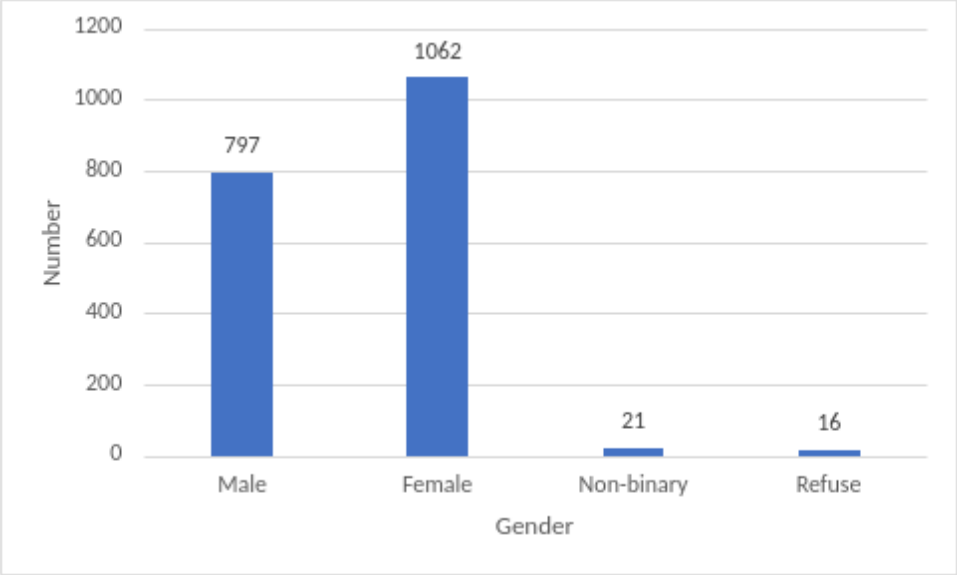
We show statistics about gender in Table 12 and Figure 31, noting that respondents to version Q, unlike version NQ, were forced to answer the question about gender for quota purposes, although no respondents to version NQ left the question blank. They show an overrepresentation of people who identify as female among survey respondents compared to the population of California, and the higher percentage of respondents who identify as female (56%) is quantitatively very similar to results from work by Circella et al (Circella et al, 2016);

that work, which also used an online opinion panel hired through Qualtrics, explains that people who identify as female tend to be overrepresented in online opinion panels.

**Table 12. Statistics about gender.**

| Ethnicity | Number |
|---|---|
| **Non-binary, genderqueer, gender-fluid, third gender, or other gender identity** | 21 |
| **Female** | 1,062 |
| **Male** | 797 |
| **Refuse** | 16 |

**Figure 31. Statistics about gender.**




## Age

We asked respondents about their birth years and retained survey responses from anyone who either definitively wrote a birth year of 2004 or earlier or said "yes" to being 18 years or older and did not give a birth year, as we defined the age of the respondent as the birth year subtracted from 2022 (the year in which the survey collected data); respondents to version Q were forced to answer the question for quota purposes. We divided ages into ranges, namely 18-33, 34-49, 50-65, and 66+, inclusive at both ends of each range. We show results in Figure 32 and Table 13. Surprisingly, and in contrast to typical results from online surveys as well as the population of California, people from the age range 18-33 were underrepresented among survey respondents; we still need to investigate whether this could be because respondents in the youngest age group were less careful about completing the survey, so many of them may have started the survey but we discarded their responses as those responses were incomplete. We also note that 72% of our sample was of traditional working age (18-65).

**Figure 32. Statistics about age.**

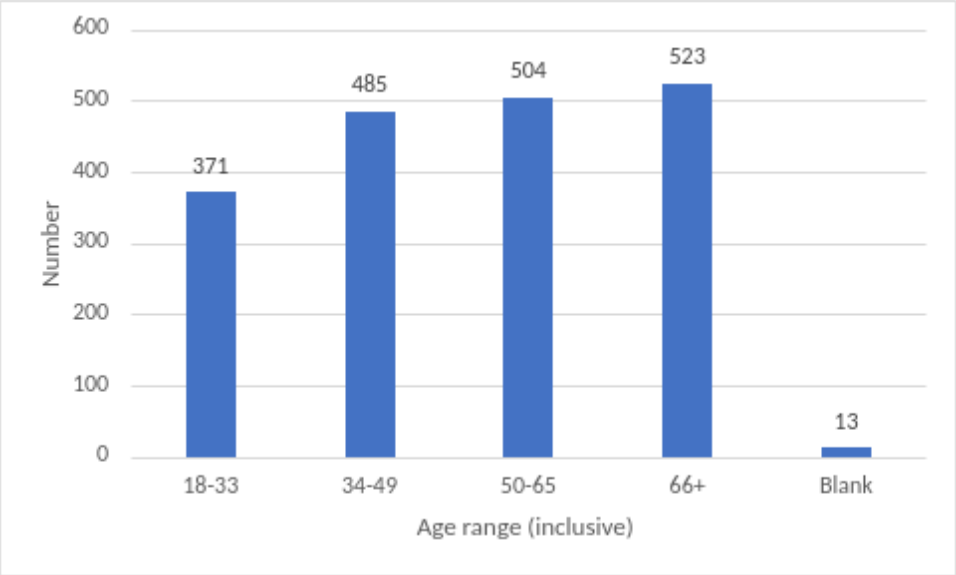



**Table 13. Statistics about age. All age ranges are inclusive on both ends.**

| Age range | Number |
|---|---|
| **18-33** | 371 |
| **34-49** | 485 |
| **50-65** | 504 |
| **66+** | 523 |
| **Blank** | 13 |

## Employment

We asked respondents about their employment status, and we structured the question so that each respondent could pick only one choice that they feel best applies to them. We show the detailed breakdown of responses in Figure 33, aggregated responses in Figure 34 with respect to whether the respondent has any job or not, and aggregated responses in Figure 35 Figure 35with respect to whether respondents among the 1,274 working get paid for their work or not. We present the same statistics all together in Table 14.

**Figure 33. Statistics about employment showing identified primary jobs (or no job).**

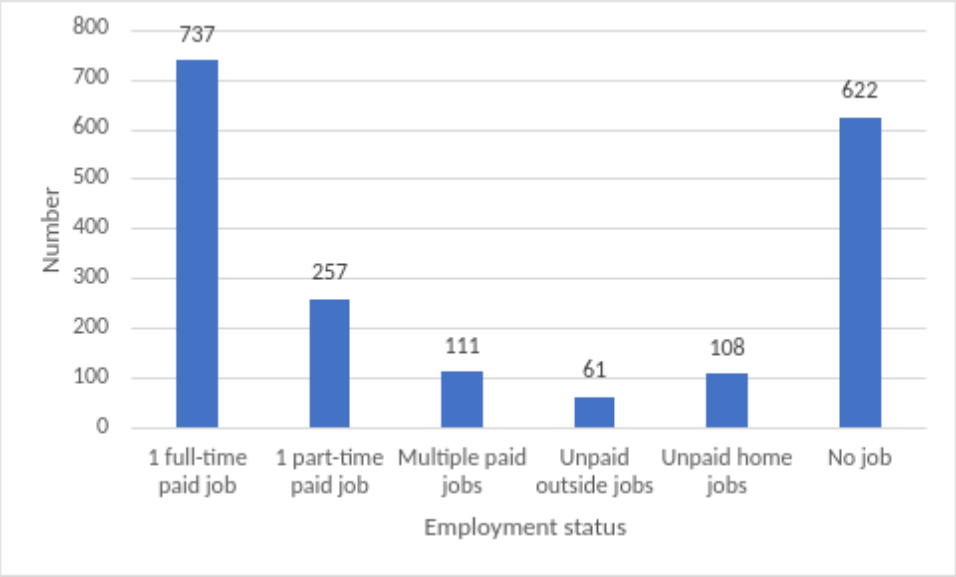



**Figure 34. Statistics about whether the respondent is employed at all; "no job" and "not working" are treated identically.**

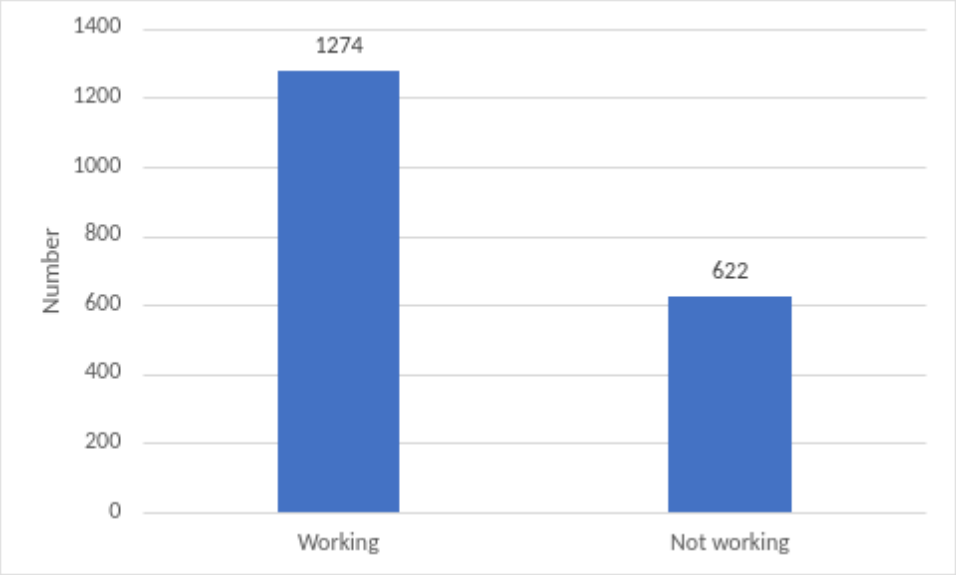


**Figure 35. Statistics about whether the respondent primarily works for pay or primarily does unpaid work; these two numbers together add to the 1,274 respondents working.**

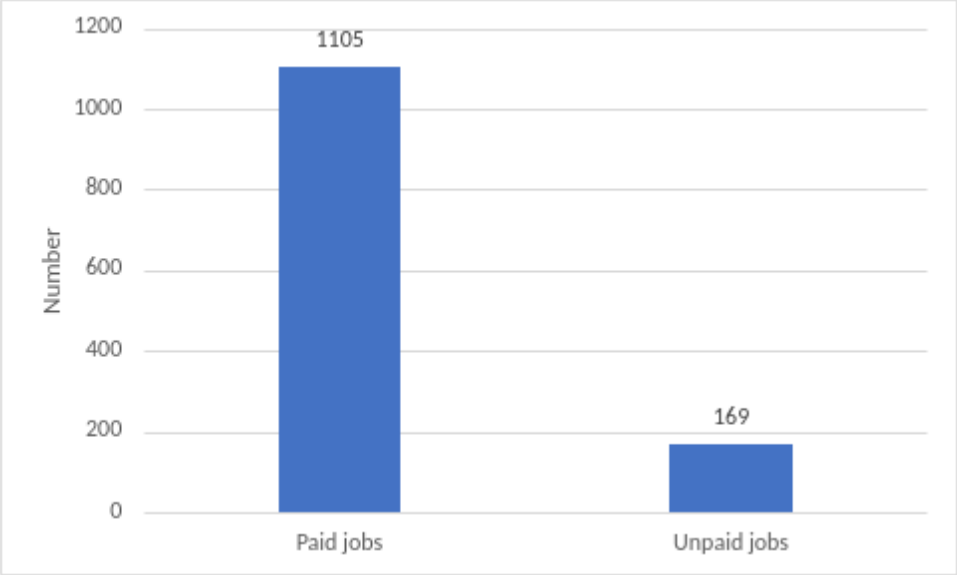



**Table 14. Statistics about employment.**

| Employment status | Number |
|---|---|
| **Total working** | 1,274 |
| **Total working for paid jobs** | 1,105 |
| **One full-time paid job** | 737 |
| **One part-time paid job** | 257 |
| **Multiple paid jobs** | 111 |
| **Total working for unpaid jobs** | 169 |
| **Volunteering or unpaid jobs outside of the home** | 61 |
| **Unpaid homemaking or caregiving at home** | 108 |
| **Not working** | 622 |

## Household income

We asked respondents about their household incomes and show the results in Figure 36 and Table 15, noting that respondents to version Q were forced to answer for quota purposes, so all 9 blank responses came from respondents to version NQ who were not forced to answer. These results show that the lowest income bracket ($0-14,999) was marginally underrepresented among survey respondents compared to the population of California (8% versus 9%) and every other income bracket was marginally overrepresented among survey respondents compared to the population of California, while the highest income bracket ($150,000+) was significantly underrepresented among survey respondents compared to the population of California (15%

versus 26%); this was likely helped by the deliberate design of the quotas for version Q to overrepresent the lowest income brackets, given the correlation of disability with poverty and the presence of significant income inequality in California.

**Figure 36. Statistics about household income. Each bar represents the income bracket whose minimum is the lower bound household income for that bar and whose maximum is just below the lower bound household income for the next bar (to the right); the bar whose lower bound household income is $150,000 has no maximum.**

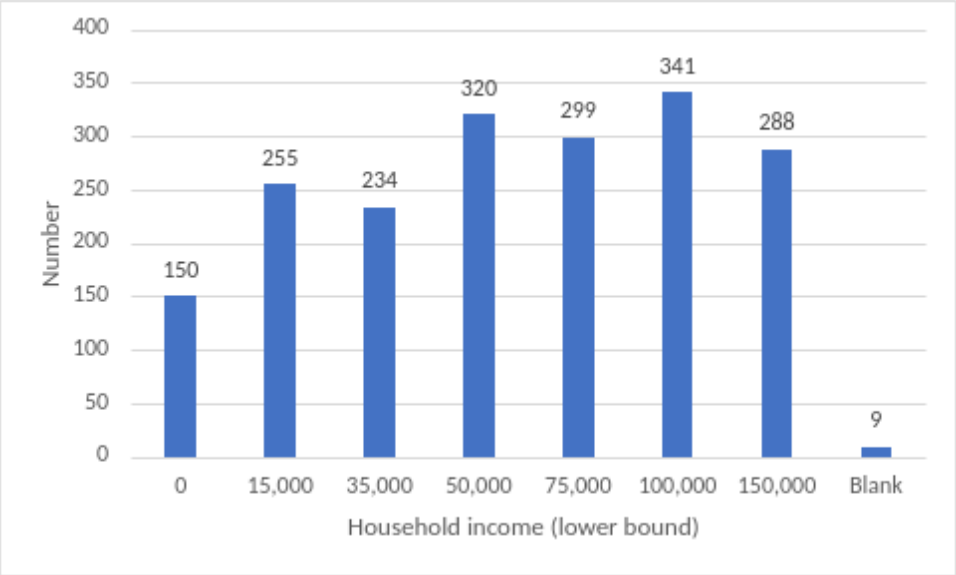



**Table 15. Statistics about household income.**

| Household income bracket | Number |
|---|---|
| **$0-14,999** | 150 |
| **$15,000-34,999** | 255 |
| **$35,000-49,999** | 234 |
| **$50,000-74,999** | 320 |
| **$75,000-99,999** | 299 |
| **$100,000-149,999** | 341 |
| **$150,000+** | 288 |
| **Blank** | 9 |

# Future Work

With respect to research, work to be done in the near future revolves around compiling and analyzing more basic statistics about the sample. These include but are not limited to statistics about geographic region as well as two- or three-way statistics involving various individual details like disability, gender, household income, employment, geographic region, age, ethnicity, and Hispanic/Latino identity, along with answers to key questions in the survey about extant neighborhood features, desired changes to neighborhood features, chosen and desired activity frequencies, and chosen and desired transportation mode usage frequencies. These analyses will help us start to understand the central question of this study: controlling for other factors, how does disability affect the choices and desires that people have for transportation mode usage frequencies, activity frequencies, and mode frequencies?

More advanced data analysis farther in the future will improve understanding of the same central question. Such data analysis will come through two main methods. First, we will extrapolate descriptive statistics about the sample to the population of California. This will require developing appropriate weights through cell weighting and iterative proportional fitting (also known as raking) techniques. These will help us understand the extent to which problems with transportation or neighborhoods that we see in the sample are representative of problems experienced by the adult population of California. Second, we will perform discrete choice modeling and similar regression techniques to avoid some (but by no means all or even the majority) of the problems that may come with extrapolation of results from relatively small samples to larger populations. This will allow us to predict how certain individual characteristics, after controlling for others, affect people's choices and desires for transportation, activity, and neighborhood.

With respect to policymaking, as we discussed earlier in this report, focus group participants wanted to ensure that their comments would ultimately be implemented as tangible policy to help people with disabilities; they were uncomfortable with the prospect that this study may become yet another report to sit passively on a shelf. We hope that policymakers will seriously consider the results presented here, especially given the implications for pedestrian infrastructure and public transit service, for policy implementation, and will continue to consider future quantitative results from this project.

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# Data Management Plan

## Products of Research

Data include survey data as well as transcripts of the focus group.

## Data Format and Content

The transcripts of the focus group are in plain text formats. The survey data file is in the CSV format.

## Data Access and Sharing

The data can be accessed on Dryad using the DOI https://doi.org/10.25338/B8RP9M. The files are significantly redacted. Users must contact the authors of this report for more detailed data.

## Reuse and Redistribution

The data files are public domain. Third party users should cite the work and send an email to the PI at pvenkataram@ucdavis.edu to inform about the use of the data. The data may be cited as follows:

> Venkataram, Prashanth; Circella, Giovanni; Flynn, Justin (2023), Cross-sectional study of the effects of disability on the mismatch of desires versus choices for transportation modes and residential location, Dryad, Dataset, https://doi.org/10.25338/B8RP9M