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Strategies to Overcome Transportation Barriers for Rent Burdened Oakland Residents

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Executive Summary

Shared mobility is gaining traction in the transportation community as a potentially more environmentally friendly alternative to automobile travel and complement to public transit. However, adoption and use of shared mobility by low-income individuals lags behind other demographic groups. Additional research is needed to better understand the transportation needs of low-income travelers and how public agencies, community-based organizations, and shared mobility operators can work together to best serve those needs.

RESEARCH QUESTIONS

- What are the transportation needs of low-income people?
- What are the main transportation barriers that low-income people face?
- How can low-income people use shared mobility to meet their unique transportation needs?
- What strategies can private operators, public agencies, and non-profit organizations use to facilitate access, awareness, and use of shared mobility by low-income people?

This research fills gaps in understanding the potential policy strategies that could be effective at increasing the access, awareness, and use of shared mobility by low-income individuals. We employ Oakland, California as our primary study site (see Figure 1 and Table 1 for more detail). In this report, we present our findings on barriers to shared mobility from a review of existing shared mobility social equity initiatives, expert interviews (n=13) and focus groups with rent burdened residents of East Oakland (n=24). We further investigate barriers and implications for transportation use in an online survey (n=177), as well as longitudinal panel of phone and video interviews (n=31) with rent burdened Oakland residents. *Rent burden refers to the percentage of income spent on rent and can more widely capture the population of Oakland residents who are struggling to keep up with rising housing costs.*

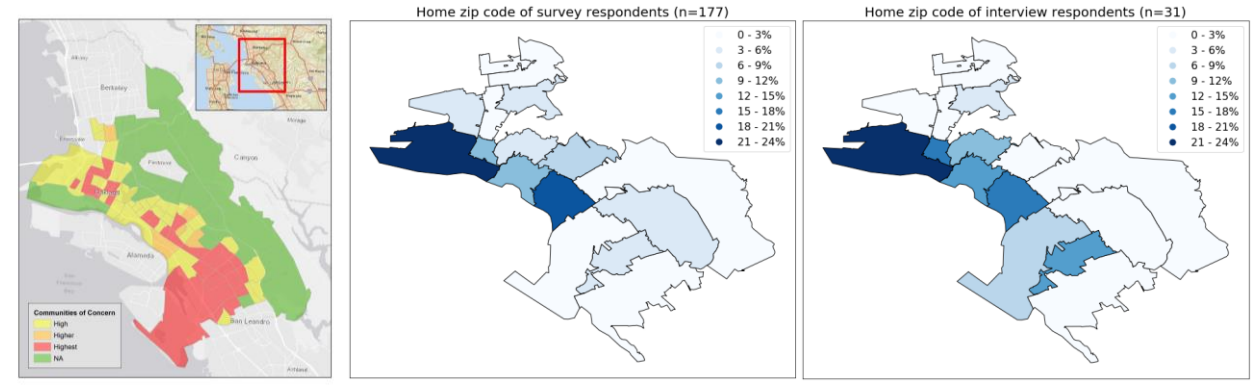

Figure 1: Oakland Communities of Concern (CoCs) (left), home zip code of survey respondents (middle), home zip code of interview respondents (right).

Note: CoCs are census tracts designated based on income, race, and other factors to evaluate the equity impacts of urban planning projects. There are three levels of CoCs: high (yellow), higher (orange), and highest (red). Census tracts that are not CoCs are shown in green.

	Focus group (n=24)	Survey (n=177)	Interviews (n=31)	**Oakland population**
Gender				
Male	42%	46%	32%	**48%**
Female	58%	52%	65%	**52%**
Non-binary	0%	2%	3%	**0%**
Age				
18 - 24	4%	17%	6%	**6%**
25 - 34	46%	45%	39%	**20%**
35 - 44	26%	26%	13%	**16%**
45 - 54	16%	2%	29%	**13%**
55 - 64	4%	7%	13%	**11%**
65 or older	0%	2%	0%	**13%**
N/A	4%	0%	0%	**0%**

	Focus group (n=24)	Survey (n=177)	Interviews (n=31)	**Oakland population**
Race				
Asian	4%	17%	16%	**16%**
Caucasian/White	50%	44%	35%	**37%**
Black/African American	38%	13%	39%	**23%**
Mixed race	8%	21%	10%	**7%**
Ethnicity				
Not Hispanic/Latino	46%	79%	77%	**74%**
Hispanic/Latino	54%	21%	23%	**26%**
Income				
< $10,000	17%	11%	16%	**6%**
$10,000 - $14,999	13%	12%	0%	**7%**
$15,000 - $24,999	21%	7%	16%	**8%**
$25,000 - $34,999	17%	21%	19%	**8%**
$35,000 - $49,999	17%	40%	19%	**10%**
$50,000 - $74,999	4%	40%	23%	**15%**
$75,000 - $99,999	0%	18%	6%	**11%**
> $100,000	8%	19%	0%	**37%**

Table 1: Demographics of research participants compared to Oakland population. Oakland population estimates come from the 2019 American Community Survey 5-Year Estimate.

Literature Review and Expert Interviews

Existing research on shared mobility equity often defines "low-income" as people who receive federal, state, or local assistance, and equity programs primarily use metrics such as number of users or number of trips taken by low-income users to measure program effectiveness. However, significant gaps still remain on *how* target populations use shared mobility once they become members and whether shared mobility helps users fulfill their transportation needs. In this research, we use qualitative methods to better understand how low-income residents make transportation decisions and their preferences and attitudes towards shared mobility. Further, we go beyond the standard definition of low-income and define our target population as rent burdened residents.

We identified three attributes of shared mobility that are important to consider for transportation equity: access, awareness, and usage (Figure 2). Access can refer to either spatial access (e.g., presence of vehicles in certain neighborhoods) or financial access (e.g., ability to sign up for a service without a credit card or bank account). Awareness can refer to knowledge of how to sign up for services, and knowledge of existing low-income programs or discounts. Access and awareness together can impact shared mobility use. In our research, we use qualitative data (e.g., focus groups, survey, and in-depth interviews) to further explore these attributes of shared mobility.

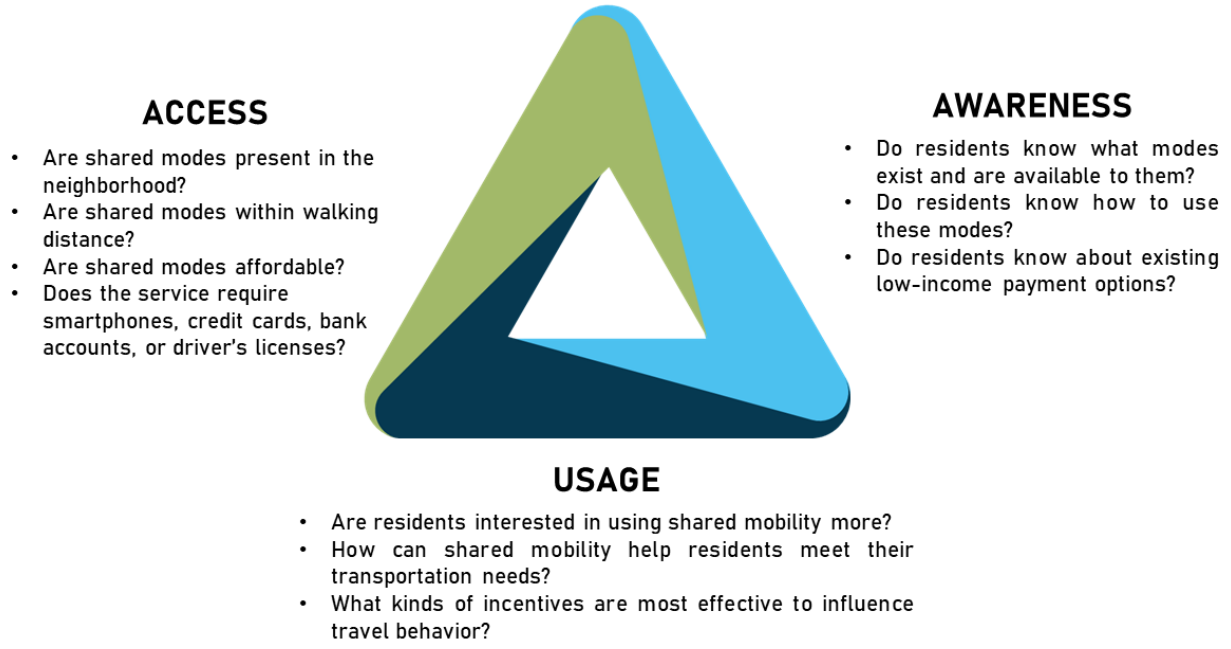

Figure 2: Attributes of Shared Mobility

KEY FINDINGS

- **Narrow definition of "low-income":** most existing work on shared mobility and transportation equity defines "low-income" as individuals who receive federal, state, or local assistance.
  - Expanding our scope to "rent burdened," or households spending more than 30% of their income on rent, encompasses a larger population who are also struggling to make ends meet.
- **Narrow use of evaluation metrics:** many shared mobility equity programs focus on increasing number of low-income members
  - Gaps remain in understanding *how* low-income people use shared mobility and whether access to it helps meet transportation needs.
- **Attributes of shared mobility:** we explore three attributes of shared mobility (access, awareness, and usage) through qualitative methods (e.g., focus groups, survey, and in-depth interviews).

Focus Groups

As part of our initial, exploratory research, we conducted three focus groups (n=24) with rent burdened East Oakland residents from November 2019 to December 2019. We conducted two focus groups in English (n=12) and one in Spanish (n=12). We found that participants rely on a range of transportation options to meet their diverse travel needs, mixing and matching public transit, driving, getting rides from family or friends, and various forms of shared mobility. When we asked participants what they wished were different about their daily travel, some participants said they wished they had a car, but many more wanted more frequent and reliable bus service. Speeding and erratic driving were also cited as major issues in the community, which discouraged residents from walking and biking.

"You need multiple plans in case one fails."

- Focus group participant, speaking about his use of transportation

Most participants had used transportation network companies (TNCs, also known as ridesourcing or ridehailing, such as Uber and Lyft). Participant trip purposes for TNCs included social/recreational trips, as a backup if their personal vehicle broke down, and for running errands. Some participants said that financial costs were a barrier to using TNCs more often while others, particularly those in deep East Oakland, had difficulty ordering a ride because drivers would cancel once they saw their address. For shared micromobility, such as electric scooter sharing and bikesharing, lack of access to vehicles in East Oakland was a major barrier to using these services. Few participants had heard of carsharing; however, after we explained the service, many participants, in particular those in the Spanish-speaking focus group who did not have access to a personal vehicle, were interested in using one-way carsharing for running errands.

We asked participants about their preferences for different types of incentives for shared mobility and public transit. For the Spanish-speaking group that had the least familiarity with shared micromobility, many liked the idea of a free trial for scooters. Free trials could be a low-risk way for new users to learn how to use a new mode and understand its application in their daily lives. For participants who had used shared micromobility, discounts on scooter trips that started or ended at BART stations were a popular option; discounted first mile-last mile (FMLM) scooter trips were also more popular than FMLM bikesharing or TNC trips. Finally, some participants discussed integrating shared mobility into Clipper cards, the regional transit card for the San Francisco Bay Area. Participants called Clipper cards a "transportation credit card," and felt that including shared mobility would allow for a more seamless travel experience. Participants said that integrated Clipper cards would increase their usage of shared mobility, even without a discount.

KEY FINDINGS

- **Multi-modal transportation**: most participants rely on a range of transportation options to meet their diverse travel needs
- **Better public transit service:** while some participants desired a car, more wanted frequent and reliable bus service
- **Barriers to shared mobility:** cost and spatial access (e.g., not being able to call a ride) were the greatest barriers to TNC use; spatial access (e.g., no scooters or bikes nearby) was the greatest to shared micromobility use
- **Free trials** are an attractive incentive for non-users to try a new service for the first time
- **"Transportation credit card":** Integrating shared mobility into regional public transit cards to create a "transportation credit card" would make it easier to use shared mobility and increase use of shared modes

Online Survey and Longitudinal Panel In-Depth Interviews

We explored questions of access, awareness, and usage of shared mobility in an online survey (n=177) conducted from August to December 2020 and in-depth longitudinal panel phone and video interviews (n=31) conducted from September 2020 to February 2021. We conducted three interviews, each 30 to 60 minutes long, with each interviewee over the period of several weeks. In this section, we first discuss interviewees' access, awareness, and usage of shared mobility, as well as their general transportation use, and preference for different types of discounts and incentives.

Access, Awareness, and Usage of Shared Mobility

In the survey, we found that overall shared mobility awareness is high, with over 90% of respondents stating they had heard of shared modes. About 40% said that they had seen bikesharing (e.g., Bay Wheels Bike Share), scooter sharing (e.g., Bird, Lime), or carsharing (e.g., Zipcar, GIG Car Share) vehicles on the street. However, the home zip code of people who had seen carsharing vehicles was more evenly dispersed throughout Oakland compared to bikesharing and scooter sharing, indicating some geographic differences in access to shared micromobility devices.

"I don't have the app I guess…I'm not really quite sure how it works."

- Interviewee, about why he doesn't use bikesharing even though he is interested in biking more

Our findings from the in-depth interviews build on survey findings to show how access and awareness can impact shared mobility use. For example, 28 of the 31 interviewees had seen docked bikesharing stations, indicating high access and awareness, but only five interviewees had used the service; this suggests that targeted outreach and education may be required to facilitate bikesharing adoption and usage. In contrast, more interviewees had tried scooter sharing after seeing devices on the street (n=8), indicating that having access and awareness of scooters was enough for some interviewees to try scooters for the first time. However, scooters were also more polarizing than bikesharing, as another seven interviewees had seen scooters and were not interested in trying them due to safety concerns or physical disabilities that limit mobility. Fewer interviewees had seen carsharing vehicles on the street (n=7). Interviewees who had used carsharing learned about the service through a friend, suggesting that personal networks are the most effective mechanism to encourage carsharing adoption and use.

"I just downloaded the app. Seeing them downtown in Oakland, it was just kind of compulsive, like, I'm going to try it out right here."

- Interviewee, about the first time she used shared electric scooters

General Transportation Use: Personal Vehicle

The percentage of zero-vehicle households was higher in both the survey sample (26%, n=46) and interviews (35%, n=11) compared to the general population in Oakland (16.5%). In the survey, among households without a personal vehicle, 52% used TNCs when they need auto access, 26% used carsharing, 17% got a ride from a friend or family member, and 13% borrowed a car. This suggests that shared mobility is providing non-car owners access to a car when needed.

"Car free" (n=4)	"Car less" (n=7)
"I don't have a car...I'm so happy when I say that!"	"Not having a car brings me a lot of stress...I feel stuck"
Live closer to Downtown Oakland and Lake Merritt	Live in Deep East Oakland or West Oakland
Good access to shared mobility and public transit	Rarely see shared mobility vehicles, poor transit quality

Table 2: Characteristics of "car free" vs. "car less" interviewees

Findings from the interviews shed light on differing perspectives of car ownership (see Table 2). Some interviewees described themselves as happily "car free," while others talked about saving

up to purchase a car soon or feeling constrained without a car, "car less." Notably, "car free" and "car less" interviewees were located in different areas of Oakland. "Car free" interviewees generally had better access to other forms of transportation and lived in areas where having a car was stressful because of parking and traffic. "Car less" interviewees had worse access to other forms of transportation; for these interviewees, having a car would make it easier to get around.

In addition to the "car free" and "car less" respondents, there were many interviewees that either had their own car or were considering purchasing a car in the future. For two interviewees, the COVID-19 pandemic played a role in their desire for a car; both interviewees wanted to avoid taking public transit, and a personal vehicle would enable them to social distance. Several interviewees also mentioned the California wildfires and poor air quality in September 2020 as a reason for wanting a personal vehicle.

General Transportation Use: Public Transit

We also found differences in perceptions and use of public transit based on geographic location. Interviewees who took public transit to San Francisco or Downtown Oakland as part of their commute had positive experiences; six interviewees said they loved taking the bus because it gave them a sense of community, and some interviewees saw public transit as a chance to escape from the stress of traffic and saw commuting as productive time. However, riders who travel during off-peak hours had a different experience; two interviewees stated explicitly that public transit worked best for commuters and not for anyone else. This notable difference in public transit quality had serious implications for one interviewee: after moving further away from her job and being assigned to the graveyard shift, she purchased a car in June 2020 rather depend on public transit.

"I always say, it's the bus's fault I started driving."

- Interviewee in East Oakland

Issues with public transit were most prominent for four interviewees who live in deep East Oakland. These residents had noticed bus quality degrading over time, as AC Transit split some routes and moved bus stops or removed them entirely. For two interviewees, unreliable and degrading bus service resulted in them learning how to drive and purchasing a car. For one interviewee, taking the bus meant constantly dealing with delays, rude bus drivers, and other riders that would make her feel unsafe, which ultimately pushed her to get her driver's license at 23: "I always say, it's the bus's fault that I started driving."

Service reductions in public transit due to the COVID-19 pandemic notably impacted one interviewee. This individual who was still commuting to work in-person began driving her car more often, both to avoid other passengers on public transit and because bus headways were too long. Another interviewee continued to use BART to commute to San Francisco and found the experience better during COVID-19 because of increased cleaning and fewer people on the train.

General Transportation Use: Shared Mobility

Our interview findings expanded on survey findings about how respondents use shared mobility to fill gaps in their transportation needs not served by other modes. For example, one interviewee relied on scooters to get to BART every morning and was unpleasantly surprised when scooters were taken off the street in late-March 2020 due to the pandemic: "one day I walked outside, and

I was screwed." One interviewee initially used the bus to get to BART, but she noticed that in the early morning, bus headways could be 30 or 40 minutes. She began using scooters instead and could get to BART in just seven minutes. While the majority of interviewees used scooters only occasionally and for recreational purposes, these examples demonstrate how some Oakland residents are using scooters as a way to make connections to public transit.

Three interviewees relied on TNC rides for work-related travel. One interviewee lives in West Oakland and occasionally needs to commute to San Francisco to start work at 4:30 am. Since she does not have a car, the only transportation option available to her at that time is a TNC. Another interviewee would take close to $350 worth of TNC rides every month to get to and from work and meetings during the day because she did not feel that she could rely on public transit to get there in time. These examples not only demonstrate how TNCs fill gaps in public transit but also show the financial burden of reliance on TNCs. Furthermore, reliance on TNCs has made travel more difficult during the COVID-19 pandemic. Some interviewees mentioned that TNC wait times had increased, with one individual saying that what had previously been a five-minute wait time had doubled to ten minutes. Two interviewees mentioned spending more on TNCs during the pandemic due to the unavailability of shared (or pooled) ride options.

Shared Mobility, Public Transit, and Alternative Fuel Vehicle Incentives

Shared mobility. Two respondents said discounts on scooter trips that connect to public transit or ticket "bundles" for scooters and public transit would encourage them to try scooters for the first time. Other interviewees, particularly those who live in East Oakland with less shared scooter access, were interested in a monthly rental option, where users pay a monthly fee for unlimited access to their own scooter. While interviewees were interested in discounted TNC rides, they still thought that the base price of TNCs was too high to use consistently. Almost all interviewees in the sample would consistently use shared or pooled TNC rides with strangers over private rides because they are cheaper. However, additional discounts for shared rides would not impact the decision to take shared rides due to other factors such as wait time and travel time.

Several interviewees found a Mobility Wallet (i.e., a mobility-as-a-service (MaaS) or mobility on demand (MOD) subscription concept) appealing, similar to the regional public transit "transportation credit card" idea from the East Oakland focus groups. Interviewees liked the convenience of integrating services and being able to see different public agencies and shared mobility on a single platform. A Mobility Wallet would also make it easier to budget and give users an easy way to compare between different options (e.g., costs, travel times, discounts, etc.).

Public transit. Of all the discounts discussed in the interviews, the most appealing ones were for public transit. Most interviewees found BART too expensive and felt that trip costs added up quickly when transferring between BART and public bus. Interviewees mentioned that AC Transit waiving fares during the pandemic financially assisted them and/or their friends and family members. More broadly, public transit discounts would help respondents access more jobs and economic opportunities and enable respondents to save money. Seven interviewees said that free or fareless transit would either encourage them to give up their car or postpone a car purchase; these interviewees primarily use their car for grocery shopping, errands, and recreational trips, and

not for commuting. For another four interviewees, fareless transit would not impact their decision to own a car and would instead allow them to save money toward a car purchase.

Alternative fuel vehicles. The majority of interviewees in the sample were interested in a hybrid or electric vehicle because it would save on fuel and maintenance costs compared to a gasoline vehicle. However, interviewees did not think that existing tax credits were an attractive purchase incentive. All car owners in the sample had purchased used cars and could not afford the upfront costs of a new vehicle or did not want to take out a car loan. For low-income and rent burdened populations, tax credits for new vehicles may not be helpful.

"I don't like to take on debt. I'd rather buy an older car and own it outright so I never have to worry about missing a payment. So for me, it wouldn't be just about tax credit."

- Interviewee, about a tax credit for hybrid or electric vehicles

KEY FINDINGS

Access and Awareness

- **High awareness of shared mobility:** over 90% of survey respondents had heard of shared modes, and 40% had seen vehicles on the street.
- **Targeted outreach and education** may be required to facilitate adoption and usage of some shared modes. For example, although respondents lived within walking distance of bikesharing stations, many did not know how to sign up or use the service.

Usage

- **Shared mobility fills gaps in car ownership:** the majority of non-car owners (52%) use TNCs when they needed car access, followed by carsharing (26%), getting a ride from a friend or family member (17%), and borrowing a car (13%).
- **Geographic differences in perceptions of car ownership:** being "car free" in Downtown Oakland or Lake Merritt is easier than being "car less" in East and West Oakland.
- **Public transit works best for riders during standard commute hours.** For respondents who travel outside of those hours, TNCs are more reliable. Some respondents have also purchased a personal vehicle to avoid taking public transit.
- **Impacts of COVID-19 on shared mobility:** Interviewees who rely on TNCs have found travel more difficult during the COVID-19 pandemic due to longer wait times and more expensive trips because of lack of shared (or pooled) options. Interviewees who rely on scooters to get to BART were impacted when companies pulled their fleets in March and April 2020.

Incentives

- **Scooter-to-BART ticket discounts:** offering discounts for scooter-to-BART trips would encourage some interviewees to try scooters for the first time.
- **Monthly rental options:** monthly rentals that provide long-term access to a personal scooter could address spatial access issues for shared micromobility in East Oakland.
- **Integrating public and private transportation options into a Mobility Wallet** (i.e., mobility-as-a-service or mobility on demand), including seamless access to discounts and incentives, would make it for interviewees easier to plan trips and compare prices across modes.
- **Discounted or fareless public transit** would increase access to economic opportunities and postpone, reduce, or supplant the need for a private vehicle. Several respondents said that AC Transit waiving fares for several months during the COVID-19 pandemic eased the financial burden of transportation for them and/or their friends and family members.

Conclusion and Policy Recommendations

In this research, we first provided an overview of the current landscape of social equity in shared mobility through a literature review and expert interviews. We identified three main attributes of shared mobility: access, awareness, and usage. We adopted these attributes as our framework for evaluating transportation use and barriers to transportation for rent burdened Oakland residents. Our findings from the focus groups, online survey, and in-depth interviews inform the conclusions and policy recommendations below.

Participants are using shared mobility to make trips more quickly and reliably, including connections to public transit. Shared mobility is particularly useful for participants who commute outside of standard work hours when public transit is unreliable. These participants instead used TNCs; however, using TNCs too often could be costly and contributed to the desire to own a personal vehicle. Some respondents also consistently use shared electric scooters or TNCs to access BART stations.

Barriers to shared mobility persist, particularly for research participants in East Oakland and non-English speakers. Lack of vehicles in East Oakland was a barrier to using shared micromobility. High costs of TNCs were also a barrier. As a whole, Spanish-speaking focus group participants had less awareness of different shared mobility options, particularly carsharing, but after learning more about the service, expressed interest in using shared mobility.

Investing in programs that go beyond addressing spatial accessibility, and instead focus on awareness of shared mobility and existing discount programs, can increase adoption by rent burdened residents. Some suggestions from respondents include increasing the presence of shared mobility companies at large community events (e.g., street fairs) and hosting informational sessions about shared mobility options at public libraries. Offering and advertising free trials can also be a low-risk way for new users to try a service for the first time and gain confidence with using the service.

Monthly rental pricing options for shared micromobility can address spatial accessibility issues. For participants who lived in areas with less access to shared electric scooters, bikesharing, and shared electric mopeds, monthly rental options that provide long-term, unlimited access to a personal vehicle were an attractive option.

Integrated Mobility Wallets (i.e., mobility-as-a-service or mobility on demand) that build on existing regional public transit passes can better support multi-modal lifestyles. The majority of research participants use a combination of transportation modes to meet their unique travel needs. Participants felt that platforms that integrate many different transportation options would make it easier for trip planning and budgeting by enabling users to compare travel time and cost more easily across modes.

Incentives for shared mobility connections to public transit. Some participants are already using shared mobility to connect to public transit, while others said that ticket bundles for shared mobility and public transit would encourage adoption and increase use of shared modes. Mobility Wallet concepts should include discounts or incentives that prioritize connections to public transit.

Increase the reach of programs that provide subsidies and discounts for "narrowly" defined low-income populations to also capture the rent burdened population. In the Bay Area, where living costs are high, many interviewees did not qualify for transportation discounts, like Clipper START or Bike Share for All, despite having a high rent burden. The high cost of public transit, in particular BART, constrained some interviewees when searching for jobs. One interviewee used bikesharing frequently but said that it was because her partner received a free membership through work. Without this free membership, she would not have been able to afford a membership on her own, and she did not qualify for Bike Share for All.

Discounted or fareless transit can potentially postpone or reduce the need for a personal vehicle. Discounts on public transit would benefit rent burdened residents financially, and not only enable them to save more money, but also potentially reach more jobs, social events, and improve their quality of life. Many participants also said that discounted or fareless transit would reduce their need for a personal vehicle.

While our research is limited to exploring a single geographic region of Oakland, California with a small sample size of rent burdened residents (n=232 total participants), we uncovered many insights. It is important to note that the population of respondents included in this research is not representative of all rent burdened Oakland residents. Nevertheless, our research demonstrates the power of qualitative methods through storytelling over time to develop a deeper understanding of the complex issues surrounding transportation equity, as well as strategies that can help to address the specific needs of rent burdened residents.

Section 1. Introduction

Shared mobility is gaining traction in the transportation community as a more environmentally friendly alternative to automobile travel, a more flexible and convenient alternative to public transit, and as a supplement for regions and times of day not covered by public transit. Shared mobility gives users short-term access to a transportation mode, such as a car, bicycle, or scooter, on an as-needed basis (Shaheen et al., 2017). The growth of shared mobility can in part be attributed to more sophisticated GPS and wireless technology, wide proliferation of smartphones, and advances in vehicle technology and alternative modes such as electric bicycles and scooters. However, adoption and use of shared mobility by low-income individuals lags behind other demographic groups (Shaheen et al., 2017). Additional research is needed to understand the specific needs of low-income communities and how public agencies, community-based organizations, and shared mobility operators can work together to best serve those needs.

This research fills gaps in understanding what policy strategies are most effective to increase the access, awareness, and usage of shared mobility by low-income groups. We first conduct an extensive review of existing shared mobility equity programs to understand the current landscape of transportation equity. We then supplement the literature review with expert interviews (n=13) and focus groups with low-income residents of East Oakland, California (3 groups, n=24 total participants) to develop an understanding of existing barriers to shared mobility. We explore these barriers and implications for transportation use further in an online survey (n=177) as well as longitudinal phone and video interviews with 31 rent burdened Oakland residents.

In Section 1 of this report, we provide some background on the research site of Oakland, California and theoretical framework used to guide this research. We present relevant literature on equity in transportation and shared mobility as well as a review of shared mobility equity pilot projects in Section 2. In Section 3, we provide an overview of the research methodology. In Section 4 we present findings from interviews with experts in transportation equity and shared mobility. These interviews provide insights on the design and implementation of equity related projects. In Section 5 we present findings from focus groups on the specific transportation needs and barriers facing rent burdened residents of East Oakland. In Section 6 we summarize findings from the online survey and resident interviews. Finally, combining the experience of experts and quantitative data with the voices of a historically marginalized community, we conclude the report in Section 7 with recommendations and best practices for developing effective and inclusive transportation equity policy.

Background

Oakland, California is the largest city in the East Bay region of the San Francisco Bay Area. The total population is 448,313 as of the 2019 American Community Survey 5-Year Estimates. A detailed table summarizing the demographics of Oakland is shown in Table 3.

Demographic	Oakland Population	Demographic	Oakland Population
Gender		**Race**	
Male	48%	Asian	16%
Female	52%	Caucasian/White	37%
Non-binary	0%	Black/African American	23%
		Mixed race	7%
Age			
18 - 24	6%	**Ethnicity**	
25 - 34	20%	Not Hispanic/Latino	74%
35 - 44	16%	Hispanic/Latino	26%
45 - 54	13%		
55 - 64	11%	**Income**	
65+	13%	Less than $10,000	6%
		$10,000 to $14,999	7%
Car ownership		$15,000 to $24,999	8%
No vehicle	16%	$25,000 to $34,999	8%
At least 1 vehicle	85%	$35,000 to $49,999	10%
		$50,000 to $74,999	15%
		$75,000 to $99,999	11%
		$100,000 or more	37%

Table 3: Demographics of Oakland. Data from ACS 2019 5-Year Estimates.

Geographic Context

A map of Oakland is provided below in Figure 3 on the right. This map includes specific neighborhood names, which are referenced in this report. In Figure 3, on the left, is a map showing

Communities of Concern in Oakland. Communities of Concern (CoC) are census tracts determined by the Metropolitan Transportation Commission (MTC), the Metropolitan Planning Organization covering the nine counties of the San Francisco Bay Area. MTC developed the CoC framework as part of the Plan Bay Area 2040 project to evaluate the equity impacts of planning projects. MTC uses eight criteria to identify CoCs, including minority status, low income, zero-vehicle household, and severely rent-burdened household. A summary of these criteria, as well as thresholds used to designate CoCs, is provided in Table C1 in Appendix C. There are three levels of CoCs (high, higher, and highest).

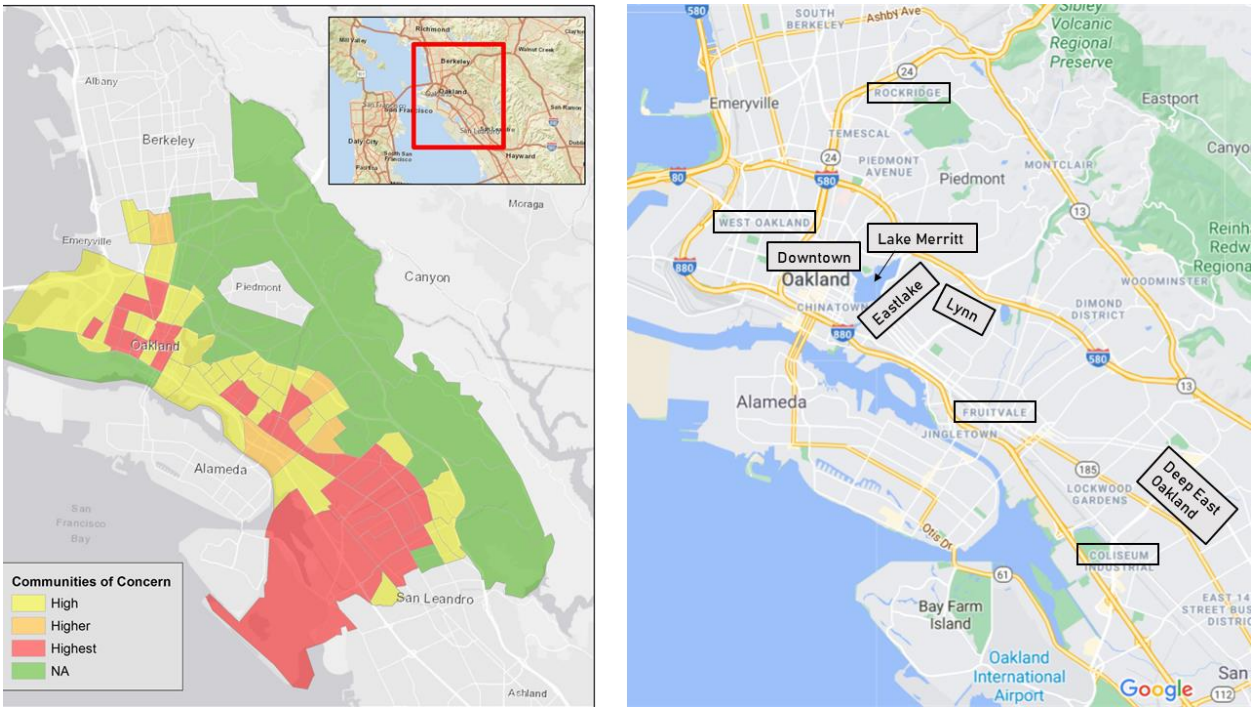

Figure 3: Communities of Concern in Oakland (left) and Oakland neighborhood names (right)

Transportation Options

Oakland is part of the Bay Area Rapid Transit (BART) District service area. BART is a heavy-rail public transit system that operates in five counties of the San Francisco Bay Area and connects the East Bay with San Francisco and cities in the South Bay. BART has 131 miles of track and 50 stations, 8 of which are in Oakland. Prior to the COVID-19 pandemic, BART averaged approximately 405,000 trips on an average weekday (*About | Bart.Gov*, n.d.). Oakland is also served by a public bus system, the Alameda-Contra Costa Transit District (AC Transit). AC Transit serves 13 cities in Alameda and Contra Costa counties and has 158 bus lines and about 5,400 bus stops. Prior to the COVID-19 pandemic, AC transit averaged approximately 175,000 trips on an average weekday (*Ridership, Buses, and Service | Alameda-Contra Costa Transit District*, n.d.). Both BART and AC Transit are part of a consortium of public transit agencies that provide paratransit services in the San Francisco Bay Area, which averages approximately 741,000 annual trips. BART and AC Transit also recently became part of the Clipper START program, a low-income public transit discount program launched in July 2020 by MTC. Residents in the Bay Area may qualify for Clipper START if they have a household income less than 200% of federal poverty

level. Through Clipper START, riders receive a 20% discount on BART and AC Transit rides, as well as discounts for 19 other transit agencies in the Bay Area (*Clipper START*, 2020). Service area maps for BART and AC Transit are provided in Figure C1 in Appendix C.

Outside of public transit, Oakland also has shared mobility options. Both Uber and Lyft currently operate in Oakland. Docked bikesharing is offered through a public-private partnership between Bay Wheels Bike Share and MTC. As of March 2021, there are three electric scooter operators in Oakland (Link, Spin, and VeoRide). Previous scooter operators in Oakland have included: Lime, Bird, Lyft, and Gruv. Shared electric mopeds are available in Oakland through Revel. Carsharing operators in Oakland include GIG Car Share (one-way carsharing), Zipcar (round-trip carsharing), Turo, and Getaround (peer-to-peer carsharing). Service area maps for shared mobility, including bikesharing, one-way carsharing, shared electric mopeds, and scooter sharing, are provided in Figures C2a-d in Appendix C

In Oakland, there are low-income discounts available for bikesharing and scooter sharing. The low-income discount program for bikesharing is called Bike Share For All. Residents who currently receive CalFresh (federally known as the Supplemental Nutrition Assistance Program, or SNAP), a San Francisco Municipal Transportation Agency low-income transit pass, or PG&E CARE utility discounts qualify for a $5 annual membership for Bay Wheels bikesharing (*Ride*, n.d.). For electric scooter share operators, the city of Oakland required operators to offer a low-income discount as part of the permit process allowing operators to have scooters in the city. As one example, the Link low-income discount, called Link-Up, provides qualifying users with up to a 70% discount on every ride. Qualifying users must show proof of enrollment in a local, state, or federally-run assistance program, such as SNAP, discounted utility bill, or discounted transit pass (*LINK-Up Program*, n.d.).

Population of Interest

The overview of equity pilots in shared mobility that we provide in Section 3 indicates that most low-income discounts and other equity discounts for shared mobility use 200% of the Federal Poverty Line or receipt of other social services as qualification criteria. Our search of low-income discounts available for transit riders or users of shared mobility in Oakland show similar findings. However, the CoC map of Oakland indicates that the majority of census tracts, representing 64% of Oakland residents, are designated CoCs. Because the criteria for CoCs is broader than criteria to enroll in federal, state, or local assistance programs, residents that live in CoCs may struggle to meet their everyday needs, yet still may not qualify for discount programs such as Clipper START or Bike Share For All. In this research, we propose instead to focus on the needs of these residents who may not be captured in conventional assistance programs by defining a target population of residents who experience rent burden. Rent burden is defined as the percentage of income that a household spends on monthly rent. The U.S. Department of Housing and Urban

64% of Oakland residents live in communities of concern, yet may not qualify for low-income transportation discounts such as Clipper START and Bike Share For All

Rent burden: the percentage of income that a household spends on monthly rent

A household is **rent burdened** if it spends >30% of income on rent and **severely rent burdened** if it spends >50% of income on rent

Development considers a household "rent burdened" if it spends more than 30% of their income on rent, and "severely rent burdened" if it spends more than 50% of their income on rent (*Rental Burdens: Rethinking Affordability Measures | HUD USER*, n.d.). The 2019 ACS 5-Year estimate for Oakland indicates that over 50% of Oakland households are rent burdened, though there is no data available for severe rent burden. However, MTC does use severe rent burden as one criteria for designating CoCs. Rent burden also varies with income, as lower income households are more likely to spend a higher percentage of their income on rent compared to higher income households.

Rent burden is a useful criteria not only because it may capture a larger population of residents who struggle with everyday costs, but also because it relates the rising cost of living in the Bay Area with housing location choice and impacts on transportation. Zuk & Chapple (2015) conducted a case study of nine communities in the San Francisco Bay Area to examine the impacts of gentrification and displacement and how these forces have impacted communities over time. The San Francisco Bay Area is home to four of the ten most expensive counties in the United States. Furthermore, the proximity of the Bay Area to Silicon Valley has resulted in rapid growth of high-income jobs and a shrinking middle class. They also found that investments in transportation and infrastructure have direct linkages to processes of gentrification and displacement. We thus use the criteria of rent burden to identify the research population.

Transformative Framework

Transformative framework: research must be intertwined with politics and a political change agenda to confront oppression and inequality in society.

We used the transformative framework to guide our research process, from defining the research scope, to design of research instruments, including survey and interview questions, to the final evaluation and recommendations. The transformative framework for research arose in the late 1980s from a group of researchers who felt that the existing assumptions in literature did not account for marginalized individuals. Instead, the transformative framework states that research must be intertwined with politics and a political change agenda to confront oppression and inequality in society (Mertens, 2010). The key characteristics of the transformative framework include: 1) challenging existing assumptions underlying the production of research that result in oppressive social structures and exclusion; 2) relationship- and trust-building with the community of study; and 3) dissemination of findings in a way that encourages use of results to enhance social justice (Creswell, 2014). Mertens adds that research must be conducted with the explicit goal of creating a more just and democratic society (Mertens, 2004).

In this research, we challenge conventional methods of transportation research for low-income individuals by using qualitative methods to interface directly with community members, allowing them to express their choices and stories in their own words. Relationship- and trust-building were central to our research process, starting from our close partnerships and collaborations with community-based organizations in Oakland, California. Finally, one of our goals from this research is to make findings accessible and easily understood not only by academic audiences, but also by a general audience that includes community members, policymakers, and private companies.

Section 2. Literature on Transportation Equity

In this section, we define transportation equity using relevant scholarship and research and identify an equity framework that we will use to guide our evaluation of equity in different shared modes. Then, we explore the current landscape of transportation equity, specifically with regards to shared mobility, and summarize transportation equity pilot projects both completed and ongoing.

What is transportation equity?

Equity is commonly defined as the morally proper distribution of benefits and burdens over members of society (Martens et al., 2019). In the context of transportation, the Greenlining Institute, a racial, economic, and environmental justice non-profit organization, defines mobility equity as "a transportation system that increases access to high quality mobility options, reduces air pollution, and enhances economic opportunity in low-income communities of color" (Creger et al., 2018). We will use this definition of mobility equity to guide our research on the adoption and usage of shared mobility platforms by rent burdened residents of Oakland.

Mobility equity: "a transportation system that increases access to high quality mobility options, reduces air pollution, and enhances economic opportunity in low-income communities of color"

The issue of transportation equity arises from historical transportation planning decisions and investments that have resulted in unequal land-use patterns and access to transportation options that disproportionately affects the health and economic opportunities of low-income communities and communities of color (Creger et al., 2018). Much of the built environment and transportation planning is centered on personal vehicles, yet low-income people have lower levels of vehicle ownership compared to the rest of the population (Cohen & Cabansagan, 2017). Lack of access to a personal vehicle limits accessibility to jobs, social services, health care, and other necessary destinations. Ong & Miller (2005) find in Los Angeles that lack of vehicle ownership is correlated to higher unemployment rates, especially among African Americans and Latinos. This problem is further exacerbated in California by rising housing costs that have pushed low-income households further away from their jobs and from public transit (Espino & Truong, 2015).

In recent years, companies offering innovative mobility solutions such as bikesharing, carsharing, and transportation network companies (TNCs, also known as ridesourcing and ridehailing) have disrupted the transportation field. As these mobility options change how people use transportation, there is an opportunity for planners and policymakers to intervene and ensure a more equitable and sustainable system.

Shared Mobility Equity Framework

Kodransky & Lewenstein (2014)'s framework defines barriers for users and can be used to identify opportunities for improving the accessibility of shared mobility services. These barriers are summarized in Table A1 in Appendix A (Kodransky & Lewenstein, 2014). We primarily use Kodransky and Lewenstein's framework to guide the assessment of equity in different shared modes.

Equity in Shared Mobility

In this section, we present an overview of the state of equity in different shared modes: shared micromobility (including electric scooter sharing and bikesharing), TNCs, and carsharing. For each mode, we first summarize the demographics of existing users, then highlight major user barriers using Kodransky and Lewenstein's framework. Finally, for each mode, we summarize actions that operators have taken to address user barriers.

Shared Micromobility: Bikesharing

Micromobility refers to the use of bicycles, scooters, and other low-speed modes of transportation (Shaheen & Cohen, 2019). Shared micromobility takes the form of either public bikesharing or standing electric scooter sharing. Bikesharing is the shared use of a bicycle fleet that allows users to rent bicycles as needed. The two primary forms of bikesharing are station-based and dockless. Station-based bikesharing systems have pre-installed stations where users can pick up a bike. Bikes must be returned to a station at the end of the ride. Dockless bikesharing systems allow users to pick up and return bikes at any location within a defined geographic zone. Scooter sharing systems work similarly to dockless bikesharing. Users have access to a fleet of shared, standing, electric scooters that they can pick up and return to any location in a geographic zone.

Public bikesharing in the U.S. tends to follow a station-based model, where users can check out and return bikes at bicycle stations, or docks, at different locations around a city. Many barriers to biking also apply to public bikesharing, though bikesharing also has unique barriers of its own. In this section, we first discuss the demographics of cyclists as a whole before focusing on bikesharing specifically.

Demographics

Biking and other forms of active transportation such as walking and running have been linked to lower rates of self-reported obesity and diabetes (Pucher et al., 2010). However, other researchers have found that active transportation is not equally accessible to all populations and therefore the positive health impacts are not distributed equitably. It is well-documented in the United States that there are significantly fewer female than male cyclists (Emond et al., 2009; Nehme et al., 2016), though this is not the case in other countries such as the Netherlands, Germany, and Denmark (Emond et al., 2009). The lower rate of female cyclists in the United States is often attributed to higher risk aversion and reluctance to cycle next to cars, exacerbated by the lack of bicycle infrastructure in the U.S. compared to cities in Europe (McCullough et al., 2019).

Invisible cyclists: low-income cyclists of color underrepresented in mainstream bicycle research, policy, and advocacy

On the other hand, cyclists in the United States have been found to be surprisingly diverse in racial and ethnic background. Both Hispanic/Latino and Native populations reported a higher percentage of commute by bike compared to the white population. The fastest growth in trips taken by bikes is among African Americans, Asians, and Hispanics/Latinos (The League of American Bicyclists & The Sierra Club, 2013). Smart (2010) found that recent immigrants to the United States are twice as likely to bike as the native-born population.

Some researchers have coined the term "invisible cyclists" to refer to low-income cyclists of color that are underrepresented in mainstream bicycle research, policy, and advocacy (McCullough et al., 2019). The lack of representation of racially and gender diverse cyclists in advocacy circles poses problems for addressing the specific barriers faced by diverse cyclists that are not faced by other cyclists. Through 28 in-depth interviews with cyclists conducted in Portland, Oregon, Lubitow (2017) discovered that female cyclists feel more visible when cycling and experience gendered harassment from passersby on the street. Meanwhile, the people of color who she interviewed feel more visible to police and have felt less safe while cycling due to recent incidents involving police brutality. This finding is quantitatively corroborated with a study from Stanford University that found that 73% of bicyclists pulled over in Oakland, California were Black, while only 28% of the total population is Black (McCullough et al., 2019). Disproportionately high ticketing and arrest rates of Black cyclists were also found in Chicago, Tampa, New Orleans, and Minneapolis (McCullough et al., 2019). Cyclists of color also reported that motorists seemed less likely to stop for them at crosswalks compared to white cyclists (Lubitow, 2017). Additionally, there are disparities in access to safe biking infrastructure that result in higher fatality rates for Hispanic/Latino and African American riders (The League of American Bicyclists & The Sierra Club, 2013).

Disproportionately more Black cyclists are pulled over or ticketed by police (e.g., 73% of cyclists pulled over in Oakland, California were Black, compared to 28% of the population)

Though cyclists in the U.S. are diverse, users of bikesharing are not – more likely to be young, Caucasian, middle- to high-income, and highly educated

Though bicycle users in general are fairly diverse in the U.S., studies of station-based bikesharing have found that users are likely to be young (under the age of 35), Caucasian, middle- to higher-income, and highly educated (Shaheen et al., 2012, 2014). These studies have found between 74-92% of users are Caucasian, 29-39% earn a household income of more than $100,000 per year, and 37-54% are under the age of 35.

User Barriers to Bikesharing

Structural

Structural barriers include impeded access to bikeshare stations and insufficient coverage of the bikesharing network. A spatial analysis of 42 bikesharing systems in 72 places in the U.S. found that only 12% of stations were located in census tracts with high economic hardship (Smith et al., 2015). Similarly, Ursaki & Aultman-Hall (2016) conducted a spatial analysis in six U.S. cities and found that in five cities, the percentage of white residents with access to bikeshare was significantly higher than the percentage of Black residents. A survey of residents in low-income neighborhoods and communities of color found that people of color were more likely to cite far away destinations as a barrier to using bikeshare (McNeil et al., 2017).

These structural barriers are present in the Bay Area as well. A report from TransForm looked at the expansion plans for Bay Area Bike Share (now called Bay Wheels) and found that, though the expansion will cover most of Oakland, significant portions of East Oakland are left out. Population

density is a main driver for the expansion but TransForm found that racial and income biases may be influencing the choice of expansion areas. For example, Rockridge is a predominately white and affluent neighborhood that has bikesharing stations and has a density of 6 to 12 households per square acre. This residential density is comparable to predominantly minority and low-income neighborhoods in East Oakland, where no expansion has been planned (Brown, 2017).

Financial

The cost of using public bikesharing, which includes a one-time membership fee and recurring usage fees, was a commonly cited barrier for low-income individuals (Hoe, 2015; McNeil et al., 2017). Credit card requirements were also a barrier, as some low-income individuals either do not have a credit card or do not want to use it (McNeil et al., 2017; Stewart et al., 2013). McNeil et al. (2017) found that some low-income individuals who did have a credit or debit card were still reluctant to sign up for bikeshare with the card. These individuals were afraid of overdrafting their bank account with unexpected costs, such as paying for damage to the bike or losing the bike.

Informational and Cultural

Two studies found that low-income individuals were less likely to have information about bikesharing and how to use it. Some respondents thought the bike check out and return process seemed confusing (McNeil et al., 2017). Low-income respondents to an intercept survey in Philadelphia did not know how to sign up for bikesharing and some did not know that a credit card was not required for sign up (Hoe, 2015). Inadequate or ineffective marketing and outreach could explain the knowledge gap between low- and high-income individuals. In a case study of Denver B-cycle, Kodransky & Lewenstein (2014) found that low-income individuals avoided promotion materials received in the mail because it seemed too governmental and not approachable. In a survey of bikesharing operators, some stated that confusing instructions and lack of multilingual options at bikesharing stations limited uptake by equity populations (Howland et al., 2016).

Summary of Bikesharing Barriers

- Bikesharing stations are more likely to be located in high-income neighborhoods, leaving low-income communities with less access to bikesharing services
- High costs, including membership and user fees, as well as credit card requirements are financial barriers for low-income users
- Inadequate or ineffective marketing and outreach targeting low-income communities results in knowledge gap in what bikesharing is and how to use it

Addressing Barriers to Bikesharing

As bikesharing operators have an increasing awareness of equity gaps in bikesharing service, operators have begun taking steps to address these gaps. McNeil et al. (2019) conducted a survey of bikesharing operators, city agencies, and community partners in the U.S. The majority gave detailed responses for how they were incorporating equity into their operations. These equity initiatives largely target specific populations, most commonly low-income individuals, certain neighborhoods, and different racial and ethnic groups. Half of the organizations focused on achieving equitable station siting by placing more stations in low-income neighborhoods and prioritizing the redistribution of bikes to those stations. 84% offered some kind of financial

assistance to alleviate the costs of membership, such as free or discounted passes or cash payment options. 53% of operators conducted educational outreach, including group rides and neighborhood ambassador programs, to overcome informational and cultural barriers to bikesharing.

Though the responses indicate that more operators, city agencies, and community partners are considering equity in bikesharing, McNeil et al. (2019) found few examples of specific, measurable outcomes of equity programs. This makes it difficult to assess the degree to which equity programs were successful in reaching target populations.

Summary of Strategies to Address Bikesharing Barriers

- 84% of organizations offer discounted passes or cash payment options
- 53% conducted educational outreach (e.g., group rides, neighborhood ambassadors)
- 50% plan to place more stations in low-income neighborhoods
- Few examples of specific, measurable outcomes of equity programs

Shared Micromobility: Electric Scooter Sharing

Within shared micromobility, scooter sharing is still a fairly recent transportation development in many U.S. cities, with the first scooter fleets launching in late 2017. In comparison to bikesharing, there is less academic, peer-reviewed literature around the specific barriers to using scooter sharing. The review in this report instead relies on published reports from cities that have conducted scooter pilots, newspaper and magazine articles, and interviews with public officials.

Demographics

Some initial research has found that populations marginalized by cycling may not have the same aversion to using scooters. A research report from Populus, a private transportation data company, used a survey of over 7,000 residents in 10 U.S. cities to determine the adoption rates of dockless scooter sharing compared to public, station-based bikesharing. The results indicate a smaller gender gap between men and women for adoption of scooter sharing than for bikesharing (*The Micro-Mobility Revolution: The Introduction and Adoption of Electric Scooters in the United States*, 2018). However, findings in San Francisco contradict this hypothesis; a user survey (n=2,256) conducted by the city of San Francisco in partnership with two dockless vehicle operators found that more women used dockless bikeshare than scooters (26% vs. 17%). Furthermore, as a whole, the proportion of women using dockless bikeshare and scooters combined was still lower than the proportion of bike commuters who were female (Barnes, 2019).

To understand resident perceptions of scooter, the Portland Bureau of Transportation (PBOT) conducted two focus groups (n=22) with Black residents of Portland, Oregon and residents of East Portland, a historically underserved neighborhood of Portland. The majority of these respondents viewed scooters positively, though some stated concerns with policing and racial profiling (*2018 E-Scooter Findings Report*, 2019). However, the recruitment process, selection criteria, and demographics for focus group participants was not shared in the report, so it is unclear to what extent participants represent these communities.

PBOT also used a representative online survey (n=301) to determine perceptions of scooters among residents. The demographics of this survey were not reported but response quotas were set to match the demographics of the city. Over 70% of both people of color and individuals earning an income of less than $30,000 per year had a positive impression of scooters. However, the share of survey respondents who had ridden a scooter was not statistically different for different income groups (DHM Research, 2018). These findings suggest that scooter use in Portland is relatively similar across demographic categories.

The Baltimore Department of Transportation (Baltimore DOT) also conducted a general population survey (n=5,283). Survey respondents were not demographically representative; 75% of respondents identified as Caucasian compared to only 32% in the city overall (*Community Mobility and Dockless Survey*, 2019). A representative of Baltimore DOT said that the demographic imbalance was likely due to survey bias and mistrust of government in communities of color (personal communication, October 29, 2019). Though the racial/ethnic demographics of respondents were unbalanced, within each racial/ethnic category, the adoption rate was consistent, similar to the findings in Portland (*Community Mobility and Dockless Survey,* 2019).

PBOT also observed scooter users at seven locations in Portland and found that sidewalk riding was lowest on streets with safe infrastructure, such as greenways and protected bike lanes. On streets with high-speed limits, most users rode illegally on the sidewalk, posing a risk to pedestrians. Sidewalk riding was also more prevalent in disadvantaged neighborhoods such as East Portland that have less safe infrastructure than the rest of the city. Improperly parked scooters on the sidewalk also posed a risk to pedestrians as well as impeding ADA access.

Early evidence from surveys and qualitative reporting (e.g., local news reports) suggests that **electric scooters are viewed favorably and adopted by more diverse groups of users** compared to bikesharing

Growing anecdotal evidence in several U.S. cities, including Oakland, suggests that traditionally underserved communities and people of color are using dockless modes, especially shared scooters, at higher rates than other shared modes. In Chicago, a four-month scooter pilot program concluded in mid-October and is currently under evaluation. The pilot regulations mandated that 50% of all scooters must be placed in "Priority Sub-Areas," historically under-resourced areas on the South and West side of Chicago (*City of Chicago Requirements for Scooter Sharing Emerging Business Permit Pilot Program*, 2019). Researchers in Chicago used public Application Programming Interface (APIs) to verify that an average of 48.7% of scooters were located in the priority areas during the study period (Smith & Schwieterman, 2019). Furthermore, employees who rebalance scooters say that when they deliver scooters to priority areas early in the morning, there are often residents already waiting for them (Alani, 2019). In Oakland, a representative of the Department of Transportation (OakDOT) reported that the department was seeing more people of color adopting scooters as an easy, convenient way to get around (Aguilar-Canabal, 2019).

Two pilot program evaluation reports have provided quantitative data on the demographics of users. In San Francisco, 66% of survey respondents were Caucasian compared to 47% of San Francisco residents, 3% were African American compared to 5% of residents, and 7% were Hispanic/Latino compared to 15% of residents. 21% of respondents reported an annual household income of

$50,000 or less compared to 41% of the population (Barnes, 2019). In Arlington, Virginia, a general population survey (n=4,063) found that there were more African American and Hispanic/Latino respondents who had used a scooter compared to those who had not. There were also more scooter riders with an annual household income of less than $50,000 than non-riders and dockless e-bike riders (Mobility Lab, Arlington County Commuter Services, 2019).

Other reports have used trip activity or scooter location data to assess the spatial equity of scooter trips and availability. In Baltimore, activity data from the six-month pilot project show that 17% of all trips started from equity zones. On average, in the morning from 6 to 8 am, 21% of scooters are placed in these zones and in the evening between 7 to 9 pm, 28% of scooters returned to equity zones (Young et al., 2019). A representative from Baltimore DOT interpreted the net positive flow of scooters into equity zones in the evening as evidence that scooters were being used for commute purposes. Though the equity zone selection criteria and demographics are not provided, a representative from Baltimore DOT said that the city is highly segregated and these usage rates in the equity zones imply that scooters are serving a diverse user base (personal communication, October 29, 2019). In the absence of detailed data that can link trip purposes with scooter activity and demographics, however, any conclusions drawn from this report are tenuous.

In three U.S. cities, users took longer scooter trips originating from neighborhoods with higher disadvantage factors

In Arlington, Virginia, some neighborhoods with income below the median household income exhibited high trip generation rates, suggesting that shared electric scooters could be appealing to lower-income residents. In San Diego and Nashville, (Arnell, 2019) found that areas with a higher disadvantage index were associated with the origin location of longer and more expensive trips. Researchers found a similar pattern when comparing two neighborhoods in Columbus, Ohio, finding that the average trip length for rides starting in the more disadvantaged neighborhood was 3.7 km compared to 2.8 km in the less disadvantaged neighborhood (Master et al., 2019). Findings from these evaluation reports seem to corroborate evidence that scooters are popular among disadvantaged groups.

User Barriers to Scooter Sharing

While anecdotal evidence suggests that scooter users are more diverse than bikesharing users, there are still barriers that inhibit wider use by low-income people and people of color. Some reports evaluating shared electric scooter pilot programs in cities across the U.S. have identified user barriers which will be discussed in this section using Kodransky & Lewenstein (2014)'s categorization of barriers to shared mobility. While some barriers, particularly financial and cultural barriers, are similar to station-based and dockless bikesharing, there are also barriers unique to shared electric scooters.

Structural

One major concern that residents have about scooters is rider safety. In Arlington, Virginia, 58% of non-riders did not think that scooters were safe and 36% of respondents felt unsafe riding in the street (Mobility Lab, Arlington County Commuter Services, 2019). A general population survey in Baltimore found 52.5% of respondents thought that safer places to ride would improve the dockless vehicle pilot program (Young et al., 2019).

There have also been safety concerns for pedestrians, as some scooter riders may use vehicles on sidewalks. In Arlington, 57% of respondents did not feel safe as a pedestrian around scooter riders (Mobility Lab, Arlington County Commuter Services, 2019). 31.8% of respondents to the Baltimore general population survey supported "slow ride" or "no ride" zones for scooters to enhance pedestrian safety (Young et al., 2019).

Financial

Similar to bikesharing, there are financial barriers to scooter sharing such as credit card or bank account requirements and costs of using the service. Based on findings from general population surveys, the percent of users citing these barriers seems relatively low. In Arlington, less than 3% of survey respondents had not used scooters because it was too expensive or because they did not have a credit card (Mobility Lab, Arlington County Commuter Services, 2019). In Baltimore, 4% of respondents wanted to be able to rent a scooter without a credit card and 6.7% wanted to be able to rent without a phone (Young et al., 2019). However, the Baltimore survey was not demographically representative of the city and the Arlington survey did not compare survey demographics to city demographics. It is likely that these survey data do not fully capture the barriers faced by more vulnerable populations.

Information and Cultural

There are some indications that marginalized populations face additional information or cultural barriers when adopting or using electric scooters. PBOT conducted two focus groups with Black residents of Portland and East Portland. Many participants mentioned concerns with racial profiling and harassment. One participant felt that it was not "their culture" to pick up a vehicle from the street, use it, and then leave it for the next person (*2018 E-Scooter Findings Report*, 2019).

Even for scooter companies that did conduct outreach or offer discount programs, information about these efforts was difficult to find. PBOT felt that low enrollment in low-income plans was, at least in part, due to companies inadequately promoting these programs (*2018 E-Scooter Findings Report*, 2019). The research team evaluating the electric scooter pilot program in Columbus, Ohio found that low-income discount programs were undermarketed and even had difficulty finding information about these programs online themselves (Master et al., 2019). These information barriers indicate that even though scooter companies may be taking action to increase accessibility of their service, there is still more work to be done.

Summary of Electric Scooter Sharing Barriers

- A major concern is safety for riders (e.g., safety of the vehicle and having safe places to ride) and for pedestrians (e.g., scooter riders using the sidewalk)
- Financial barriers for bikesharing (e.g., lack of cash payment options, cost of service) appear to be less of an issue for electric scooter sharing
- While many operators offered low-income discount programs, inadequate promotion of these programs may have resulted in low enrollment

Addressing Barriers to Scooter Sharing

In a review of scooter company policies, researchers found that there are some companies offering equity related programs. Out of 17 companies, seven have a low-income discount plan, three have non-smart phone or credit card payment options, and three have more than one language communication option (Wood et al., 2019). However, evidence from several U.S. cities indicates that just setting up or offering these programs is not enough. In Portland, only 47 users were enrolled in low-income plans (*2018 E-Scooter Findings Report*, 2019). In San Francisco, there were less than 522 users, or less than 1% of all riders, enrolled in a discount plan (Barnes, 2019). As discussed in the previous section, these alternate payment options and low-income discount programs might be poorly advertised.

Many cities, including those highlighted in this literature review, have set equity mandates or requirements for scooter companies who wish to operate within the city. For example, Chicago, Baltimore, and Portland targeted spatial equity by requiring that operators place a certain percent of their scooter fleet in designated priority neighborhoods. These cities also required that scooter companies offer alternate payment options and discount programs (Wood et al., 2019). The finding that few riders have actually taken advantage of these programs shows the limitations of this regulatory approach. While it is important that these options are important to increasing the accessibility of shared electric scooters, simply setting up the program is not sufficient.

Summary of Strategies to Address Electric Scooter Sharing Barriers

- Many cities have targeted spatial equity by setting vehicle fleet quotas in designated priority neighborhoods
- Cities have also mandated that companies develop low-income discount plans, cash payment options, and non-smart phone options.
- Enrollment in equity programs remains low, suggesting that more targeted advertising or promotion may be required to increase participation by low-income groups.

Transportation Network Companies (TNCs)

TNCs are app-based services that connect riders with drivers. Since Uber first launched in 2009, TNCs have experienced explosive growth. Though TNC companies are reticent with sharing user activity data for the purposes of protecting user privacy, user surveys and other methods for gathering vehicle location data have provided some insights into the demographics of TNC users and barriers to use.

Demographics

Surveys conducted in several U.S. cities have found a range of demographic data for TNC riders. In a survey of representative populations of seven major U.S. cities, Clewlow & Mishra (2017) found that early adopters of TNCs tended to be younger, more highly educated, and had higher incomes than the rest of the population. In particular, the authors found a significant adoption gap between younger and older users; 36% of adults between the ages of 18 and 29 use TNCs compared to only 4% of adults older than 65. Another significant gap was between low- and high-income households. Households earning an annual income of less than $35,000 had a TNC adoption rate of 15%, compared to 33% for households earning $150,000 or more a year (Clewlow & Mishra, 2017). A major weakness in this report was the aggregation of findings across all cities. This level

of aggregation is surprising considering the difference in demographics for each city included in the study, not to mention differences in culture, built environment, transportation infrastructure, and population density. By aggregating responses from Boston with those from Chicago, for example, the authors ignore these crucial differences between cities that influence the travel patterns of residents and how TNCs fit into their transportation landscape. Given inter-city heterogeneity, reporting TNC adoption rate stratified by income but combined across cities makes little sense. Low-income individuals may have better access to transit in some cities or have lower rates of vehicle ownership in other cities, all of which would impact adoption of TNCs.

Surveys in two U.S. cities found a **bimodal income distribution of TNC users** centered on riders earning around $30,000 per year and $100,000 per year or more

In Denver, Henao (2017) posed as a TNC driver and surveyed his riders, finding that Caucasians and Asians were overrepresented, while Hispanics/Latinos and African Americans were underrepresented compared to the general population. Henao found a bimodal income distribution, with about 25% of riders earning less than $35,000 per year and 25% earning more than $100,000 per year, both income groups overrepresented with respect to the general population. In San Francisco, Rayle et al. (2016) also found a bimodal income distribution centered around households earning $30,000-$70,000 per year and $100,000-$200,000 per year. This distribution is similar to that of the general population. However, crucially, households earning less than $30,000 are underrepresented in the TNC user survey. Finally, a rider survey in the metropolitan Boston region found a racial/ethnic distribution of riders that was similar to the overall distribution (Gehrke et al., 2018).

Using trip data in six U.S. cities provided by a major TNC, Feigon & Murphy (2018) found that most zip codes with the highest usage rates of TNCs had more young and white residents. At the same time, they found some high-TNC-use zip codes with high concentrations of black or Hispanic residents (Feigon & Murphy, 2018). Overall, in all cities but Seattle, zip codes with the highest TNC usage had a higher annual household income than the city average, though in Seattle, the median household income of the city is $80,000, almost $30,000 higher than other cities in the study. Though the findings from this analysis provide some insight on the spatial distribution of trips in these cities, trip volume flows were analyzed based on zip code areas (ZCTAs) with no information about individual users within those areas. Even if a ZCTA has a high concentration of Black or Hispanic residents, this does not guarantee that those residents are the ones taking trips on TNCs, particularly with the acceleration of gentrification in cities such as Seattle. ZCTAs might also be at too high of a resolution to capture differences in neighborhood characteristics such as transit access, car access, and demographics. Census tracts or block groups would be a better alternative for such an analysis. A transportation planner in the San Francisco Bay Area said that the San Francisco County Transportation Authority was exploring the option to calculate the Communities of Concern metric used by MTC at the block group rather than the census tract level. This methodology can better capture concentrations of disadvantaged groups that exist even in more affluent communities or identify gentrifying areas of disadvantaged neighborhoods (personal communication, October 3, 2019).

Activity data in LA show that **residents of low-income census tracts took more trips than those in high-income census tracts**; for low-income groups, TNCs may be filling gaps from lack of car ownership

Using activity data in Los Angeles, Brown (2018) found that on average, users living in low-income neighborhoods, those in the lowest quartile of household income in Los Angeles, took more trips than higher-income neighborhoods (10.5 trips compared to 9.0 for middle-income neighborhoods and 7.7 for high-income neighborhoods) (Brown, 2018). Combined with data that show high-income households in Los Angeles make more trips in personal vehicles than low-income households, Brown (2018) hypothesizes that TNCs fill different roles for different income groups. For high-income groups, TNCs are likely to supplement existing vehicle ownership for trips to bars or the airport; over the study period, 28% of high-income users took Lyft to the airport compared to just 14% of low-income users. For low-income groups, t TNCs are likely filling gaps in mobility resulting in lack of car ownership (Brown, 2018). This analysis was conducted at the census tract level, a higher-resolution spatial unit than ZCTAs. Again, with no individual level data available, these results cannot be extrapolated to make statements about low-income *users*, simply low-income *neighborhoods*. As with ZCTAs, even if the median income of a census tract is in the lowest quartile in the city, this does not guarantee that riders in that neighborhood are necessarily low-income. Further work is needed to connect neighborhood or zip code level activity data with individual rider characteristics.

User Barriers to TNCs

Structural

The main structural barrier to TNC use relates to spatial equity and service in low-density areas. Compared to bikesharing and taxis, the overall spatial coverage of TNCs is broader; Brown (2018) found that the Lyft service area in Los Angeles covered 99.8% of the population. Using trip data in six U.S. cities, Feigon & Murphy (2018) found that almost all zip codes in each city served as TNC trip origins and destinations. Bialik et al. (2015) found that TNCs are more spatially equitable than taxis; comparing TNC trip data to taxicab data in New York City revealed that TNCs pick up more passengers in boroughs outside Manhattan than both yellow and green taxi cabs.

Studies in different cities show mixed results for wait times and cancellation rates. Using Uber API data, researchers in Washington, D.C. found that riders in low-income and more racially diverse neighborhoods experience significantly longer wait times than other neighborhoods, with a difference of about three minutes (Stark & Diakopoulos, 2016). An experiment in Seattle and Boston, conducted in 2015, employed a team of riders with user profiles either showing a “white sounding” or “distinctively black” name. Riders with distinctively black names waited longer for their ride request to be accepted, resulting in longer wait times overall (Ge et al., 2016).

However, using Uber API data, Hughes & MacKenzie (2016) found shorter wait times in low-income neighborhoods in Seattle. Neighborhoods with high concentrations of minorities experienced shorter wait times during the day but longer wait times late at night. Brown (2018) compared trip data in two zones in Los Angeles with significantly different racial/ethnic and income compositions and found no differences in wait time or cancellation rates. Brown (2018)

also compares service quality in terms of average wait time and cancellation rate between taxi services and TNCs. Journalists have long covered discriminatory practices in the taxi industry that result in higher cancellation rates for black riders compared to riders from other racial categories (Didymus, 2013 in Washington, D.C. and Belcher & Brown, 2015 in Chicago). In this more recent study in Los Angeles, black taxi riders are 73% more likely to have a ride canceled compared to white taxi riders (Brown, 2019). No significant differences were found for Hispanic or Asian riders. Overall, TNCs have lower cancellation rates compared to traditional taxi services (just 4% of TNC trips compared to 20% of taxi trips). Although TNC cancellations do happen, the consequences are less severe, as 99.7% of canceled TNC trips were fulfilled by another driver, while none of the taxi trips were similarly replaced.

In several cities, studies have found that wait times for TNCs are significantly lower than wait times for taxi services and are more consistent and predictable (Brown, 2018; Rayle et al., 2014; R. Smart et al., 2015). In L.A., Black riders waited about a minute longer than white riders for TNC rides, while for taxi rides, Black riders waited over ten minutes longer than white riders (Brown, 2019). Participants of color in an experiment in L.A. that compared ride experiences between TNCs and taxis reported being discriminated against or refused service by taxis on four occasions. In the same experiment, no TNC trips were canceled. The findings of these studies suggest that, though there are incidences of racial discrimination in TNC service, the overall service quality is higher than taxis (Brown, 2018).

Financial

Lack of cash payment options has been cited as a barrier by 12% of non-users (*2018 Ridesharing Report*, 2018). Additionally, pricing for TNCs is less transparent than for taxis and rates can be subject to surge pricing, which is the increase of fares when demand for rides is high. Despite price uncertainty and surge pricing, studies have found that average TNC fares are lower than taxi fares (Brown, 2018; Smart et al., 2015). However, cost of a TNC ride is still significantly higher than public transit and may be prohibitive to some users who mainly rely on public transit. At the same time, an analysis of trips taken in metro Boston found that some users, even those who are low-income, are willing to pay a premium to replace transit trips with TNC trips because they are faster (Gehrke et al., 2018). Surveys of TNC riders in San Francisco and Denver also indicate that TNC trips are replacing transit trips for some riders (Henao, 2017; Rayle et al., 2014).

Informational and Cultural

Older adults exhibit discomfort with using TNC services because it requires payment and booking through the internet or an app; older adults own and use smartphones at a lower rate compared to the general population (Shirgaokar, 2018). The digital divide exists not only for older adults; in Los Angeles, lower shares of Lyft users in predominantly Hispanic neighborhoods may be correlated to lower rates of smartphone ownership in Spanish-speaking households (Brown, 2018). Only 47% of households that are only Spanish-speaking own smartphones, while 68% of other households own smartphones (*2017 FDIC National Survey of Unbanked and Underbanked Households - Appendix Tables*, 2018).

For pooled rides specifically, Brown (2018) found in Los Angeles that pooling was more common in neighborhoods with a homogenous racial or ethnic makeup, and overall, non-Caucasian riders were less likely to share compared to Caucasian riders. This suggests that when it comes to sharing rides with a stranger, some riders are influenced by racial biases.

Summary of TNC Barriers

- There is mixed evidence on wait time disparity for low-income riders or people of color.
- Compared to traditional taxicabs, TNCs have broader spatial coverage and have less wait time disparity and cancellation rates for African American users.
- Lack of cash payment options were cited as a barrier for 12% of non-users.
- High cost and uncertainty around surge pricing were also cited as barriers, though some riders are willing to pay a premium to get to a destination faster than public transit
- Digital divide and discomfort with using smartphone technology is a barrier for older adults and predominately Spanish-speaking households
- Shared or pooled TNC rides were more common in LA neighborhoods with homogenous racial or ethnic makeup

Carsharing

Carsharing is a service that offers members access to a shared fleet of vehicles that can be reserved through an app or online. The three main business models for carsharing in the U.S. are: 1) peer-to-peer; 2) roundtrip, station-based; and 3) one-way (can be either free-floating or station-based). In peer-to-peer carsharing, individuals can rent out their personal vehicles to the member network. Roundtrip and one-way carsharing are both controlled by companies that maintain a fleet of vehicles. Roundtrip carsharing requires that members pick up and return their vehicle at the same location, while one-way carsharing allows members to return vehicles at a different location, generally within predetermined geographic zones (Shaheen et al., 2018).

Demographics

Surveys of carsharing users indicate that the majority of users are young, Caucasian, earn more than the median income, and are highly educated. In San Francisco, a survey of City CarShare (now Getaround) users (n=619) found that the median age of respondents was 39.6 years (Cervero et al., 2007). In a large survey of carsharing users across the U.S. and Canada (n=1,340), the median age was 35 years (Millard-Ball et al., 2005). A similar large survey of carsharing users across the U.S. and Canada (n=6,281) conducted by Martin & Shaheen (2011) found that about one-third of respondents were over 40 years old, with the median age between 30 and 40 years old.

In the City CarShare sample, researchers found that 77% of respondents were white, 6.5% were Asian, 4.5% were African American, 4.2% were Hispanic/Latino, and 7.7% identified as another race or ethnicity (Cervero et al., 2007). Millard-Ball et al. (2005) found slightly more respondents who identified as white or Caucasian (87%), and slightly fewer respondents who identified as Hispanic/Latino (3%) or as another race or ethnicity (4%).

The median income of carsharing users in these three studies vary. In the City CarShare sample, the median household income of respondents was $50,000, similar to the 2000 census average in the Bay Area (Cervero et al., 2007). In Millard-Ball et al. (2005)'s sample, 50% of respondents reported an annual household income of more than $60,000 and only 13% reported incomes less

than $30,000. Martin & Shaheen (2011) found 57% of respondents reported an income greater than $60,000. 6% of respondents reported an annual household income of less than $20,000.

Both large U.S. and Canada-based surveys asked respondents about their educational attainment. Millard-Ball et al. (2005) found that 35% of respondents held a Bachelor's degree while 48% of respondents held post-graduate or advanced degrees. Similarly, Martin & Shaheen (2011) found that 80% of users held at least a Bachelor's degree.

User Barriers to Carsharing

Structural

Like bikesharing, the placement of carsharing stations for one-way or round-trip station-based business models favors higher income neighborhoods. Free-floating carsharing has the potential to be more spatially equitable and cover a more diverse area. However, findings in Oakland indicate that even with free-floating carshare, the majority of vehicles are still located in more white, affluent neighborhoods (Brown, 2017). As of 2017, only one car share provider had operations in East Oakland, compared with several providers in other parts of Oakland.

Financial

Financial barriers to carsharing are similar to those found for micromobility and TNCs. Credit card and bank account requirements limit an estimated 30 million unbanked or underbanked households in the U.S from using carsharing services (*2017 FDIC National Survey of Unbanked and Underbanked Households - Appendix Tables*, 2018). Additionally, high up-front membership fees and usage fees are barriers to low-income individuals.

Informational and Cultural

Similar to bikesharing, low-income individuals may have less information about carsharing and why it can be beneficial to them. There are also additional cultural barriers, such as social status attached to car ownership, that may preclude low-income individuals from signing up for carsharing (Kodransky & Lewenstein, 2014).

Summary of Carsharing Barriers

- Similar to bikesharing, inequitable siting of station-based carsharing results in lack of access in low-income neighborhoods
- Free-floating carsharing systems have more potential for spatial equity, yet findings in Oakland indicate the majority of vehicles are still located in more white, affluent neighborhoods
- High up-front membership fees and user fees are financial barriers to use
- Cultural barriers around car ownership may make carsharing less attractive

Addressing Barriers to Carsharing

As transportation equity has become more of a concern, carsharing operators and nonprofits have made efforts to overcome barriers and expand carsharing services to disadvantaged communities. Some operators, such as Zipcar, eGo in Denver, CO and iGO in Chicago, IL have set up short-term pilot programs in neighborhoods to gauge demand, leaving the option open to retract services if found to be unprofitable (Kodransky & Lewenstein, 2014). City CarShare (now part of

GetAround) in the San Francisco Bay Area and Buffalo Carshare, in Buffalo, NY, opened storefronts to help new users sign up and learn how to use carsharing. Ithaca CarShare in Ithaca, NY, and iGO in Chicago, IL, have payment options for unbanked populations.

Summary of Strategies to Address Carsharing Barriers

- Some operators have conducted short-term pilot programs in low-income neighborhoods to gauge demand for carsharing
- Some operators used storefronts to engage new users
- Two operators offer payment options for unbanked users

Equity Pilots in Shared Mobility

Private companies and public agencies have implemented pilot programs using different outreach methods and financial incentives to achieve greater equity in shared mobility. In this section, we will first summarize pilot programs in station-based bikesharing and carsharing, highlight key characteristics, strategies for operationalizing equity, methods of analysis, and overall findings of each program. Then, we will discuss program components in further detail, evaluated based on whether they enabled companies and agencies to achieve the goals of their pilot programs. Finally, we identify areas where more rigorous methods are necessary.

Pilot	Location	Years Active	Objective	Findings
Nice Ride Neighborhood	Minneapolis and St. Paul, MN	July-Oct 2014	Community-based approach for promoting bikesharing and biking in underserved communities by giving bikes to residents	Increased comfort level with biking, sense of community developed around using bikesharing
Citi Bike	Brooklyn, NY	2015-2016	Increase use of existing bikesharing system in low-income, majority African-Caribbean neighborhood	225% more trips, 56% increase in members (compared to 46% increase citywide)
BIKETOWN for All	Portland, OR	2016-present	Make bikesharing accessible to low-income residents	Low-income residents account for 7% of total members and take 20% of total trips
Indego	Philadelphia, PA	2015-present	Foster awareness and support for bikesharing among low-income residents	Low-income residents account for 9% of total trips
BlueLA	Los Angeles, CA	2018-present	Make carsharing accessible to low-income residents and reduce greenhouse gas emissions	Low-income residents account for 47% of members and 60% of total trips

Table 4: Overview of Shared Mobility Equity Pilot Projects

Key Characteristics

The pilot programs we present in this report all aimed to increase equity in shared mobility, to varying degrees of success. To systematically evaluate the effectiveness of these programs, we selected five key characteristics:

1) The stated goals of the program and the definition of "success"
2) How the program defined the target population
3) How the program recruited or reached out to the target population
4) The evaluation methods used to measure the immediate impact of the program
5) Lasting impacts of the program, if any

Notably, there is a distinction between immediate impacts (item 4) and lasting impacts (item 5). Transportation mode choice tends to be habitual and path-dependent since the routes that we travel day to day and the modes available to us for those routes are familiar (Verplanken et al., 1994). Through pilot programs, participants are either actively recruited or given incentives to use a new mode, and the novelty factor might encourage higher use. In this research, we want to evaluate whether pilot programs are effective in causing long-lasting changes in travel behavior.

For each pilot program, the key characteristics are summarized in Table B1 in Appendix B. In this section, we describe each characteristic in further detail.

Goals and Definition of Success

Two bikesharing pilots (Citi Bike and BIKETOWN for All) defined success as increasing number of members enrolled in the service through discounted memberships (Fillin-Yeh & Chaney, 2017; McNeil et al., 2019). Discounted memberships served as a proxy for number of members who are low-income or people of color. Citi Bike also hoped to improve health outcomes in a neighborhood with high rates of obesity and high blood pressure by encouraging more physical activity through biking. Indego, another bikesharing program, had a general goal of increasing engagement by low-income people and people of color (*Access Pass Fast Facts*, 2018). Nice Ride Neighborhood (NRN), a bikesharing pilot, also had a more general goal to change the perception of biking for transportation in targeted neighborhoods (Martin & Haynes, 2014).

BlueLA, an electric carsharing pilot in Los Angeles, is the only program of those discussed in this report with a precise quantitative goal: over three years, BlueLA aims to recruit 7,000 total members who shed 1,000 vehicles and reduce 2,150 tons of greenhouse gas emissions annually (Ferguson & Holland, 2019). There were no explicit goals or targets for recruitment of low-income and other disadvantaged populations. However, BlueLA stations are intentionally sited in disadvantaged communities, as defined through a California state model that accounts for income and air pollution.

Summary of Equity Pilot Goals and Definition of Success

- All programs had the goal of increasing number of low-income members.
    - BlueLA carsharing was the only program that set a precise quantitative target for number of members and greenhouse gas emission reduction.
- Some programs had other goals including improving health outcomes (e.g., obesity rates) and changing perceptions of biking in low-income neighborhoods.

Target Population

The definitions of success for each program all identified some target population whose usage rate or behavior the pilot aimed to influence. NRN and Citi Bike both took a geographic approach, focusing efforts on specific disadvantaged neighborhoods based on percentage of people of color and low-income people in the neighborhood (Martin & Haynes, 2014; Fillin-Yeh & Chaney, 2017). Low-income was not specifically defined by the program, but recruitment and marketing were conducted in areas where low-income individuals may receive social services.

BIKETOWN for All, Indego, and BlueLA defined target populations as individuals who were already receiving other types of public assistance. Eligibility for discounted memberships was given to EBT card holders, individuals who receive utility assistance or other social services (McNeil et al., 2019). BlueLA defined "low-income" as households earning less than 250% of the federal poverty line, or individuals earning less than $31,550 per year, or a family of four earning less than $45,050 per year. Eligible participants were required to show proof of income or proof of participation in a public program with similar eligibility requirements, such as Medicaid/Medi-Cal, CalFresh, or WIC (Ferguson & Holland, 2019).

Summary of Equity Pilot Target Population

- Two bikesharing programs selected specific disadvantaged neighborhoods.
- Three other programs defined target populations based on individuals who receive public assistance (e.g., Medicaid/Medi-Cal, SNAP, WIC, etc).

Recruitment and Outreach Strategy

All of the pilot programs partnered with a local community-based organization (CBO) to recruit potential participants. NRN collaborated with community agencies in three target neighborhoods and hired "community liaisons" to identify, recruit, and engage participants in the community (Martin & Haynes, 2014). Citi Bike, BIKETOWN for All, and BlueLA used partnerships with public housing developments, local non-profits, and social service agencies to market discounted memberships (Ferguson & Holland, 2019; Fillin-Yeh & Chaney, 2017; McNeil et al., 2019). Citi Bike also partnered with health care providers to give free memberships to patients whose doctors advised them to increase activity levels.

The community-based outreach approach worked particularly well for Indego, who used early community feedback to make changes to the pilot program. Indego partnered with non-profits in Philadelphia from the beginning of the program and implemented a range of strategies to lower what the operator perceived to be the major barriers to bikesharing, for example, placing bikesharing stations in low-income neighborhoods, offering flexible payment options, and using a diverse marketing campaign. However, after the first year of operation, engagement from low-income users and communities of color remained low. Indego received feedback from the community that despite all of these efforts, the largest barrier to using bikesharing still remained: cost of the membership. In response, Indego reduced the price of a monthly membership from $15/month to $5/month (*Access Pass Fast Facts*, 2018).

Summary of Equity Pilot Recruitment and Outreach Strategy

- All five programs partnered with community-based organizations to recruit participants.
- Three programs also partnered with public housing developers, local non-profits, and social service agencies to advertise equity programs.
- Community engagement enabled the bikesharing service Indego to make changes to pricing to appeal to more low-income residents

Evaluation Methodology

Citi Bike, BIKETOWN for All, Indego, and BlueLA used activity data from operators to measure number of users from the target population and number of trips taken by these users. BlueLA used these data to estimate the amount of greenhouse gas emissions reduced as a result of the electric carsharing pilot (Ferguson & Holland, 2019). NRN and Citi Bike also used attendance at group rides or community events as a way to measure level of engagement of residents with the pilot program (Fillin-Yeh & Chaney, 2017; Martin & Haynes, 2014).

Some programs also conducted user or resident surveys and focus groups to understand perceptions and attitudes towards the shared mobility service. Indego deployed a user survey in select target neighborhoods with high rates of poverty to understand how low-income members were using Indego (*Access Pass Fast Facts*, 2018). Citi Bike conducted an intercept survey (n=230) and four focus groups (n=30) before the pilot launched to gather information about residents' attitudes towards Citi Bike (Fillin-Yeh & Chaney, 2017). BlueLA deployed a survey at the beginning of the program with plans to periodically re-survey members to measure behavioral change (Ferguson & Holland, 2019).

NRN used exclusively qualitative methods to evaluate impacts of the program. NRN staff observed participants at half of the group rides and all the closing events where participants returned their bicycles and reflected on their experience. Researchers also conducted one-on-one interviews with 90 of the 145 total participants within one month after the program ended. Focus groups were conducted for community liaisons (N=5) and residents of the targeted neighborhoods who did not participate (N=10 to 14) (Martin & Haynes, 2014).

Summary of Equity Pilot Evaluation Methodology

- Four programs used activity data for quantitative metrics (e.g., number of low-income users and number of trips taken by these users).
- Three programs also collected qualitative data (e.g., surveys, focus groups) for a more nuanced understanding of how low-income users were using the service.
- One program only collected qualitative data (e.g., participant observation, interviews) to evaluate impacts of the program.

Lasting Impacts

BIKETOWN for All and Indego have seen overall growth in number of members who sign up under discounted memberships. Since the implementation of BIKETOWN for All in 2016, membership has grown every year from 23 memberships in 2016 to 495 in 2018. BIKETOWN for All members represent 7% of overall members but take 20% of all trips (*2018 BIKETOWN Annual Report*, 2018). Anecdotal evidence from the director of the Community Cycling Center, an early partner of the BIKETOWN for All pilot, suggests that new riders in the program are making

bikesharing their main transportation mode around Portland. He also states that the success of the program can be attributed mainly to collaboration with CBOs and a "boots on the ground" outreach approach. These findings were not corroborated quantitatively with activity data or a member survey (McNeil et al., 2019).

Indego reports similar results as BIKETOWN for All. Access Pass members represent 10% of all active members who are taking 25% more trips per month compared to the average member (*Access Pass Fast Facts*, 2018). Overall, as of 2018, 35% of Indego members earn less than $25,000 per year compared to 31% of Philadelphia residents and 18% earn between $25,000 and $50,000 per year compared to 22% of Philadelphia residents (U.S. Census Bureau, 2018). The higher income categories ($50,000 to $95,000 and $95,000 or greater) comprise 24% and 23% of members, respectively, compared to 27% and 21% of Philadelphia residents (U.S. Census Bureau, 2018). 45% of all members are people of color (*Indego 3rd Birthday Snapshot*, 2018).

Citi Bike reported that in the year after the pilot was implemented, the total number of trips in Bedford Stuyvesant more than doubled. Membership in the neighborhood also grew at a faster rate than the citywide average, a 56% increase in Bedford Stuyvesant compared to a 46% increase citywide (Fillin-Yeh & Chaney, 2017). The experiences of a group ride leader are a small indication of how the service has been more widely accepted in the neighborhood; group bike rides grew from 2 or 3 participants initially to eventually 25 participants at each ride (Capers, 2017).

NRN has not published findings from follow-up evaluation of the program. The immediate feedback, one month after the completion of the program, was largely positive. Evidence from interviews and observations at group events indicates that participation in the program increased comfort, knowledge, and skills with biking. Participants also stated that they overcame previous barriers to biking, such as a fear of riding in the street, injury, and lack of knowledge or support for biking, through participation in the program. Most participants attributed this change to the sense of confidence acquired through group rides. Participants also reported that the visibility of orange bikes from the program helped spread awareness within their neighborhood. Some participants said that having an orange bike sparked conversations with their neighbors about the program and biking in general (Martin & Haynes, 2014).

Interestingly, though the program seemed to successfully change perceptions about biking in the short term, it did not succeed in spreading awareness about the existing bikesharing system. The majority of participants interviewed at the end of the program had not used the bikesharing system and had misconceptions about how the program worked. The long-term impacts on changes in attitudes about biking, and whether participants continue to bike after returning their free, program-provided bike, have not been reported (Martin & Haynes, 2014).

Summary of Equity Pilot Lasting Impacts

- Three bikesharing pilots continued to track low-income membership and trip data after program completion. All of these operators report positive results; low-income members take more trips than the average member, and trip rates in target neighborhoods have increased significantly.
- Two bikesharing pilots reported that increasing visibility of biking through distinctive bike designs and well-attended group rides was successful at spreading awareness about biking.

Gaps in Literature

The pilot programs we evaluated in the section above all defined goals related to increasing equity in shared mobility and incorporated some kind of evaluation of the effectiveness of their program intervention. Four of the five pilots in bikesharing and carsharing stated goals that were oriented around increasing overall participation by the general low-income population or people of color.

Increasing participation levels is an admirable goal, especially given that previous literature has shown that significant barriers to participation in shared mobility do exist for certain populations. But these analyses do not study *how* or why low-income individuals or people of color choose to use shared mobility services, and more crucially, who still chooses not to use shared mobility, even in the presence of pilot programs. In particular, since these programs failed to determine the specific transportation needs of the community at the outset, there is no guarantee that the shared mode offered through the pilot program is the most cost effective, most convenient, or most sustainable option for residents of that community. Understanding the current travel patterns and needs of residents allows researchers, private operators, or public agencies to tailor pilot programs and transportation options more effectively and specifically to meet those needs.

Furthermore, the short-term and long-term impacts of shared mobility on the travel behavior of pilot participants are not clear. Of the five pilot programs, only BlueLA plans to measure travel behavior before and after the pilot. NRN conducted interviews after the pilot, asking participants to reflect on their changes in attitudes and perception as a result of their participation, but further follow-up has not been conducted. Thus, it is not clear whether participation in pilots were effective in enabling long-term change.

Strategies for Operationalizing Equity

In this section, we describe common strategies used in shared mobility equity pilot projects. A summary of these strategies and examples is below in Table 5.

Strategy	**Description**	**Example**
Local Partnerships	Collaborating with local community-based organizations to recruit research participants, advertise existing equity programs to residents, or engage with residents throughout the equity program.	Citi Bike partnered with a local CBO to educate residents about how bikesharing could help in their everyday lives
Community-Led Program Design	Involving community members from the beginning to design key aspects of equity programs	BlueLA posted a map on their website where residents could provide input on station locations
Educational Workshop	Workshops organized to teach participants about shared mobility services	Indego held workshops to familiarize participants both with using the bikesharing app and with biking in general
Community Events	Events organized by shared mobility operator to engage with local residents	NRN and Citi Bike organized group bike rides which helped build community among riders and increase biking confidence
Community Ambassadors	Leveraging community members to help promote programs through personal and neighborhood networks	Indego and BlueLA hired community members to facilitate outreach and education on bikesharing and carsharing
Discount Program	Programs that offer discounts on shared mobility services for qualifying participants	BlueLA offered a discount for multi-hour rentals that allowed members without a car

		to use carsharing to combine different errands into one trip
Alternate Payment Options	Payment options for unbanked populations or those who prefer not to use credit or debit cards	Citi Bike partnered with a local credit union to help unbanked individuals open bikesharing accounts
Accessories to Enable Use	Shared mobility operators providing accessories (e.g., helmets, bike lights) to lower entry costs of biking related to equipment	NRN and BIKETOWN for All gave participants free helmets

Table 5: Overview of Strategies for Operationalizing Equity

Local Partnerships

Every pilot program formed a local partnership with community-based organizations. The BlueLA Carsharing Pilot even created a steering committee of multiple community-based organizations (CBOs) in the project area, which led the public outreach efforts. Though the steering committee organized 136 community events, there was still some tension between the committee and the rest of the BlueLA organization, as the steering committee felt that communication between all project partners could have been better and a greater appreciation of local engagement was necessary (Ferguson & Holland, 2019).

Elsewhere, local partnerships were used to recruit participants for the pilot program and connect with residents about existing programs. NRN used local nonprofit liaisons to recruit participants and engage with them throughout the program (Martin & Haynes, 2014). Citi Bike partnered with a CBO in the Bedford-Stuyvesant neighborhood of Brooklyn, New York to speak to residents about how bikesharing could help them in their everyday lives (Fillin-Yeh & Chaney, 2017).

These examples of local partnerships highlight the importance of leveraging existing community relationships when implementing a pilot program in a disadvantaged neighborhood. Each of these organizations recognize that entering neighborhoods that have been historically neglected by transportation planners or engaging with marginalized populations can be a sensitive undertaking. In Harlem, another expansion neighborhood for Citi Bike in New York, community leaders pushed back against the expansion plans, calling bikesharing a "gateway to gentrification" (Alcorn, 2016). Community leaders in Milwaukee and the Twin Cities echoed this opinion from New York, believing that bikesharing signaled that a neighborhood was changing in ways that did not benefit long-time residents (Hannig, 2015). Partnering with local, trusted CBOs allows organizations to introduce innovative mobility options to a neighborhood in an authentic way without appearing paternalistic or removed from the residents who they want to serve.

Community-Led Program Design

Some organizations also used community outreach to elicit feedback and ideas for designing the pilot program. BlueLA found that community forums were the most effective way to hear from residents about their specific mobility needs and how carsharing could help them meet those needs. Mapping exercises at these events allowed residents to visually show their travel patterns and suggest placement of carsharing stations. BlueLA also posted a map on their website where people could provide input on station location (Ferguson & Holland, 2019). This feedback, along with

BlueLA and LADOT site assessment and feedback from community forums, was used to identify potential station sites. Though BlueLA has not done a user survey yet, anecdotal evidence from BlueLA customer service suggests that station siting in certain neighborhoods is the primary way that residents become aware of and sign up for BlueLA.

Citi Bike already had operations in the target neighborhood before the launch of the pilot program. Later, community feedback was gathered using intercept surveys, revealing that 32% of residents felt that Citi Bike was not intended for people like them and that very few residents were aware of the discounted membership option. This feedback helped Citi Bike focus the pilot program on showing local residents how bikesharing could work for them (Fillin-Yeh & Chaney, 2017).

Ultimately, allowing community members to have a voice on the design of pilot programs ensures that the programs, once implemented, will actually serve the target populations. However, the community engagement process for pilot programs in shared mobility thus far has assumed a desire for the service itself; that is, BlueLA and Citi Bike approached community engagement assuming that target populations needed or wanted carsharing or bikesharing services. Our research deviates from the existing state of practice by first asking the target population about their transportation needs and concerns and using these responses to identify and design desired incentives. Our approach to include community voices early on in the design process ensures that any strategies or incentives are responsive to specific community needs and desires.

Educational Workshops

Three of the organizations highlighted in this report used educational workshops to address knowledge gaps on how to use bikesharing, benefits of using bikesharing, and how to bike safely. NRN offered educational workshops at the beginning of the program to teach participants about the rules of the road and bike maintenance (Martin & Haynes, 2014). BIKETOWN for All partnered with a local organization, the Community Cycling Center, to host similar workshops for participants (Lanning, 2016). However, organizers noted that providing biking-specific education may not be sufficient, and there were other barriers such as digital literacy and smartphone access (McNeil et al., 2019). Indego recognized that some participants may have felt uncomfortable or unfamiliar with the bikesharing app and online reservations and offered community classes combining bicycling and digital skills (“Sign Up for Digital Skills and Bicycle Thrills,” 2016).

Though educational workshops were successful in bridging knowledge gaps in biking and digital literacy, hosting workshops was labor intensive. BIKETOWN for All used most of its budget on labor costs, both for staffing and organizing workshops (McNeil et al., 2019). Offering educational workshops may not be the most feasible or cost-effective action for shared mobility organizations interested in increasing equitable service.

Community Events

Another way that bikesharing organizations increased biking knowledge and comfort was by organizing community rides. NRN required participants attend at least four group rides to be eligible for a $200 voucher at the end of the four-month pilot program (Martin & Haynes, 2014). The group rides were incorporated into existing community events and took riders through their own neighborhoods via bike lanes and parkways. At the end of the program, participants reported

feeling a greater sense of community with their fellow riders and neighbors that had developed through group rides and seeing the bright orange, branded bikes on the street (Martin & Haynes, 2014). Crucially, the Nice Ride Neighborhood team selected members of the Major Taylor Bicycling Club, a non-profit that promotes bicycling among African Americans in the Twin Cities, to lead the group rides. Participants in the rides responded positively and were motivated by cycling leaders who looked like them (Martin & Haynes, 2014).

Citi Bike also held group rides during the year-long pilot program. A total of 47 rides helped increase the pilot media coverage. The rides also attracted the attention of residents who otherwise would not have considered using Citi Bike, serving as a promotion for bikesharing and an example of how bikesharing could be for people like them (Fillin-Yeh & Chaney, 2017).

Group rides are an effective way for bikesharing organizations to build community among riders, increase rider confidence, and establish a positive community presence. An equivalent type of community-based event did not seem to be implemented in carsharing or other types of shared mobility pilot programs. Thus, the effectiveness of group activities has not been considered or tested for general shared mobility pilots.

Community Ambassadors

Some shared mobility organizations promoted their pilot programs using community ambassadors. These ambassadors either belonged to local CBOs, in the case of Indego, or were hired from the community, in the case of BlueLA. Street Ambassadors hired by BlueLA resided in the service areas of the low-income pilot program and handled most of the one-on-one outreach activities, assisted people with using the app to reserve vehicles, and provided education about the electric vehicles (Ferguson & Holland, 2019). The bike ambassadors for Indego all represented trusted local organizations and promoted the use of bikesharing to community members. Ambassadors had a wealth of neighborhood-specific knowledge, such as the safest bike routes in the neighborhood, potentially dangerous intersections, and local points of interest (Goffman, 2018).

Community ambassadors can serve as direct liaisons between the shared mobility organization and its members. Residents can speak more easily with their own neighbors about how to use a service and have a better understanding of how it may benefit them. By delegating promotion of a pilot program to community members, shared mobility organizations can leverage and possibly even strengthen existing relationships.

Discount Program

Every pilot program evaluated in this report incorporated some kind of discount program for low-income members, with the exception of Nice Ride Neighborhood which gave participants bikes for free. People who qualified for the discounts included EBT card holders, residents of affordable housing units, recipients of social services or other types of public assistance, or people who earned an income below 250% of the federal poverty line.

The benefit of using these qualifications for discount programs is that they are easily verifiable. In particular, Indego found that using the EBT card, a card that most people always carry with them, as proof of qualification greatly simplified the sign-up process. Potential participants can sign up

online at any time of day, compared to other low-income programs that may require someone to go to an office and show physical proof of income (Andersen, 2016).

All of the bikesharing programs offered discounts in the form of a monthly payment. Citi Bike initially promoted a $60/year option for low-income riders, but later found out through focus groups and intercept surveys that the upfront cost of membership was too high. Shifting the payment instead to $5/month lowered a financial barrier significantly and allowed residents to try the service without a year-long commitment (Fillin-Yeh & Chaney, 2017).

Citi Bike's community engagement paid off when low-income residents told them the upfront cost of the discounted $60/year membership option was too high. This prompted Citi Bike to shift to a $5/month membership instead.

Both carsharing pilots had discounts for per-minute and per-hour rates. BlueLA also found that the most popular pricing option among low-income users was $9 for 3 hours of use (Ferguson & Holland, 2019). An evaluation of Buffalo CarShare members found that members without access to a personal vehicle tended to use carsharing vehicles to trip chain, combining different errands together into one trip. Buffalo CarShare is notable for attracting many low-income members; a report from 2011 found that half of members had an annual income of less than $25,000 per year (Randall, 2011).

Alternate Payment Options

Two of the bikesharing pilots (Indego and BIKETOWN for All) and one of the carsharing pilots (Ithaca CarShare) offered cash payment options for users who are unbanked or prefer not to use credit or debit cards to sign up. Citi Bike partnered with a local Community Development Credit Union to allow unbanked individuals to open an account (Fillin-Yeh & Chaney, 2017). The marketing team at Indego stressed that the lack of a credit card was not the only barrier and the cash payment option needed to be combined with a discount program in order to significantly impact accessibility for low-income Philadelphians (Andersen, 2016). For example, Bike Arlington conducted a one-year pilot for a cash payment option and found that no one took advantage of it. Though the pilot had logistical and marketing issues, as well as a limited number of locations to purchase a cash pass, the findings suggest that cash payment on its own is not enough to overcome financial barriers (Corbin, 2016).

Accessories to Enable Use

Offering accessories to participants was a characteristic unique to the bikesharing pilots that we highlighted. Both Nice Ride Neighborhood and BIKETOWN for All gave participants free helmets, and Nice Ride Neighborhood also offered free bike lights, locks, and other bike accessories. These items lowered the entry costs of bikesharing by giving participants necessary safety equipment for riding (Lanning, 2016; Martin & Haynes, 2014). Also in Portland, through the electric scooter pilot program in 2018, scooter companies that participated in the pilot were required to either hand out or mail free helmets to prospective riders (*2018 E-Scooter Findings Report*, 2019). Interestingly, an evaluation of the electric scooter pilot program found that 90% of scooter riders do not wear helmets, suggesting that lack of a helmet is not a barrier to using scooter sharing in the same way that it is for bikesharing.

Gaps in Shared Mobility Equity Literature

From the pilots we analyzed, strategies for operationalizing equity were largely based on marketing, recruitment, or informational campaigns to address informational and cultural barriers to using shared mobility. Discount programs and alternate payment options were strategies to address structural and financial barriers. As a whole, these strategies use broad strokes to target potential users and encourage uptake. However, significant gaps still remain on how target populations use shared mobility once they become members and whether access to shared mobility helps users fulfill transportation needs.

Our research hypothesizes that factors other than cost and accessibility, such as cultural and educational factors, are significant barriers to using shared mobility for low-income populations. Furthermore, we hypothesize that low-income as it is currently defined in transportation equity is not capturing other populations, such as rent burdened individuals, who are also struggling with housing and transportation costs. We propose to fill these gaps by using qualitative methods to understand how low-income residents make transportation decisions and their preferences for different types of incentives. The results of our research will be used to understand how low-income populations respond to different types of incentives and how incentives impact use of different modes and transportation decision making. This understanding will be instrumental in developing inclusive and equitable policies that are sensitive to the unique transportation needs of low-income populations. Our findings can also be used to make recommendations for the efficient allocation of transportation funds to benefit low-income populations. In the next section, we will describe the methodology in more detail.

Section 3. Methodology

We employ a mixed methods approach drawn from different academic fields of study. In this section, we describe our methodology in more detail.

Expert Interviews

To supplement findings from the literature review, we conducted 13 expert interviews from October 2019 to February 2020 with subject matter experts in the public, private, and non-profit sectors whose work is related to transportation equity. We compiled a list of experts based on exemplary shared mobility pilot programs aimed at increasing transportation equity, focusing mostly on shared micromobility programs. Since shared micromobility is a relatively newer service compared to carsharing or TNCs, the literature, particularly for shared electric scooters, was not as comprehensive, and we used expert interviews to better understand ongoing social equity programs in shared micromobility.

The experts we interviewed come from all over the United States, but we intentionally sought out experts who either currently work in the San Francisco Bay Area or have worked there in the past to participate in interviews. We felt that perspectives on past, present, and future work in the city of Oakland were valuable to our research which is specifically focused on neighborhoods in Oakland, California.

We contacted experts via email to set up an interview which we conducted in-person or virtually via video conference and phone call. We asked interviewees the same set of general questions about their prior work in transportation equity and their recommendations for best practices to design and implement equity-focused projects. We also asked experts who had worked on equity projects about major findings and evaluation methodology. Finally, we asked all interviewees to reflect on what the future of shared mobility should look like for low-income people. On average, these interviews lasted about an hour.

Focus Groups

A key finding from the literature review and expert interviews was that involving community voices throughout the planning process is crucial to developing equity programs that work for the community. With that in mind, we conducted three focus groups (n=24) in November and December 2019 with East Oakland residents. We conducted two focus groups in English (n=12) and one focus group in Spanish (n=12). We recruited participants through community-based organizations, such as TransForm[1] and The Unity Council[2], public events, and tabling at community centers, transit stations (Fruitvale and Coliseum BART), and libraries. We used a short, five-minute screener survey to check the eligibility of participants. The screener survey included basic demographic questions as well as questions about recent travel patterns. In the focus groups, we asked participants about their current use of different transportation modes, the major transportation barriers they faced, perceptions of shared mobility, and preferences for incentives to use shared mobility. At the end of the focus group, each participant received a $50 gift card. Each focus group was recorded and we used the recordings to write detailed notes and identify key quotes from participants.

Online Survey and In-depth Longitudinal Panel Resident Interviews

Based on the findings from the focus groups and expert interviews, we conducted an online survey (n=177) and in-depth phone and video interviews (n=31) to further understand the transportation decisions of rent burdened residents of Oakland, how shared modes including public transit can help meet their transportation needs, and their preferences for different types of incentives and interventions to increase access, awareness, and usage of shared mobility. The online survey took about 15 minutes to complete and was distributed through the Qualtrics platform, community-based organizations in Oakland, and on Craigslist. Survey respondents received a $10 gift card after completing the survey. The survey included questions about general use of transportation, changes to transportation due to the COVID-19 pandemic, awareness of shared mobility, reasons for not using shared mobility, and demographic questions. We identified rent burdened residents using a screener question at the beginning of the survey.

We also conducted in-depth interviews with 31 rent burdened Oakland residents. We recruited interviewees through Craigslist, community-based organizations, and snowball sampling. We

[1] TransForm is an organization based in the San Francisco Bay Area that promotes walkable communities with excellent transportation choices to connect people of all incomes to opportunity, make California affordable, and help solve the climate crisis.

[2] The Unity Council is a community development organization committed to promoting social equity and improve quality of life in the Fruitvale District of Oakland.

asked interested participants from Craigslist and CBOs to fill out a short 5-minute screener survey with general transportation questions and demographics. We selected potential participants to represent a range of car ownership, use of public transit and shared mobility, demographics, and home location. We conducted a total of three 30 to 60-minute long interviews with each interviewee either over the phone or Zoom. We spaced out the three interviews over several days or weeks. Respondents received a $100 gift card after completing all three interviews. In the first interview, we asked questions about background, employment, housing choice, and use of transportation. The second interview focused on travel decisions, trade-offs between transportation modes, budgeting decisions, and transportation expenses. In the final interview, we asked participants about their preferences for different incentives to use shared mobility and public transit and impact on travel behavior. Interviews were recorded, transcribed, and coded using a method of flexible coding detailed in Deterding & Waters (2018).

Study Limitations

As with any small-N study, our research may not be representative of the general population of rent burdened residents in Oakland. We offered incentives for participating in the survey and interviews to mitigate response bias. However, our survey was conducted online and the sample may not include Oakland residents without access to a laptop or cellphone connected to the Internet. We did consider distributing paper surveys through mailers, however, at the time that we were preparing the survey over the summer, the transmission rate of the COVID-19 virus on paper surfaces was unclear. As a result, we decided to move forward with an online format. Similarly, we conducted interviews either over the phone or using Zoom conferencing services. However, these phone and video interviews might not capture Oakland residents without access to a phone. Furthermore, in the process of recruiting potential interviewees, we noticed that some interviewees that we contacted who seemed interested in participating in the study were not able to commit to a full hour for the interviews because of childcare, other family obligations, or work obligations. Many national news outlets have reported on the uneven burdens of the pandemic on working mothers (Goldberg, 2020; Joyce & McCarthy, 2020) and we found this to be true in our interview recruitment as well. In addition to working mothers, a report from the Bureau of Labor Statistics found that low-income workers were less likely to be able to work from home (Dey et al., 2020). Based on these reports, we believe our interview sample may be biased towards Oakland residents who had the time and emotional energy to participate in three hour-long interviews over the phone or video conferencing.

Section 4. Expert Interviews

In this section we organize findings from shared mobility expert interviews into three sections: design, findings, and reflections. In the design section, we highlight the main components of equity programs, how practitioners operationalize equity, and the reasoning behind program design. In the findings section, we provide an overview of the outcomes of equity projects, including insights that were not articulated in publicly available reports. In the reflections section, we summarize the outlooks of these experts on the future of shared mobility and its role in the transportation landscape for low-income people.

Design

Of the 13 experts we interviewed, nine were directly involved in designing or overseeing the implementation of equity-focused shared mobility programs. These experts came from public agencies, university research centers, and private shared micromobility operators. We identified several major themes from these interviews about the design of these programs which we describe in further detail in this section. All interviewees stressed the importance of involving voices from the community from the beginning and conducting outreach to understand community needs – that is, embedding equity in the process itself and not just in the outcomes of the program. These experts shared additional strategies to operationalize equity such as equity requirements or mandates. Finally, to assess the impact of equity initiatives, experts used a variety of quantitative and qualitative evaluation metrics. In this section, we discuss the common themes and strategies used by experts to design shared mobility equity programs.

Community Involvement and Equity in Process

A common sentiment expressed by several interviewees, including those from public agencies and private shared mobility companies, was that equity research and initiatives can easily appear paternalistic and presumptuous of what low-income communities want. In the words of a director of partnerships at a shared mobility company, "equity should not be policymakers or regulators getting in a room and coming up with some idea that [they] think is a good idea." Instead, equity in process starts with involving the community from the inception of equity programs to ensure that programs are responding to a specific community need.

> **"Equity should not be policymakers or regulators getting in a room and coming up with some idea that [they] think is a good idea."**
>
> *- Director of Partnerships at a shared mobility company*

In practice, four of the five equity programs discussed in these expert interviews used focus groups with community members to assess transportation needs and preferences towards shared modes. Three of the five equity programs used widely distributed online surveys to gauge community opinions and perspectives towards shared modes. One of these three programs used community members themselves to help design survey questions and collect data by distributing surveys. The strategy of involving community members directly in the evaluation and data collection process was specifically recommended by a program manager who oversees funding allocation for equity projects. She stated that the key benefit of this strategy is allowing community members to determine and prioritize their needs independently, rather than having an outside party assessing the relative importance of different transportation needs. Another benefit of this strategy is having a trusted member of the community conducting the research which may increase response rates.

One expert shared that the key to successful outreach is "meeting people where they are." This approach has two main implications. The first implication is that isolated outreach centered around promoting a particular shared mobility service is not as effective as participating in larger events within the community. As an example, one researcher described the difference between a bikesharing company sending representatives to community meetings and a bikesharing company creating their own outreach meeting. A bikesharing company that shows up to a community meeting exemplifies meeting the community where they already are, while creating their own

meeting effectively asks the community to come to them. Organizing isolated outreach events places the burden of participation on the community, rather than the shared mobility company or public agency taking action themselves to find out what the community thinks.

The second implication of this approach is that it is up to the operator or public agency to understand and highlight the ways in which shared mobility can serve the transportation needs of low-income communities. If shared modes are not already in the purview of low-income people or the use case is not clear, simply offering discounts is not sufficient to nudge their behavior and adoption of a new mode of transportation. In this case, meeting people where they are means listening to community voices to understand where people are traveling, what kinds of transportation and social services they are already using, and the issues that are important to them. Once the transportation needs and travel patterns of the community are understood, then shared mobility operators or public agencies can proceed to figure out how shared mobility can be useful in that specific context.

Equity Requirements in Shared Mobility Programs

As we presented previously in the literature review, most equity programs in shared mobility include requirements to address financial barriers, such as offering a low-income discount, cash payment options, and non-smartphone options. We conducted interviews with three people at public agencies who oversaw scooter sharing pilot programs. All three mentioned some form of spatial equity requirement that mandated companies place a certain number or percentage of the total scooter fleet in designated equity zones or neighborhoods. In Baltimore, equity zones were census tracts selected based on average household income; this strategy was the first time the city attempted imposing a spatial equity requirement. Interestingly, the city found that scooter operators were placing vehicles along the borders of these zones, technically complying with the requirement but not actually providing comprehensive spatial coverage. The city then modified the requirement to identify twenty more specific equity locations at transit stations, shopping centers, and street corners, and required each of the four scooter operators to place at least three vehicles at each location at the beginning of each day. The city also required operators to rebalance vehicles if too many were concentrated in one area of the city. These requirements ensured not only an even spatial distribution of vehicles but also that non-smartphone users could reliably find a vehicle at the twenty equity locations at the beginning of the day. The Baltimore pilot project exemplifies the flexibility required of cities and other public agencies when it comes to introducing innovative shared mobility options to the community. The city used a trial period to evaluate the effectiveness of equity mandates and adjusted the mandates based on findings from the trial period.

Portland, Oregon also exhibits flexibility in regulations for scooter companies. Portland has a flexible permitting structure that incentivizes operators for having certain programs or initiatives by increasing their fleet allotment. For example, operators are incentivized to partner with the city to develop strategies that meet climate and equity goals. The city has also offered incentives for operators that have a workforce development program for people in underserved communities. Since these initiatives are still fairly new, the city does not yet have a clear idea on how these incentives are motivating scooter companies.

Evaluation Metrics

We asked all nine experts directly involved in equity programs to state the goals of the program. Overwhelmingly, the response was simply to make the demographics of users match the demographics of the service area. Some other stated goals of shared mobility in general were to reduce vehicle miles traveled, private vehicle use and ownership, and induce behavioral and attitudinal changes towards shared mobility. One program team we talked to in Minnesota stated that they saw their bikesharing program as a way to build community and connect low-income residents with their neighbors.

The main tools used to track progress towards program goals were activity data that operators were required by cities to provide and membership data such as number of low-income members or number of members who signed up for low-income programs. Some programs followed up with user surveys and in one case, qualitative interviews with participants after the pilot program was completed.

Given that many experts stressed importance of community involvement and consideration of the specific transportation needs of the community, it is surprising that only one program used qualitative data to evaluate the impacts of the pilot program. Quantitative data such as origins-destinations of trips, number of low-income members, or percentage of users of color may be easier to obtain and can be tracked over time to see whether behaviors or demographics are changing. However, evaluating a program with qualitative data through interviews or focus groups may provide richer insights on how the low-income community is using shared modes to meet their needs, what barriers still remain, and what steps need to be taken in the future to close persistent demographic gaps in shared mobility member bases. To truly have equity in process, programs must continually include voices from the community, even after the equity program has been designed and implemented.

To truly have equity in process, **programs must continually include voices from the community,** even after the equity program has been designed and implemented.

Summary of Design of Equity Pilots

- Equity in process: involve community voices from the beginning to design equity programs through focus groups and interviews
  - Involve community members in data collection and analysis
- Community outreach should meet people where they are
  - Shared mobility companies should send representatives to existing community meetings or events, rather than expecting community members to show up to events hosted by the company
  - Listen to community voices and understand their travel patterns and how they use existing transportation services
- Cities should be flexible when developing equity requirements and use a trial period to understand whether those specific requirements lead to desired outcomes
- Quantitative data dominate evaluation metrics of equity pilots. However, given the importance of community involvement and desire to lift the voices of the community, more qualitative approaches should be considered in the future.

Findings

We asked the nine experts directly involved in equity programs to share insights about the main findings and takeaways from these programs. We categorize their responses in this section based on low-income preferences and use cases for shared mobility and barriers that remain for low-income adoption and use of shared mobility. The findings we present in this section are a high-level overview from the perspective of personnel at public agencies, private companies, and non-profit organizations that have designed and overseen shared mobility equity programs. In the next sections of this report, we will take a more detailed look at low-income shared mobility preferences, use cases, and barriers using perspectives gathered from focus groups, survey, and interviews.

Preferences and Use Cases for Shared Mobility

Several bikesharing programs found that low-income users tended to use the service for more recreational purposes and in some cases for managing stress and mental health. Indego Bike Share in Philadelphia found from focus groups that low-income residents and communities of color saw a clear recreational use case for bikesharing which led program organizers to introduce discounts for longer rental times of several hours. However, these experts noticed that trip purposes have changed over time to include trips other than recreation, especially with e-assist bikes in the fleet.

In two cities, experts stated that electric scooters seemed to be more appealing than bikesharing. In Baltimore in particular, a city planner shared that the bikesharing program had a total of 35,000 rides in one year of service in 2017, while the dockless scooter sharing program had over 40,000 rides in one week after launching in 2018. In Portland, a user survey found that 77% of surveyed scooter users had never used bikesharing before and the majority do not ride bikes regularly. A city planner in Baltimore and a bike equity researcher posited that the wider appeal of scooters compared to bikes could be attributed to the lack of presumptions or images of what a "scooter rider" looks like. Although bike riders are a rather diverse population, as discussed previously in the literature review, there is an image of what a biker looks like based on the loudest bike advocacy groups, which one interviewee called the MAMIL, or middle-aged man in Lycra. This image can be exclusionary towards people that do not identify with that image. In comparison, scooters are detached from any distinct image of a "scooter rider" which perhaps makes scooters culturally accessible to a larger demographic audience.

For preferences for shared modes in general, experts from two cities (Portland and Oakland) shared both revealed and stated preference data. The city of Portland held transportation fairs at seven affordable housing sites and distributed a $300 prepaid gift card to residents to spend on different transportation options. The organizers of this event found that residents either spent the whole amount on an annual public transit pass (light rail and bus) or on a combination of TNC and scooter credits. In Oakland, a non-profit group surveyed residents of an affordable housing site, asking residents to rank their top three transportation benefits. Residents had the highest preference for a free bus pass, credit to use on public transit, and discount TNCs. Other shared mobility options were less popular; few residents selected bikesharing or scooter sharing and 85% of residents had never heard of carsharing.

Barriers to Low-Income Adoption and Use of Shared Mobility

Some barriers stated by the experts interviewed were consistent with findings from the literature review. One interesting new finding was that even for low-income people who have a debit or credit card, there were still concerns about linking the card to an account for fear of overdrafting or being held liable and fined for vehicle damages and theft. Furthermore, though many scooter companies and bikesharing operators are required by cities to have low-income discount programs, lack of widespread knowledge of these programs is a persistent challenge. Information about programs is diffuse, confusing to find on websites, and requires completing separate applications for each shared mobility service.

Another persistent barrier stated by many interviewees was the feeling within the low-income community that shared mobility "wasn't for them." In Baltimore, the docked bikesharing program had most stations situated downtown with plans to expand to other parts of the city. However, because the city is so highly segregated, when bikesharing launched primarily in downtown, residents in communities of color felt excluded and hostile towards the service which, in their perspective, was built for a higher-income, Caucasian demographic. In contrast, dockless scooters require less upfront capital investment and do not need stations, thus allowing the companies to distribute vehicles throughout the city very quickly. As a result, in a community survey with over 5,000 respondents, the city of Baltimore found that scooters had a high approval rating across all racial and gender groups. Adoption rates were also fairly similar across demographics. A city planner in Baltimore specifically cited the greater accessibility and spatial coverage of scooters compared to bikesharing as the reason for popularity and adoption of scooters, especially among low-income communities. The activity data showed that scooters placed in census tracts designated as "equity zones" were not used much during the day, which made sense given that the equity zones are not major commercial centers. However, the activity data also showed a net positive flow of scooters into census tracts designated as "equity zones" in the evening, meaning that more scooters ended up in equity zones than were placed there in the morning. This city planner felt this was an encouraging sign and indicated that residents in equity zones might be using scooters to return to their homes after work or other activities during the day. In Baltimore, then, the biggest factor in overcoming the barrier of low-income communities thinking "this mode isn't for me" was simply having vehicles accessible and visible in low-income neighborhoods.

While increased vehicle presence in the street addressed certain cultural barriers in Baltimore, the same was not true in Portland. From focus groups with African American residents, planners found that even after seeing vehicles in the street, residents still did not believe the mode was "for them." These focus group participants did not realize that shared scooters were something that they could sign up for or use and had further policing concerns. The planners we spoke to stated that these participants felt that, as people of color, they were much more vulnerable and aware of their behavior when using a public right-of-way, which they saw as a major barrier to using shared active transportation. Other focus group participants suggested a lack of culturally appropriate marketing made shared scooters feel exclusive. Thus, the relationship between spatial accessibility and adoption of shared modes by low-income communities is complex and may vary from city to city based on local context and history.

Summary of Equity Pilot Findings

- Low-income residents primarily used shared micromobility for recreational trips
  - Shared electric scooters are more appealing than bikesharing
- Though low-income discount programs exist, few residents are aware of these programs
- Low-income communities still believe that shared modes are not "for them"
  - More culturally appropriate marketing could make shared modes more inclusive
- Adoption of shared mobility may vary from city to city based on local context and history

Reflections

In this section, we discuss the reflections of the experts about the future of equity considerations in shared mobility. These reflections include insights on both the limitations and potential of shared modes to improve the mobility of low-income communities and a discussion of some problems that transportation cannot solve.

Limitations of Shared Mobility: "It's bigger than transportation"

One common theme echoed by experts in the public, private, and non-profit sectors was that the mobility problems faced by low-income communities are much bigger than just a lack of transportation modes. A planner in Oakland noted that in the Bay Area, to begin a conversation about equitable mobility necessitates addressing issues of affordable housing. A researcher who studied bike equity and advocacy in the Bay Area stated that improving accessibility is broader than moving people faster and more efficiently. Improving accessibility can also mean improving existing amenities and services within low-income neighborhoods. This viewpoint was echoed by a director of partnerships at a private mobility company who said that those interested in mobility equity should reshape their thinking on how to "lift up communities where they are." Within the transportation industry, much of the focus is on moving people from A to B, but that strategy does not necessarily fix systematic issues of spatial mismatch when many low-income and communities of color live in public transit deserts removed from job centers. Thus, any discussion about sustainable or equitable transportation must acknowledge and respond to these issues that are bigger than transportation. Furthermore, some experts that we spoke with suggested that expectations for increasing equity in shared mobility must be tempered by these existing paradigms of urban space and spatial mismatch.

Opportunities for Shared Mobility

Despite the limitations of shared mobility, many interviewees were still hopeful and felt that while shared mobility cannot solve all transportation problems, it still had great potential as an additional tool in the transportation toolkit of low-income people. In this way, shared mobility can increase the resilience of low-income people by expanding their existing transportation options.

Eight of the experts we interviewed explicitly stated that shared modes could help support public transit systems. One city planner in Oakland, California saw a clear use case for shared modes such as TNCs and microtransit to serve low-performing bus routes, thereby allowing bus agencies to focus their resources on other high-ridership routes and improve overall service quality. Planners in Portland believed that shared services could support the limited resources of a city to effectively serve a large population of riders. Three experts, from the public and private sectors, stated that shared mobility could serve as a first mile-last mile connection to public transit, thus

increasing the existing catchment area of transit. This use case for shared mobility is particularly important as housing costs continue to rise in urban cores and low-income people get displaced into outlying suburbs.

Future of Shared Mobility

We asked each interviewee to share their outlook on what the future of shared mobility should look like for low-income communities so that the opportunities of shared modes could be realized. Six experts said that shared mobility must be designed and deployed to meet specific community needs which requires the involvement of community voices at every stage of the planning process. In terms of actual implementation and usage, five experts said that services had to be easy to understand and integrated. Currently, even though low-income discount and membership options exist, information on these programs is difficult to find and different services have different policies. These insights from experts point towards the desire for integrated platforms, or "Mobility as a Service" apps that can seamlessly integrate information for many different transportation options.

One interviewee who was currently working on designing a carsharing pilot, summarized her work to advance equity in shared mobility to target three key attributes of shared mobility: access to shared modes, awareness of shared modes, and usage of shared modes. These three attributes of shared mobility will be explored further in the focus group, survey, and interview findings.

Summary of Expert Interviewee Reflections

- Any discussion about transportation equity must also engage with issues of spatial mismatch and inequitable development of urban space.
- Shared mobility can be an additional tool in the transportation toolkit for low-income travelers, particularly as a first mile-last mile connection to public transit, which can increase the catchment area for public transit services.
- The future of shared mobility should be inclusive, integrated, and easy to use.
- Three key attributes to consider when advancing equity in shared mobility are: access, awareness, and usage.

Section 5. East Oakland Focus Group Findings

To further explore the transportation use of rent burdened Oakland residents and their adoption and use of shared mobility, we conducted three focus groups (n=24) in East Oakland from November to December 2019. In this section, we summarize findings from these focus groups.

Participant Demographics

A detailed table of participant demographics is shown in Table 6 below. The focus group sample is a good representation of a diverse set of voices from East Oakland across gender, age, race, ethnicity, and household size. Although the sample underrepresents Latino men, given resource constraints, we felt it was important in our research to prioritize the voices of Latina women. Furthermore, from the majority of Latina women in the focus groups, we found that the issues they faced were often larger and more complex than those faced by their husbands due to lack of car access and needing to travel to many destinations to fulfill childcare and other household

responsibilities. Through these focus groups, we were able to hear from more vulnerable groups in East Oakland whose unique perspectives may not be adequately captured in existing research.

Demographic	Participants (n=24)	Oakland population
Gender		
Male	42%	**48%**
Female	58%	**52%**
Age		
18-24	4%	**6%**
25-34	46%	**20%**
35-44	26%	**16%**
45-54	16%	**13%**
55-64	4%	**11%**
65 or older	0%	**13%**
Prefer not to answer	4%	**0%**

Demographic	Participants (n=24)	Oakland Population
Race		
Asian	4%	**16%**
White/Caucasian	50%	**37%**
Black/African American	38%	**23%**
Mixed race	8%	**7%**
Ethnicity		
Not Hispanic/Latino	46%	**74%**
Hispanic/Latino	54%	**26%**
Income		
Less than $10,000	17%	**6%**
$10,000 to $14,999	13%	**7%**
$15,000 to $24,999	21%	**8%**
$25,000 to $34,999	17%	**8%**
$35,000 to $49,999	17%	**10%**
$50,000 to $74,999	4%	**15%**
$75,000 to $99,999	0%	**11%**
More than $100,000	8%	**37%**
Prefer not to answer	4%	**0%**

Table 6: Focus group participant demographics compared to Oakland population. Oakland population estimates come from the 2019 American Community Survey 5-Year Estimates.

Current Transportation Use

We asked focus group participants about the transportation modes they currently used and their typical travel patterns. Seventeen participants had at least one car in their household and two participants said that they could borrow a car, get a ride from a friend or family member, or use TNCs when they needed car access. Five participants said they had no car access at all.

Car access	# of participants
At least one car	17
Borrow a car, get a ride, or use TNCs	2
No car access	5

Table 7: Focus group participant car access

We then asked participants to list transportation modes they had used in the last month to understand what set of transportation options were available to them. The most frequently selected modes were: public transit (local buses and BART), walking or running, driving a personal vehicle, and TNCs. Use of shared micromobility was low; only 2 participants selected scooter sharing and 1 participant selected bikesharing. No one had used a carsharing service in the last month.

Participants live multi-modal lives, mixing and matching the options available to them to meet diverse travel needs and destinations.

To understand which of these options were used most frequently in their daily lives, we asked participants to estimate how many times they had traveled using each transportation mode in the past week. For the majority of participants, there were not any modes that clearly dominated (e.g., were used 7-10 times per week or more). Instead, most people were multi-modal, using several different modes at a frequency of 1-3 times per week, which suggests that these participants mix and match the transportation options available to them to meet diverse travel needs and destinations. When asked directly about transportation modes used on a typical day, one participant responded, "whatever I can use at the time," listing the bus, BART, skateboarding, and cycling as potential options. Another respondent stated, "currently you need multiple plans in case one fails," suggesting the instability and inconsistency of his existing transportation options.

Out of these modes used in the past week, the most frequently used was the public bus. Many participants preferred using the bus over taking BART because they could buy a daily pass for the bus which is cheaper than paying for every trip on BART. However, there were several people who preferred taking BART when they had to get somewhere quickly, with someone noting that BART was just as fast as Uber or Lyft but much cheaper. Participants also relied heavily on informal transportation networks, such as getting rides from a friend or family member or borrowing a car. Generally, these participants would repay these rides by giving gas money to the driver or owner of the car.

We asked participants who had children how they typically traveled as a family. For people that had access to a car in their household, they would most often use the car. For people without a car, they would ask for a ride or use public transit. However, many of the women in the focus groups shared how difficult it was to take public transit with young children, especially with strollers; when the bus was crowded, some bus drivers would not let riders with strollers onboard. Additionally, many participants stated that it was difficult to take a Lyft or an Uber if you had more than two young children who need car seats. Two women in different focus groups said that they had sent young children to destinations alone in a TNC vehicle as a last resort but did not feel comfortable when doing so.

One major discussion that arose during the Spanish-speaking focus group was around financial dependency. The majority of women in this focus group were the primary caretakers at home and stated that they did not have control over their own finances, credit cards, or bank accounts. Several women said that because they did not have their own credit card, they would have to ask their husbands to call an Uber for them from his phone. One participant also mentioned that she and her husband would often have to negotiate for use of the car; if she wanted the car to take the children to a doctor's appointment, her husband would have to forgo a day of wages since he would be unable to get to work otherwise. These anecdotes are meaningful examples of the trade-offs that households with limited resources must make when it comes to planning and executing daily travel.

Households with only one vehicle often have to make **difficult trade-offs when planning and executing daily travel.**

Transportation Barriers

Many participants wanted to take public transit more, especially with their families, but it was often cheaper and more convenient to drive or get a ride.

After discussing current uses of transportation, we asked participants to share what they wished were different about their daily travel. While some participants wished they had a car, many others said they wanted better transit service – "more frequent buses," "buses that keep to their schedule." The participants who had occasionally used Uber or Lyft to send their children to school specifically mentioned better school buses. One participant who traveled extensively on BART noted that she had seen BART giving out discounted tickets at Lake Merritt and Rockridge but rarely at stations in East Oakland. Several others agreed that some kind of BART discount was necessary, with one participant saying that she currently spends up to $16 per day on BART. In two of the focus groups, participants also talked about wanting discount bus or public transit passes for families to travel together. There was a consensus across the three focus groups that people wanted to take public transit with their families, but it was cheaper and more convenient to drive or get a ride from a friend or family member.

Each focus group had a passionate discussion about the Bus Rapid Transit (BRT) project under construction on International Boulevard, a major corridor running through East Oakland. The project was first approved in 2011 and construction began in 2014. The BRT project was completed in summer 2020 (*History | AC Transit: Bus Rapid Transit*, n.d.). The BRT project closes one lane of traffic on International Boulevard for a dedicated bus lane. Since the beginning of the project, many small businesses along International Boulevard have worried about the impacts of construction and losing on-street parking spaces. In the focus groups, participants were generally unhappy with the project. They had noticed traffic conditions worsening on International Boulevard and that current buses running along the corridor were often delayed because of the construction. Many participants also felt that the project was not "for them" and would not serve their travel needs.

Issues with street maintenance (e.g., potholes) and **excessive speeding and other unsafe driver behavior** makes active transportation (e.g., walking and biking) less appealing.

Participants also mentioned issues with street and sidewalk maintenance, especially potholes, that were dangerous not just for drivers but also for pedestrians and cyclists who risk getting injured when drivers swerve to avoid potholes. Because of this, many participants said they did not feel safe walking with their children. In the Spanish-speaking focus group, one person mentioned that some recent immigrants were not familiar with the rules of the road, making roads unsafe for cyclists and pedestrians. Others in the group agreed and thought that this was a barrier to increasing cycling. Interestingly, in this focus group, some participants advocated for increasing traffic police presence, surveillance, and fines for traffic violations in their neighborhoods. However, others disagreed, saying these measures rarely helped to improve traffic safety. Another focus group with mostly African American participants also discussed excessive speeding, but instead suggested speed bumps and speed tables as possible solutions. Finally, two women in the Spanish-speaking focus group wanted more dedicated bike lanes in East Oakland like they had seen in other parts of the city.

There were few major differences in the transportation barriers faced by English- and Spanish-speaking focus groups. Both groups relied heavily on public transit and discussed public transit improvements extensively. Both groups also discussed road safety for pedestrians and cyclists. With regards to road safety, the Spanish-speaking group discussed more specific issues around drivers who are recent immigrants, while the English-speaking group discussed unsafe drivers more generally.

Shared Mobility

After discussing current use of transportation, we asked participants about their existing knowledge and use of shared mobility. The most commonly used shared mode was TNCs, which participants primarily used as a backup option – "if my car breaks down." Others used TNCs for going out for recreational purposes, especially if they knew they would be going to a bar or club. Some participants said they had occasionally sent their children to school alone in an Uber as a last resort but did not feel safe doing so. One common complaint about TNCs was that it could be difficult to get picked up or dropped off in East Oakland; some drivers would see the pick-up address and cancel the ride because they did not want to drive into East Oakland, especially at night. Several participants in one focus group had similar experiences with food delivery and the UberEats platform. These participants said they sometimes used UberEats but had many issues with drivers who did not want to get out of their cars to deliver food to the door or wanted the customer to walk to the corner to meet them.

Participants in East Oakland found it **difficult to get picked up or dropped off by TNCs.** Several participants also experienced **issues with food delivery platforms where drivers did not want to deliver in their neighborhood.**

There was some distrust around Uber or Lyft drivers, though there were two participants in two different focus groups who had previously worked as Uber drivers. These participants had more positive perspectives towards TNCs. However, one former driver was adamantly against using shared rides because she knew from her own experience that the driver for shared rides is paid significantly less than for private rides. The other former driver would often take shared rides over private rides because shared rides were cheaper. In the Spanish-speaking focus group and one of the English-speaking focus groups, several women did not feel safe getting a ride from someone they did not know. Other participants did not like the idea of a shared Uber or Lyft for safety reasons and one participant said that he had one bad experience in a shared Uber and would never take a shared ride again. Some women said they would not take a shared ride at night with people they did not know. Another reason for disliking shared rides was not knowing the destinations of the other riders and the uncertain travel times. There were a few participants who said that they would take a shared ride over a private ride because of the cheaper price.

For shared micromobility options, most participants said they would use it for fun, for example to ride around Lake Merritt or with their children. Generally, older participants were more skeptical of trying scooter sharing than younger participants. In two of the three focus groups, participants cited safety issues around the travel speed of scooters as reasons for not trying the service. Others mentioned that when scooters first launched, there were more clusters of scooters in East Oakland, but now scooters were mostly clustered around BART stations and places with more people. For

bikesharing, there was a discussion in one focus group around whether the service was more or less convenient than owning a bike. Some participants felt that it was too hard to find a station to park the bike while others were afraid of having their own bike stolen or did not have space in their home to store a bike, and thought bikesharing was a good alternative option.

For shared micromobility, access to these services or not seeing them in their neighborhoods was a major barrier for most participants. Many people said, "we don't have that [in East Oakland]" or "we have to go downtown to use them," about scooters and bikesharing. These access barriers limit the utility of such services in the everyday lives of focus group participants, as they thought of micromobility mostly for recreational use, or for when they happened to travel to downtown Oakland or around Lake Merritt.

Lack of accessibility to shared micromobility devices led participants to use those modes for mostly recreational purposes.

Very few people had ever used carsharing before and only some participants knew about it. However, after we explained how carsharing works, many participants, particularly in the Spanish-speaking focus group, were interested in the service and said they could see it being useful for longer, shopping related trips. In one of the English-speaking focus groups, many participants questioned the quality and maintenance of carsharing vehicles. One participant worried about the previous user cleaning up after themselves or leaving trash behind. Other participants had heard about people who put their vehicles on Getaround, a peer-to-peer carsharing service, and the vehicles were returned damaged.

One participant had used carsharing previously as part of his small business and found it convenient for transporting large items such as bikes or materials to set up an event. He mentioned spatial access as a major barrier; he used to be able to find City CarShare vehicles (now part of Getaround) at nearby BART stations but now he had to be lucky to find a carsharing vehicle in East Oakland or would go downtown to pick one up.

In each of the focus groups, participants discussed other general barriers to using shared mobility services. Out of the 24 participants, everyone had a smartphone with a data plan and familiarity with app-based technology. However, in both of the English-speaking focus groups some participants mentioned others in East Oakland who might be less comfortable with using technology. One participant said that he knew people who had credit cards but did not want to link them to an app. In the other English-speaking focus group, someone mentioned that she did not like the idea of giving out personal data on an app. She also made a broad statement that people in East Oakland may not know how to use "tech services" and "needed a real person to talk to," such as a customer service agent, to help them set up an account and learn how to use a service.

Residents who are less familiar with smartphone technology may need more guidance to learn how to use shared mobility services.

There was also some discussion of financial barriers. One participant in one of the English-speaking focus groups was unbanked and relied on a network of friends and family to help him call an Uber if he needed one. In one English-speaking focus group, there was a consensus that Uber and Lyft rides could often cost up to $20 or $30. One participant said she knew many people

who spent up to $250 a month on Uber and Lyft rides. Participants in the Spanish-speaking focus group also spoke about the high cost of Uber, with one participant sharing that her brother had spent over $50 on a trip to Berkeley because of surge pricing.

Financial costs were often cited as a barrier to using TNCs, but not shared micromobility.

Interestingly, none of the participants brought up cost as a barrier to using bikesharing or scooter sharing. For participants in the Spanish-speaking focus group, the biggest barrier was being unfamiliar with shared micromobility. For participants in the English-speaking focus group, the biggest barrier was lack of presence of shared micromobility in their neighborhoods.

As a whole, participants in the English-speaking focus groups were more aware of different shared mobility options than participants in the Spanish-speaking focus group, especially carsharing and shared micromobility. More of the English-speaking participants had used different shared modes than Spanish-speaking participants, whose use of shared mobility was primarily through TNCs. Spanish-speaking participants, who mostly lived in the Fruitvale neighborhood, did not mention any difficulties calling a TNC, while the English-speaking participants, some of whom lived further east in Easr Oakland, had problems getting Uber drivers to come to their neighborhood.

On some topics, there was consensus across all focus groups. Many participants perceived shared micromobility as a primarily recreational mode, with some noting that bikesharing does not have a presence in East Oakland and scooters are clustered downtown and around Lake Merritt. Many participants were wary of taking shared TNC rides, not just because it would be more difficult to travel with family but also because of safety issues from fellow passengers and the driver.

Shared Mobility Incentives

In each focus group, we asked participants what kinds of incentives they would like to see for shared mobility. We organizes their responses into incentives that can introduce users to a new service, measures to address financial barriers, and strategies to decrease the cost of using a service.

Incentives to Try Shared Mobility

Free trials and test ride events could be effective incentives for people who are relatively unfamiliar with shared mobility.

The Spanish-speaking group was the least familiar with shared micromobility and carsharing. In this group, many participants liked the idea of a free trial for scooters: “Maybe if some distances were free, just to try it and figure out if you like it to keep on using it.” Free trials could be a low-risk way for new users to learn how to use a shared mode and understand its application in their daily lives. Someone else suggested a “transportation fair” or test ride event where she could try out many different modes. This participant specifically talked about GIG Car Share which uses hybrid vehicles; since she had never driven a hybrid vehicle before, she wanted to test it out first before signing up. Free trials and events, such as a transportation fair, are examples of incentives that might be more appealing to those who are relatively unfamiliar with shared mobility.

Measures to Address Financial Barriers

In one of the focus groups, participants discussed integrated fare payment and Clipper card (the regional public transit card for the San Francisco Bay Area) discounts as a way to address users

who are unbanked or underbanked. Furthermore, across all of the focus groups, even for those who had credit or debit cards or bank accounts, many people distrusted linking their accounts to an app. This was similar to findings from the literature review, as many low-income people fear hidden fees, liability for stolen or vandalized vehicles, and overdrafting. Some participants discussed integrating shared mobility into Clipper cards, which they called a "transportation credit card," for a more seamless travel experience. Using Clipper card would protect their credit cards and bank accounts from overdrafting and hidden fees, since they would just load their Clipper card with money whenever their balance ran low.

Integrating shared mobility into existing regional public transit passes can create a more seamless travel experience and address concerns such as overdrafting and hidden fees for unbanked or underbanked individuals.

Pricing Strategies

Participants who had used shared mobility before were asked about their preferences for discounts on each trip, paying for a bundle of 10 discounted trips upfront, or buying a monthly pass with unlimited trips under a certain length. The majority of participants preferred receiving a discount on each trip because of uncertain finances. Some participants said that if they had a steady source of income, they would prefer paying for a bundle which would give them peace of mind to have a "bank" of free rides to use whenever they needed them.

We also asked participants about discounts that could encourage first mile-last mile connections to transit. At the same level of discount, the scooter-to-BART incentive was much more popular than the bikesharing-to-BART incentive. However, taking shared micromobility to BART was more popular than taking a TNC to BART. Participants said that scooters and bikesharing would be faster than TNCs because there would be no wait time and less traffic if they rode on the sidewalk or on the street. However, they would not choose micromobility to get to BART if they were traveling with their family.

Summary

From the expert interviews, we identified three main attributes of shared mobility that can be targeted with interventions to increase equity in shared mobility: 1) awareness of shared mobility, 2) access to shared mobility, and 3) usage of shared mobility. We found that each of these attributes was addressed in the focus groups. A high-level summary of these attributes is shown in Figure 4 below. We discuss each attribute in more detail below, using examples from the focus groups.

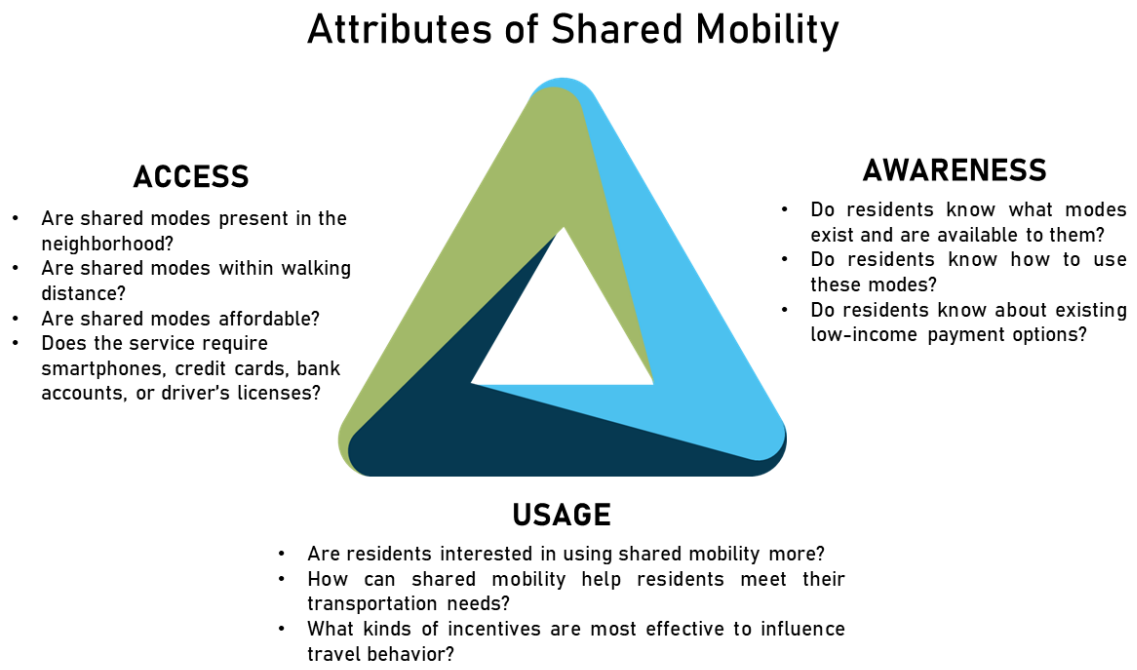

Figure 4: Attributes of Shared Mobility

Access to shared mobility

Participants addressed access to shared modes in two ways: spatial access and financial access. For shared micromobility, the lack of presence of these services in East Oakland was a major barrier for our focus group participants to incorporate these modes into their daily lives. For those participants who lived in Deep East Oakland, requesting pick up or drop off at their home was difficult, as some TNC drivers were unwilling to travel into their neighborhood. Although addressing these spatial barriers is outside the scope of our research project, it is important to note the larger issues of urban form, as discussed in some expert interviews, that can limit the effectiveness of shared mobility equity programs. The problem of financial access is another larger, systemic issue that may fall outside the scope of this project. An interesting finding from the focus groups was that even those participants with credit cards and bank accounts do not feel comfortable linking these accounts to an app. While this project might not be able to entirely address distrust towards credit cards or fear of hidden fees, there are actionable measures that might be able to lower other financial barriers such as the high costs of using shared modes. Additionally, many shared mobility companies have cash payment options or accept gift cards, but information about using these options can be difficult to find online or confusing to set up. One potential strategy is to develop messaging, advertising, or design training around these alternate payment options to facilitate the awareness of these programs for low-income groups.

Issues of financial access may extend beyond traditional unbanked or underbanked populations. In focus groups, **even participants with a credit card did not want to link their card to shared mobility apps.**

Awareness of shared mobility

In the Spanish-speaking focus group, many participants were unaware of certain shared modes such as carsharing, but once participants learned how the service worked, they were interested in trying it and could clearly see how carsharing would benefit certain types of trips. Another participant suggested free trials as a way to increase awareness of shared scooters. The free trial lowers the barrier to entry for trying a shared mode that is completely unfamiliar to the user. Another idea was a transportation fair where participants could learn about and try many different shared mobility services.

Usage of shared mobility

These first two attributes, awareness and access, impact the third attribute, usage of shared mobility. The potential interventions discussed in this section that target awareness and access can facilitate usage of shared mobility by low-income groups. However, for the usage of shared mobility, it is important to go beyond the standard usage metrics of ridership, membership, and ride volume that are typically collected through activity data. Instead, by using qualitative methods such as surveys, interviews, or participant observation, researchers can understand how low-income groups choose to use shared mobility to fulfill their travel needs, and particularly how shared mobility can help supplement existing use of public transit.

In the following section, we use the three attributes of shared mobility as a guiding framework for understanding how rent burdened residents of Oakland make transportation decisions, and what interventions and incentives can shift travel behavior and address barriers to shared mobility.

Section 6. Online Survey and Resident Interview Findings

We explored access, awareness, and usage of shared mobility using an online survey and in-depth, longitudinal phone and video interviews with rent burdened Oakland residents. Demographic summaries for the survey respondents and interviewees are in Table 8 below. A detailed table with interviewee characteristics is in Appendix D. All interviewee names have been changed to maintain anonymity.

	Survey (n=177)	Interviews (n=31)	**Oakland population**
Gender			
Male	46%	32%	**48%**
Female	52%	65%	**52%**
Non-binary	2%	3%	**0%**
Age			
18 - 24	17%	6%	**6%**
25 - 34	45%	39%	**20%**
35 - 44	26%	13%	**16%**
45 - 54	2%	29%	**13%**
55 - 64	7%	13%	**11%**
65 or older	2%	0%	**13%**
Car Ownership			
No vehicle	26%	35%	**16%**
1+ vehicle	74%	65%	**84%**

	Survey (n=177)	Interviews (n=31)	**Oakland population**
Race			
Asian	17%	16%	**16%**
Caucasian/White	44%	35%	**37%**
Black/African American	13%	39%	**23%**
Mixed race	21%	10%	**7%**
Ethnicity			
Not Hispanic/Latino	79%	77%	**74%**
Hispanic/Latino	21%	23%	**26%**
Income			
< $10,000	11%	16%	**6%**
$10,000 - $14,999	12%	0%	**7%**
$15,000 - $24,999	7%	16%	**8%**
$25,000 - $34,999	21%	19%	**8%**
$35,000 - $49,999	40%	19%	**10%**
$50,000 - $74,999	40%	23%	**15%**
$75,000 - $99,999	18%	6%	**11%**
> $100,000	19%	0%	**37%**

Table 8: Demographics of online survey respondents and interviewees

Access and Awareness

Overall awareness of shared mobility was high:

- Only 1% of respondents had never heard of scooter sharing, bikesharing, TNCs or pooled TNCs.
- 6% had never heard of carsharing.
- 17% did not know how to use scooters.
- 10% did not know how to use TNCs.

In the survey, we asked questions about access and awareness of shared mobility options, including TNC rides, pooled TNC rides, bikesharing, scooter sharing, and carsharing. To measure access and awareness, we asked respondents if they had heard of shared modes, if they had seen vehicles in the street, if they knew how to use it, and if they had friends or family who used it. The overall awareness of shared mobility was high, with over 90% of respondents saying they had heard of shared modes. Carsharing had the highest percent of respondents who had never heard of the service (6%) though this was still much lower than findings from the focus groups. Only 1% of respondents had never heard of scooter sharing, bikesharing, TNCs, or pooled TNCs. Furthermore, less than 20% of respondents said they "didn't know how to use" a shared mode. This percentage was highest for scooters (17%) and lowest for TNCs (10%).

There were some geographic and modal differences in who had seen shared vehicles in the street. Overall, about 40% of respondents said that they had seen bikesharing, scooter sharing, or carsharing vehicles in the street. However, the home zip code of people who had seen carsharing

vehicles was more evenly dispersed in Oakland neighborhoods, including West Oakland, Downtown Oakland, Fruitvale, Oakland Hills, and Deep East Oakland. Meanwhile, the majority of respondents who had seen bikesharing stations reside in West Oakland and Fruitvale. Respondents who had seen scooters were more geographically diverse; though the majority live in Downtown Oakland and near Lake Merritt, there was a higher percentage in Coliseum and Deep East Oakland compared to those who had seen bikesharing.

Findings from the interviews expand on survey findings to indicate how access and awareness of shared modes can impact usage. We present interview findings separately for each shared mode.

Bikesharing

For bikesharing, three interviewees started using bikesharing after seeing the stations, while two tried bikesharing initially because of a free ride or membership incentive. Overall, only one interviewee was a frequent bikesharing user and it was because she received a free membership. Two other interviewees had used bikesharing occasionally, about a few times a month. The two most common reasons for not using bikesharing were either because the interviewee already had their own bike (n=5) or because they did not like biking (n=5).

Spatial accessibility to bikesharing station is not the only barrier; **more intensive, targeted outreach and education may be required to increase adoption.**

While 28 of the 31 interviewees had seen bikesharing stations, seven did not think stations were accessible to where they lived or the places they wanted to go. Furthermore, though literature in bikesharing suggests that improving spatial access to bikesharing is one strategy to increase equity of bikesharing users (Smith et al., 2015; Ursaki & Aultman-Hall, 2016), responses from the interviews suggest that intensive, targeted outreach and education may also be required. For example, two interviewees lived in downtown Oakland, an area with a high concentration of bikesharing stations, and often walked by stations close to their apartments. However, when we asked why he had not tried the service, Derek answered, "I don't have the app I guess […] I'm not really quite sure how it works." Robert shared that though he had noticed new bike lanes around Lake Merritt and wanted to start biking for exercise, he did not feel that there were resources that taught him how to use bikesharing.

Tanya, who lives in deep East Oakland, uses bikesharing only when she is downtown where bikes are more accessible. While she would like to see more bikesharing stations closer to where she lives, she also believed that building stations should be accompanied by an educational campaign to teach residents where to place bikes to not obstruct pedestrians and how to ride safely. Educational outreach and community engagement could also alleviate tensions between residents in a neighborhood and bikesharing companies. Three respondents saw how bikesharing was received poorly by their neighbors, who were long-term residents who saw the stations as a sign of gentrification. Emma, who currently lives in East Lake but previously lived in the Mission District in San Francisco, said "I know there's a lot of hatred towards Bay Wheels and Lime scooters and stuff like that, because it does kind of symbolize gentrification and the change in neighborhood demographics or how people get around […] When I lived in the Mission, on many different occasions, I saw people just trying to destroy Bay Wheels bikes, just smashing them against the ground."

Scooter sharing

All but one of the interviewees had seen scooters on the street, and nine interviewees in Downtown Oakland, West Oakland, and by Lake Merritt felt that they had good access to scooters. Tiffany referred to the congregations of scooters as "stations," and when she occasionally worked as a scooter charger, the app would tell her to put scooters in specific locations around Downtown and West Oakland. Though scooters were scarcer in Deep East Oakland, two interviewees said they still saw scooters more than bikesharing.

More interviewees used scooter sharing than bikesharing, though the majority of these rides were for recreational use or just to try it. Three interviewees used scooters at least once a week as a means to get to either West Oakland or Lake Merritt BART station, with two of these interviewees using scooters almost every day. Four others would use scooters occasionally to run errands or for short, "last mile" trips to get to a final destination, such as the farmer's market or a flea market.

Compared to bikesharing, **more interviewees started using scooter sharing after they saw devices on the street or sidewalk.**

Compared to bikesharing, more interviewees had tried scooters because they saw them in the street (n=8), mostly with friends. Alice said, "I just downloaded the app. Seeing them downtown in Oakland, it was just kind of a compulsive type of, I'm going to try it out right here." Similarly, Melissa was walking with her brother when she saw a scooter by Lake Merritt and "just went for it." For Damian, having friends who used scooters converted him to a consistent user who would use scooters to get to BART: "I was really opposed to them when they came out […] I just kind of took it as like, look at the way the neighborhood is changing. But I had some friends, they started riding them and then I got on one of them and actually, they're really fun." Though more interviewees had tried scooters compared to bikesharing, an even larger proportion of interviewees were not interested in trying scooters at all; six interviewees had safety concerns and one interviewee had a disability that prevented them from using scooters.

Shared electric mopeds

A few interviewees became interested in shared electric mopeds after seeing the vehicles in the street. Margaret had even begun using the service over the summer to get to her job near the Oakland airport from where she lived in Deep East Oakland. She said that she became curious after seeing the vehicles and started using them when the weather was nice as an alternative to driving. She also wanted to avoid taking public transit during the pandemic. Alice had also seen vehicles parked around Oakland and thought it could be an interesting way to get around. Alice thought it might be useful for grocery shopping because of the storage space on the moped and it would be faster than taking the bus. However, she found the pricing too expensive to use consistently.

Carsharing

Compared to bikesharing and scooter sharing, fewer interviewees had seen carsharing vehicles in the street (n=7), and only one interviewee became interested in carsharing after seeing a vehicle. However, only one interviewee had never heard of carsharing and one interviewee had heard of it but did not know how it worked. Eight interviewees either use carsharing currently or had used it in the past. The most common way of being introduced to carsharing was through a friend (n=6)

or internet search (n=2). Three other interviewees had friends who use carsharing more regularly and are interested in trying it in the future. For carsharing, learning about the service through personal networks was more effective to introduce someone to carsharing than seeing vehicles in the street, such as bikesharing and scooter sharing.

TNCs

All 31 interviewees knew how to use TNCs and pooled TNCs, and 30 interviewees had used them in the past. Regardless of geographic location, all interviewees felt that wait times were reasonable, with the longest wait time around 8 minutes and most interviewees saying the wait time was between 3 and 5 minutes. However, two interviewees who lived in Deep East Oakland noticed that wait times and prices had increased during the COVID-19 pandemic, which made TNCs less affordable and convenient. Robert had only been in a TNC with a friend and had never called a TNC himself because it was too expensive. He related calling a TNC to calling a taxi, which he saw as a luxury because of how expensive it was. Alice also viewed TNCs as a "splurge."

Interviewees used TNCs occasionally but **viewed them as a luxury or a "splurge" because of how expensive they are.**

Usage

In the previous section, we discussed how access and awareness of shared mobility impacted how interviewees were introduced to a service and how they started using it. In this section, we will focus on usage of transportation as a whole and shared mobility specifically. First, we will provide an overview of the travel behavior of survey respondents, supplemented by interview data, as well as the accessibility barriers that interviewees face. We will then explore whether interviewees are interested in using shared mobility more, how shared mobility can help them, and what types of incentives would make shared mobility easier to use.

General use of transportation

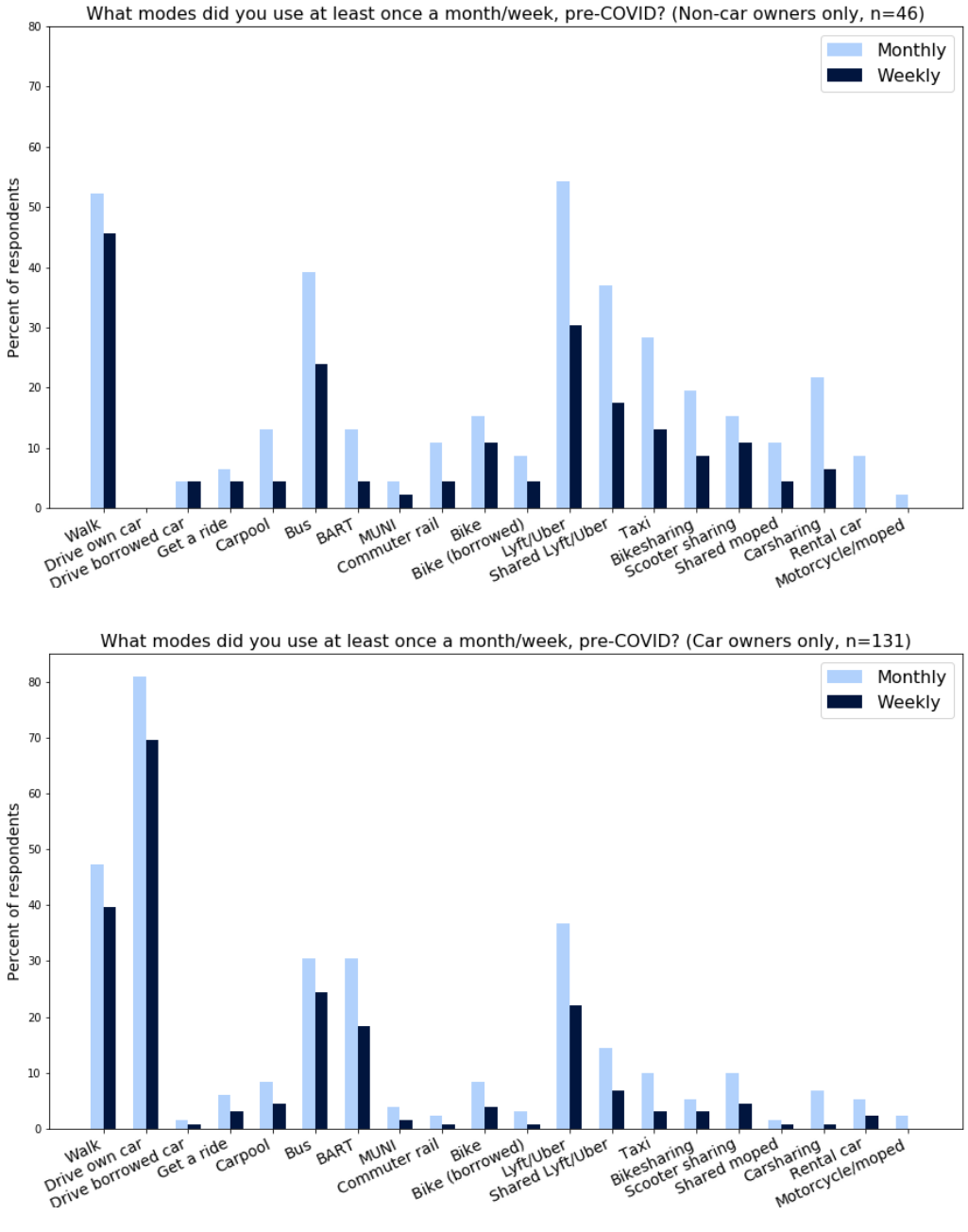

Figure 5: Use of transportation, pre-COVID for non-car owners (top) and car owners (bottom)

Car usage

In the survey sample, 26% of respondents do not have a car in their household, compared to 16.5% of Oakland residents (2019 ACS 5-Year Estimates). For respondents without a car, 54% used Uber or Lyft when they needed car access, 26% used carsharing, 17% got a ride from a friend or family member, and 13% borrowed a car. These findings suggest that shared mobility is giving non-car owners access to a car when needed.

In Figure 5, we show the monthly and weekly transportation modes used for non-car owners (above) and for car owners (below). Monthly transportation modes, or modes used at least once a month, are those that the respondent use occasionally, while weekly transportation modes are those that the respondent rely on for more frequent travel. Comparing the active transportation use of non-car owners to car owners, significantly more non-car owners walked as a form of transportation ($p < 0.01$). There was no significant difference in respondents who biked. For use of public transit, significantly fewer non-car owners used BART ($p < 0.01$) and bus ($p < 0.01$) in a weekly basis. This finding is surprising because of literature on transportation equity that has found that people without cars are transit dependent. However, this may corroborate the finding from focus groups that no single mode dominates (i.e., few modes are used on a consistent weekly basis), and instead, non-car owners meet their transportation needs by mixing and matching many different modes.

Non-car owners are more likely to...

- Walk
- Use TNCs and carsharing more frequently

Car owners are more likely to...

- Use public transit more frequently (BART and bus)

Similar to focus group findings, **non-car owners in the survey did not rely on a single mode for transportation**, and instead mix and match modes to meet diverse transportation needs.

One transportation mode non-car owners are using frequently are TNCs. More non-car owners used TNCs on a weekly basis ($p < 0.05$) and monthly basis ($p < 0.01$), as well as shared TNCs ($p < 0.05$), compared to car owners. These findings from the survey about frequency of transportation use confirm the findings presented earlier that non-car owners primarily use TNCs when they need car access.

The interview sample had a higher percentage of non-car owners compared to the survey sample (35%; n=11), and similar to the survey population, 10 of the non-car owners would use TNCs or carsharing when they needed a car, while one non-car owner relied on public transit because he does not have a driver's license and TNCs are too expensive. However, findings from the interviews shed light on perspectives of car ownership, which differed within the sample. Some interviewees described themselves as being happily "car free" (n=4) while others talked about saving up to purchase a car soon or feeling constrained without a car, or "car less" (n=7).

"Because of public transportation, I only apply [to jobs] in my little East Bay bubble…with a car, I feel like I can work, not anywhere, but at least in the North Bay, maybe SF, Palo Alto."

- Tiffany, talking about her desire to own a car

Alice, who had previously owned a car, acknowledged that driving took a physical toll on her body and that parking and maintenance could be a hassle. At the same time, she followed up to say "in the future, if I had a lot more income…I mean, I don't know. I'm not ruling it out in the future." To her, having a car would make it easier for recreational travel and would replace the occasional two-hour journeys to the beach, or four-hour journeys to Northern California.

Tiffany does not currently have her own car and can borrow her partner's car if she needs to. She still tends to take the bus because she does not like driving. Nevertheless, she wants to get a car in the next few years: "it'll give me more access to other jobs. Because of public transportation, I

[only] apply in my little East Bay bubble. It's bad. Whereas with a car, I feel like I can work, not anywhere, but at least in the North Bay, maybe SF, Palo Alto."

For both Katie and Kristen, not having a car is a burden. Katie, who lives in Deep East Oakland, has owned cars previously but currently relies on a combination of Lyft, public transit, and walking to get around. When asked about her car, she said, "I'm just trying to get back to it because I'm used to having that freedom […] having the convenience of getting to A to B and stuff when I want to, how I want to is what I'm accustomed to." For Kristen too, as she saves up for a car in the near future, the car "would bring freedom. I honestly feel kind of stuck…not having a car brings me a lot of stress. Cause you can't just take a drive to go anywhere you want."

In contrast, when asked if she owned a car, Janet replied, "No [I don't have a car], I'm so happy when I say that!" Two of the other interviewees, Megan and Sarah, did not feel that they needed a car where they lived and that alternative options such as carsharing were enough to fulfill their needs. Megan had previously owned a vehicle and was happy with her car-free lifestyle during COVID and not having to spend time sitting in traffic. Janet, Megan, and Sarah all live either in Downtown Oakland or close to Lake Merritt and all have good access to buses, BART, and shared modes such as scooters and carsharing. In comparison, the "car less" interviewees live further east in Oakland, with a few interviewees also living in West Oakland. For these interviewees, a car would make it easier for them to travel and be less dependent on public transit and getting rides from friends and family. Overall, the desire for a car and satisfaction levels associated with not having a car were correlated with the accessibility and availability of other transportation options, such as public transit and shared mobility.

"Car free" (n=4)	"Car less" (n=7)
"I don't have a car…I'm so happy when I say that!"	"Not having a car brings me a lot of stress…I feel stuck."
Live closer to Downtown Oakland and Lake Merritt	Live in Deep East Oakland or West Oakland
Good access to shared mobility and public transit	Rarely see shared mobility vehicles, poor transit quality

Table 9: Characteristics of "car free" vs. "car less" interview respondents

Public transit usage

There were also differences in interviewees' perceptions of public transit (see summary in Table 10 below). All of the positive comments about public transit came from interviewees who would take BART or AC Transit to San Francisco or Downtown Oakland as part of their commute. Six interviewees said they loved taking the bus because it allowed them to be around different people and feel a sense of community. Jordan, who would take the 14 bus to commute to Downtown Oakland, said "I would regularly run into the same folks on the bus. We were all commuting home at the same time. And it just helped me feel more connected." Both

"I would regularly run into the same folks on the bus. We were all commuting home at the same time…it just helped me feel more connected."

- Jordan, talking about their experience on the bus

Dylan and Tiffany liked taking the bus to "observe people's daily life" or "see different aspects of people in different parts of life." Some commuters also saw public transit as a chance to escape from stress or as productive time. Erica, who took the AC Transit Transbay bus from East Oakland to San Francisco, listened to podcasts during her commute and liked not having to worry about driving or having to sit in traffic. Megan, who would sometimes take BART to commute to San Francisco, said it was "a nice way to begin and end the day, if that's all you're using it for, to get to and from work."

Megan's statement alludes to a divergence in the public transit experience between commuters who travel during peak hours and other riders who travel during off-peak hours. Two other interviewees stated this explicitly, that public transit worked best for commuters and not for anyone else. Mindy used to travel during regular commute hours and previously lived in West Oakland, where she could take BART to her job in the city near Montgomery Street station. It was only a 10-minute ride and she loved her commute, but after moving further away and switching to a job where she was assigned to different shifts in different parts of San Francisco, there was a noticeable decrease in public transit quality. Her 10-minute trip on BART turned into a BART ride plus two bus rides in San Francisco to get to her job. She added that as an hourly worker, she has less flexibility over her schedule and has to arrive at work on time, which makes taking public transit more of a gamble. A combination of frustrations with public transit, an accident that made it even more difficult to travel using public transit, and smoke from wildfires over the summer led to Mindy purchasing a car in June 2020.

"When I lived on 23rd and I was so much closer to everything, like my little hub […] the time I spent traveling was so much easier, and not as conscious to me as when I moved further [into Deep East Oakland]...I feel trapped, basically, is what I feel here."

- Rebecca, comparing her public transit experience near Lake Merritt vs. in East Oakland

Public transit issues were also particularly prominent for interviewees who lived or had previously lived in Deep East Oakland. Four of the five interviewees said that they wished public transit were more connected, or, in the words of Tanya, that it would "flow better." Both Katie and Rebecca had noticed bus quality degrading over time, as AC Transit split some routes and moved bus stops or removed them entirely. As a result, where Rebecca used to be able to take one bus all the way to Berkeley, she now had to transfer in downtown Oakland, which added even more time and friction to her trips. Rebecca had never anticipated living as far east as she does, within walking distance to the border of San Leandro, but when her previous living situation fell through, she prioritized finding a place that was both affordable and stable in terms of having fewer rent increases. While she feels relatively secure in her housing for the future, the limitation on her accessibility is a problem: "When I lived on 23rd and I was so much closer to everything, like my little hub, everything kind of centered between Lake Merritt and Downtown…it took no time. The time I spent traveling was so much easier, and not as conscious to me as when I moved further out here. Like really now, I feel trapped, basically, is what I feel here."

For two interviewees, unreliable and degrading bus service resulted in them learning how to drive and purchasing a car. Melissa used to live in Deep East Oakland with her family and would take

the bus, and often two buses, to attend the Peralta Community Colleges. Taking the bus meant constantly dealing with delays, rude bus drivers, and other riders that would make her feel unsafe. Often times, "being on the bus made me more tired than class," which was what pushed Melissa to get her driver's license at 23: "I always say, it's the bus's fault that I started driving." Jordan had a similar experience more recently, as AC Transit consolidated bus routes which meant that with their disability, walking to the bus stop became too difficult: "I was so grateful when I got a car because I can't handle this [walking]."

Public transit commuters (n=6)	Non-commuters (n=6)
Live near Downtown Oakland, Lake Merritt, or West Oakland and commute to Downtown Oakland or San Francisco	Live in Deep East Oakland, travel during non-standard commute hours
Sense of community on public transit	Drivers and other passengers can be rude
Can use time on the bus or train to be productive and escape from stress	Removal of bus stops, splitting bus lines has led to more friction when making trips on public transit
BART is "a nice way to begin and end the day, if that's all you're using it for, to get to and from work."	"Being on the bus made me more tired than [being in] class […] I always say, it's the bus's fault that I started driving."

Table 10: Comparison of perceptions of public transit from commuters and non-commuters

Overall accessibility: The 15-Minute City Ideal

The 15-Minute City: a city where residents can access basic essentials within a 15-minute travel radius.

Rebecca's experience with transportation in Deep East Oakland, contrasted with her experience closer to Lake Merritt, was echoed by the experiences of other interviewees. Largely, interviewees who lived in Downtown or near Lake Merritt described their neighborhoods and travel patterns in a way that invokes the image of a 15- or 20-minute city. The 15- or 20-minute city concept is focused on accessibility and changes to the built environment that would enable residents to access basic essentials within a 15- or 20-minute travel radius (Capasso Da Silva et al., 2019; Weng et al., 2019). The idea has gained traction in conversations about recovery from the COVID-19 pandemic, and recently, an international coalition of mayors endorsed 15-minute cities as a necessary goal to focus on transportation sustainability and combat climate change post-COVID-19 (*C40 Mayors' Agenda for a Green and Just Recovery*, 2020).

Derek's experience in Downtown Oakland exemplifies the 15-minute city concept. He lives within walking distance of 12th Street BART station and several bus stops, but transportation is not the only service easily accessible from his house. He also lives near parks, stores, schools, and hospitals. While he owns a car, he drives it less than 5,000 miles a year, mostly to see family in the South Bay and groceries once a week. For the remainder of his transportation needs, he uses BART to commute, Lyft to bring his parents to medical appointments, and walking for other errands.

Interviewees who live close to Lake Merritt shared similar stories about the accessibility of their area. Erin described her living situation east of Lake Merritt as the "confluence of about eight different bus lines…it's easy for me to take the bus. And I live close enough to downtown that I can get to many places on the bus without transferring." She uses the bus or her own bike for commuting, shopping, visiting friends, and other errands such as going to the bank. When Linda lived in Adams Point, she had a car at the time but issues with parking and vandalism led her to sell the vehicle. However, her central location, with "everything one could need available right there within just a couple blocks," allowed her to travel easily even without the car.

For some interviewees, the 15-minute city was an ideal only available in certain neighborhoods of the Bay Area, and there was an understanding that they would have to pay a premium to live there. Alice moved to the East Bay in search of a quieter neighborhood and cheaper rent but found taking the bus less convenient compared to where she had lived previously in San Francisco. In San Francisco, she felt that she did not have to plan as much: "you can just kind of step out and know that a bus is going to probably come within 15 minutes or something." Emma consciously made the trade off between rent and transportation costs when choosing to live in the Mission District in San Francisco. She felt it was worth an extra $150 or $200 in rent to have more services in walking distance: "If I had a random need, like, I ran out of toothpaste or I needed an ingredient for my dinner or something, I would just walk probably less than five blocks out to get what I needed. […] What I was paying for in rent was that convenience." Like Alice, she later moved to Oakland for cheaper rent, and prioritized apartments in neighborhoods with similar walkability and access to stores and other sevices.

"If I had a random need, like, I ran out of toothpaste or I needed an ingredient for my dinner or something, I would just walk probably less than five blocks out to get what I needed."

- Emma, describing the convenience of living in the Mission District in San Francisco

In Deep East Oakland, the 15-minute city ideal was often just out of reach. Since she started working in 2005, Katie had always left East Oakland, and Oakland entirely, for work. In 2013, she found her first job in Oakland, and it was only in the past four years that she was able to work in her own neighborhood: "for me to actually work in my neighborhood and be able to walk to my office, or walk to a community meeting, or Lyft in a reasonable amount […] has been pretty cool."

Tanya, who also lives in Deep East Oakland, called this the "Bay Area dream," and said that before the pandemic, "my life was starting to get really small. For once I was working in the same city I live in. My job, my gym, my grocery store, everything […] I was almost feeling like, this is when people start biking to work or taking public transportation to work." Though Tanya uses her car as her primary means of transportation, she said this was not necessarily by choice and she was always envious of people, like her sister, who could live a "car free" life. Right before the pandemic, she was thinking about ways to organize her schedule to reduce wear and tear on her car and decrease her carbon footprint. But like Katie, she was only

"For once I was working in the same city I live in. My job, my gym, my grocery store, everything […] I was almost feeling like, this is when people start biking to work or taking public transportation to work."

- Tanya, talking about attaining what she called the "Bay Area dream"

recently able to shrink her daily activities to a place where it would open up more opportunities to use alternatives to driving, such as active and public transit.

One interviewee in Deep East Oakland did not talk about lack of accessibility in her neighborhood the same way the other three interviewees had. Margaret has her own car and finds using BART and the bus convenient to get to her job by the Oakland airport, which she has had for 10 years. She started using her car more during the pandemic only because reductions in bus service made public transit unreliable to get to work. She also uses public transit to do most of her grocery shopping and social activities. While public transit is adequate to meet most of her needs, her car also gives her autonomy and a way to escape: "it's nice to build community in that way [on public transit] and stuff but sometimes I just want to go. Like sometimes I'm like, oh, let me just take a drive. Which is what I do now, just get in the car and take a drive for an afternoon." In this case, the car gave her the freedom to travel where she wants, while two of the "car less" interviewees in Deep East Oakland, Katie and Rebecca, feel more trapped and dependent on public transit and TNCs.

Opportunities and barriers for shared mobility

Some interviewees were already using shared mobility to fill gaps in their transportation needs not served by other modes, while others brought up examples of how increased access to shared mobility could help meet their needs. Three interviewees used scooters as a way to connect to BART. Both Kristen and Damian used scooters because it was faster than walking and Kristen was unpleasantly surprised when scooters were taken off the street in late March due to the pandemic: "one day I walked outside and I was screwed." Mindy initially used the bus to get to BART, but noticed that early in the morning when she would be commuting to work, the bus headways were 30 or 40 minutes. She began using scooters instead and could get to BART in just 7 minutes. Alice also used a scooter once when she was on a bus that was delayed; she had to get to a bus stop on time to transfer to another bus, saw a scooter out the window and got off the bus to use that instead. While the majority of interviewees in the sample used scooters only occasionally and for recreational purposes, these four examples still show how some Oakland residents use scooters as a way to make connections to transit more easily.

Shared mobility connections to public transit: some interviewees relied on scooters to reach public transit and found it faster than walking or taking the bus.

Only one interviewee in the sample used bikesharing consistently. When Emma lived in the Mission, she would bike two miles to work with bikesharing. Although she also had her own bike, she thought bikesharing was more convenient because it removed the stress of worrying about her bike getting stolen or vandalized. She also took advantage of the electric bikes when they were first introduced, which increased her biking range, as the electric bikes made it easier to bike further distances and in places with more hills. However, a major barrier to bikesharing would have been cost, had she not be able to use the free membership that her partner received through work. She felt that paying for the membership on her own would have been prohibitively expensive and had looked into Bike Share For All, but her income was just over the threshold for eligibility.

Impact of pricing on travel behavior: the pricing change around e-bikes in San Francisco (i.e., charging a per-minute fee and instituting a $2 penalty for not docking at a station) made TNCs and public transit more affordable and attractive options for Emma than biking.

Emma's thought process around the pricing change for Bay Wheels e-bikes is enlightening on how pricing policy can have immediate impacts on transportation decision making. When e-bikes were first introduced in the Bay Wheels system, they could either be used as a dockless bike or parked at a bikesharing station, and they were free to use under the existing annual membership. Emma said that pricing later changed so that e-bikes were charged an additional per-minute fee and there would be a $2 penalty for not docking the e-bike at a station. Before this happened, she was taking e-bikes on longer trips or using e-bikes to get places faster. After the price change was implemented, Emma said, "Taking an e-bike was about twice as fast as biking manually. So there became a point where if I couldn't do [a trip] in time on a regular bike and the e-bikes cost money, that would be another reason to take a Lyft or take the bus or something else." In essence, the pricing change around e-bikes in San Francisco had made taking a Lyft or taking the bus a more affordable or attractive option than biking.

Many interviewees either currently use or had previously used carsharing to fulfill the needs of a personal vehicle. Three interviewees used GIG Car Share, a one-way carsharing service, as a substitute for a car. Kristen used GIG at least six times a week for errands, such as getting groceries or going to Target. She liked GIG more than TNCs because it felt more like a personal car and she could load items that she had bought. She also found GIG faster and cheaper than taking TNCs, especially during the pandemic since shared rides are no longer offered. Sarah will also use GIG when she needs to run errands and also prefers it to TNCs because she likes driving herself and being able to listen to her own music.

Carsharing has become a more affordable option than TNCs during the COVID-19 pandemic, because shared TNC rides have been suspended.

Jordan used GIG more often when they lived closer to GIG car locations: "GIG is really convenient. It's not super cheap, but you don't have to pay for gas or insurance, you can just walk right up to it, get in and go." Even though they did not use GIG cars all the time, it was a good supplemental option to using public transit and taking Lyft, in times when they did not have their own car. Three other interviewees had previously been members of Zipcar or City CarShare and used carsharing to make trips that required a car, for example, bringing items to a storage unit or run other errands. Rebecca did not find her experience with City CarShare that convenient; she would have to take public transit to Fruitvale BART station to pick up a car and found the pressure to return the car within a certain amount of time to be stressful. Alice canceled her Zipcar membership because she was not using it during the pandemic, and would also find it inconvenient to have to take a bus to the Zipcar location at Rockridge BART. Janet started using Zipcar in 2004 and used it for a number of years but does not like driving and prefers to run errands by walking or using the bus.

Interviewees who had previously used station-based carsharing found it inconvenient because they had to take public transit to reach carsharing vehicles.

Rebecca and Alice had not heard of GIG Car Share but after hearing about how one-way carsharing worked, both found the one-way model more convenient because it would enable them to use vehicles with more flexibility. Alice lives within the GIG service area and finding a vehicle would be easier than with Zipcar. Though Rebecca lives outside of the GIG service area, she would still be willing to take a short BART ride to the nearest vehicles. An additional barrier for Rebecca, however, is the cost of using the service, especially paying for the vehicle for the whole time of the rental, even if she is not actively driving. In comparison, using Lyft might be cheaper and easier to budget: "I have a limited income…I know upfront how much it's gonna cost me to take a Lyft and I don't have to worry about the time constraints. […] Say I got stuck in traffic on my way to return the car back and it makes me late by 15 minutes or half an hour. What is that cost that I would incur from not getting that car back on time?"

Though one-way carsharing would be more convenient than station-based carsharing, the **uncertainty of trip cost is a financial barrier for some respondents.**

Several interviewees mentioned TNCs as a being beneficial to serving their transporation needs. Alice lives a 15 minute walk from the nearest bus stop, a walk which she found physically taxing, especially when she has a cart full of groceries. She would prefer using a TNC to get to the bus stop or to go directly to the grocery store but finds them too expensive. Receiving a discount for TNC rides would benefit her physically and enable her to complete her errands more easily.

TNCs are filling gaps in public transit, allow people to take trips when public transit is not available, or get to destinations more quickly. However, the **financial burden of relying on TNCs is high.**

Three interviewees rely on TNC rides to get to their jobs. Kristen lives in West Oakland and once or twice a week would need to commute to San Francisco to start work at 4:30 am. Since she does not have a car, the only transportation option available to her at that time is a TNC. However, because of the uncertainty around wait time and availability that early in the day, she wakes up an hour earlier to ensure that she can book a ride. There are also times where she cannot find a ride and has to call her partner in Vallejo to drive her instead. Katie would take close to $350 worth of TNC rides every month to get to and from work and meetings during the day. Using TNCs was a necessity to get to work and in between meetings quickly because she did not feel like she could rely on public transit to get her there in time. For Megan, the cost of TNCs is not a barrier so much as the guarantee that she could find a ride. She would sometimes drive to Sacramento for work, but if she knew that it would be easy to get an Uber or Lyft from the train station to her final destination, she would be willing to take Amtrak instead of driving. She could then use the hour on Amtrak to be productive in other ways and reduce the stress of being stuck in traffic.

Financial stressors

In some of the examples above, interviewees felt that shared mobility could be helpful if it were not for the cost. Several interviewees spoke about the general financial stressors in their life, not just from transportation but also from rent and salaries that have not kept up with the cost of living in the Bay Area. The pandemic has also caused

Interviewees experience significant financial stressors outside of transportation include rising rent and salaries that have not kept up with the cost of living in the Bay Area.

additional stress for some households, with Jennifer comparing the current circumstances to the economic recession in 2008: “I felt like then I was working three times as hard and getting paid half as much. Kind of the same as now.”

A common thread between many interviewees was the lack of a social safety net that would support them in times of crisis. Matthew said, “our family is living kind of hand to mouth. After paying rent and bills, we have almost zero savings left. Everything goes all to our bills basically. So if we lose our jobs for more than like a month, we’d be out.”

Damian lost his job as an environmental consultant and substitute teacher due to the pandemic. He was able to apply for unemployment and for awhile, the unemployment benefits and the pandemic add-on assistance was enough for him to get by. However, towards the end of the summer, there was uncertainty around when these benefits would end and exactly how much California was going to pay people who were on unemployment. He followed the news closely on social media and called this time a “very large stressor” and he began looking for jobs again more in earnest.

Tiffany works at a deli in Downtown Oakland and since the pandemic began, has lost half of her hours. She also does not have health insurance, which she says is very stressful given that she works a service job, but has no choice but to continue working. Emma has similar concerns about her lack of health insurance during the pandemic: “one hospital bill could ruin my life […] I would say that’s the biggest thing that I feel like could de-stabilize my fairly stable situation.”

Like Tiffany, Kristen is also an essential worker at a bakery in San Francisco. Her hours have increased since the pandemic began and she also began working a second job as a packager at Whole Foods. Although her income has increased, she still does not feel stable: “I’m always concerned. Always feel like I need to be making more money and I want to be making more money.” Melissa echoed this sentiment. She works at a Headstart program at a school in Fruitvale and recently got a raise. Yet, Melissa still does not feel stable in her situation: “I'm better off than I was a few months ago. And I'm better off now than I was a year ago. And even with all this stuff that's happening which are good things...even with all this stuff, it's hard. And it's like, how much money will it take for me to feel comfortable and not feel like I'm struggling so much?” Katie also mentioned how her salary had not kept up with the median income in the area: “I don't have CalFresh, I don't have food stamps, or whatever, because they say I made too much. But again, looking at the whole scale, and with the AMI [area median income] of my area and Oakland period, like I am, to me poor. Like, it's almost 80, 100K, that's normal. And I'm just, just now reaching 60. So, to me, that's still low income, and the fact that I still pay a high percentage or

“I'm better off than I was a few months ago. And I'm better off now than I was a year ago. And even with all this stuff that's happening which are good things... it's [still] hard. How much money will it take for me to feel comfortable and not feel like I'm struggling so much?”

- Melissa, about her financial stress

“I don’t have CalFresh […] because they say I made too much. But looking at the whole scale, and with the AMI of my area and Oakland […] I’m still low income […] I still pay a high percentage or more to rent and transportation and food than I do to just, to be able to enjoy life.”

- Katie, about being above the income cutoff for federal/state assistance programs

more to rent and transportation and food than I do to just, to be able to enjoy life." For Katie, the financial burden of housing and transportation in the Bay Area impedes her ability to invest in enjoying her life, a problem which has persisted despite receiving higher pay at work.

The two interviewees in our sample who received rental assistance expressed less stress about their financial situation. Kimberly currently receives Section 8 housing, which allows her to only pay 30% of her income on rent. She lost her job due to the pandemic and is receiving unemployment benefits and said that "if I didn't have Section 8, I would be in pretty bad shape." Robert receives a rental subsidy through Project Independence which has allowed him to stay at the same apartment in Downtown Oakland for over 20 years, even after losing his job three years ago. Receiving the subsidy improved his life dramatically, allowing him to purchase groceries that he liked and hygiene items such as shampoo, soap, and shaving cream. Robert is also able to purchase a public transit discount card for persons with a disability, and because of his central location in Downtown Oakland, he finds public transit cheap and easy to use for his everyday errands and appointments.

However, there were many interviewees who said that they are just over the eligibility threshold for social programs despite still feeling like they are struggling to make ends meet. Kristen applied for the Clipper START program to receive a discount on public transit but did not qualify. Emma had a similar experience applying for CalFresh and tried to appeal her case based on the high cost of living in the Bay Area compared to the rest of state. Furthermore, because she did not qualify for CalFresh, she was ineligible for a Bike Share for All membership: "the income cutoff for a single person household to get food stamps…I want to say it's a little bit under $2,000 a month. And for a lot of people, that is the cost of their rent per month […] And then because of that, I couldn't qualify for any of these, like secondary things. They use that as a point of reference." Katie, who previously mentioned that she did not qualify for CalFresh, felt that while there were programs to support youth and seniors, there were fewer programs to help out people in the middle: "after being in college and being past the age of 24, man, it was like no services or nothing. And it was just like this, you're able bodied and you're healthy, just fend for yourself and figure it out." Tanya experienced this first hand when she was temporarily displaced from her apartment and living in her car. When reflecting on these events from four years ago, Tanya said: "I slept in my car. There was no shelters open. There was no nothing open. And I bet nothing has changed with that. I bet if something was to happen to me right now, again, four years later, there probably still would be no resource for me to go to."

Incentives and strategies to increase accessibility and usage of shared mobility

We asked all interviewees about what types of incentives or discounts could increase their access and use of shared modes. In this section, we discuss incentives for each type of shared mode, including public transit, as well as costs associated with private vehicle ownership and driving, separately.

Discounts for shared micromobility

We asked interviewees about three different types of incentives or discounts: discounts on shared micromobility trips starting or ending at public transit, discounts on all trips, or monthly rental options. For the interviewees who already used scooters to get to BART, a discount would reduce their expenses slightly, and one interviewee answered that he would use scooters even more to

replace walking to BART, though he already thinks of the scooter ride cost as negligible because it is such a short distance.

Bundled scooter-public transit ticket discounts: would encourage some interviewees to try scooters for the first time, would make it easier to get to bus or BART stations on time.

Two other interviewees said they would start using scooters if there were a discount to get to BART. Matthew proposed the idea of a bundled scooter-BART ticket and said that would get him to try using scooters for the first time. He lives about two and a half miles from the nearest BART station and usually takes a bus to get there. Jennifer also thought that discounted scooters for first-mile connections would increase her chances of getting to the bus stop in time and reduce the risk of missing the bus.

Existing per-minute rental fees for scooters make it hard to budget for rides, costs add up quickly. **Monthly long-term rentals for scooters** can address this issue, as well as issues with accessibility to vehicles in neighborhoods like Deep East Oakland.

Katie said that scooters seem cheap before using them, but the minutes add up: "I like to ride the scooters and I'll do it just cause it's easy, but I'll be looking back at my receipts, like damn, their 36 cents seem cheap, but minutes add up, so it's not very cheap." She knows about the low-income discounts that are offered through scooter companies but has not had the time to go through the application process. She added that the low-income discount was 23 cents, which did not make it that much cheaper than full price. Similarly, Melissa thinks that the existing per-minute payment model makes it difficult to plan ahead: "you have to figure out how much everything's gonna cost…you're always budgeting all the time." Instead, Katie, Melissa, and three other interviewees were more interested in the monthly rental model, similar to what Bird offered for a time in San Francisco, where users could have unlimited access to their own scooter for $25 a month. The monthly rental model would be helpful especially in Katie's neighborhood in Deep East Oakland, where scooters are scarce and she has seen people hoarding them in their yards. Tanya, also in Deep East Oakland, talked about the competition to get scooters in areas where they are scarce: "there was times where it was like those scenes in the movies with [people fighting over] the last Christmas present toy or something." Two interviewees did not think that they used scooters enough to pay for a monthly rental, especially since it was hard to carry items on a scooter. One of these interviewees would be interested in a monthly e-bike rental and the other would be interested in a monthly electric moped rental.

Discounts for TNCs and pooled TNCs

We asked interviewees about discounts for TNC rides that start or end at public transit, discounts on all TNC rides, discounted pooled TNC rides, and a membership model where users would pay $20 per month to lock in a 15% discount on every ride and also receive 3 free scooter or bike rides. Some interviewees liked the idea of receiving discounts for TNC rides but did not think the price could be comparable with public transit or other options and would continue to use TNCs for recreational or social purposes. Damian said that he "counts on [Lyft and Uber] being expensive and that's why I don't use them very often," so while a discount might encourage him to use it more in some circumstance, such as nights out, it was unlikely to replace his BART commute to work in San Francisco. However, especially when traveling in groups, discounts for TNCs would

Discounted TNC rides would enable interviewees to make more recreational/social trips, make grocery shopping less physically taxing without a car.

shift people away from traveling on public transit. Emma already thinks that taking a shared TNC with her partner is cheaper than taking a trip involving a MUNI bus and BART, so if TNCs were even further discounted, she would likely take public transit less. Gwen would use discounted TNC rides over driving her own vehicle, especially when traveling to places where it would be difficult to find parking. Two interviewees, who both did not have a car, thought that discounted TNC rides would enable them to do more recreational and social activities and would make grocery shopping less physically taxing.

Almost all interviewees in the sample consistently chose to take pooled TNCs over private TNCs except when they had to be somewhere on time, even if the discount was only a few dollars. Further discounts on pooled TNCs would not incentivize interviewees to choose the pooled option over private if they had to get to an appointment or get to work on time. Interviewees also brought up issues with wait time and in-vehicle travel time fluctuations as reasons why they would not choose to take a pooled vehicle. A few interviewees had taken indirect pooled trips, where they would have to walk to meet the driver. For Linda, who lives in a very residential area, the indirect pooled ride was essentially the same as a private ride because the driver came to her door and they did not pick up other passengers along the way. For Gwen, who lives close to a major intersection in East Oakland, she would never have walk far to meet the driver and chose this option often because it was cheaper than pooled rides or private rides. From these responses, there does not appear to be too much price sensitivity around using pooled rides or indirect pooled rides, because other factors such as wait time and travel time are more important.

Discounts for carsharing

Three interviewees were interested in discounts for carsharing. If she could get discounts on GIG, one interviewee would prefer driving to San Francisco instead of taking BART, especially during the pandemic when there is less traffic on the road. The other two interviewees were interested in discounts on multi-hour rentals. Both of these interviewees do not have their own car and a multi-hour rental would enable them to run all of the errands for which they need a car in one trip without worrying as much about the per-minute costs. Kristen, who is already a heavy user of GIG, would postpone the purchase of a car if GIG had a cheaper multi-hour rental option.

Subsidies for hybrid or electric vehicles

There were many interviewees in the sample that either had their own car or were considering purchasing a car in the future. We asked interviewees whether they were interested in purchasing a hybrid or electric vehicle, whether they were aware of tax credits for buying these vehicles, and whether tax credits were useful to them. All but one of the interviewees were interested in a hybrid vehicle; Gabrielle was not interested in a hybrid because she thought they had high maintenance cost and more expensive parts to replace. Few interviewees were interested in a fully electric

vehicle because there would be no place to charge the vehicle. Furthermore, four interviewees had heard of hybrid and electric vehicle tax credits but did not find the credits useful. All interviewees in the sample who currently own a car or previously owned a car purchased the car used, from used car dealers, Craigslist, friends or family, or tow yards. Matthew said that the tax credits were for people who can afford a $30,000 or $40,000 vehicle to start with, but he cannot afford that upfront cost. Similarly, Jordan considered the tax credit but ultimately decided that they did not want to pay a car note: "Because I'm a poor person, I don't like to take on debt. I'd rather buy an older car, which I did, and own it outright so I never have to worry about missing a payment and having my car repoed. So for me, it wouldn't be just about tax credit."

"I don't like to take on debt. I'd rather buy an older car and own it outright so I never have to worry about missing a payment and having my car repoed. So for me, it wouldn't be just about tax credit."

- Jordan, on why the hybrid/EV tax credit is not appealing

Other costs of driving

We also asked interviewees how they respond to other costs of driving, such as changing gas prices. For two interviewees, the cost of gas is fixed, a price they have to pay no matter what because of their reliance on the car as a mode of transportation. Tanya said, "gas is gas and that's not one thing I'm going to complain about." Mindy drives as little as possible to save on gas. When gas prices are high, she will try to trip chain and postpone purchases to days where she knows she has to drive to a store. Both Tanya and Damian said that their upper limit of driving was fixed but when gas is cheaper, they would drive more. Damian said, "I have all these other modes of transportation that I take to avoid driving […] But there's a fixed point that I'm going to drive. And then if gas is cheap, I'm gonna drive more than that." When gas was cheap for Tanya, she would "take a longer trip somewhere without thinking about it as much," for example, driving to San Jose to see family twice in one week. These responses suggest that gas prices are asymmetrically elastic for car-dependent travelers.

Impact of gas prices on driving: most interviewees had a fixed amount that they had to drive; when gas prices were high, interviewees stuck to essential trips. When gas prices were low, interviewees took more trips.

Discounts for public transit

We asked interviewees about free transfers between different transit agencies, discounted transit (50% off) and free or fareless transit. If public transit were half off, the majority of interviewees would use it more often instead of TNCs and for some interviewees, instead of driving. If public transit were fareless, every interviewee said that they would use it more often, though a few interviewees had concerns about cleanliness, service reliability, and crowding.

Discounted (50% off) and fareless public transit would shift interviewees away from driving personal vehicles, make it easier to access jobs, and improve quality of life.

Most interviewees felt that AC Transit was reasonably priced but found BART too expensive. Mindy would use the bus instead of BART because it was cheaper even though BART would get

to her final destination more quickly. When she was assigned an extra shift at work, her gratefulness at earning some extra income was mitigated by the thought of having to spend money on transportation to get there. Melissa also thinks that BART is too expensive compared to the cost of the parking pass at her work. She lives across the street from Coliseum BART station and her work is very close to Fruitvale BART station, yet she drives to work every day because her parking pass is $65 while BART would cost $4 every day. She said she does not consider the cost of gas or maintenance when comparing driving to BART because the distance is so short. However, she said that if BART cost $2 every day instead of $4, she would immediately switch to taking BART instead.

Megan thinks that cheaper public transit would help her professionally, by making it easier to multi-task while traveling to meet clients, and personally. In a statement that evokes the sense of community around the bus that was discussed in a previous section, Megan said of discounted public transit: "it would help the overall good of the social aspects of the community because it would put more people in social settings […] it just gives people the feeling of being surrounded by people."

Interviewees also responded positively to fareless transit. Two interviewees said that fareless transit would improve access to jobs and economic opportunities. Tiffany previously said that not having a car and the expenses of BART meant that she only looked for jobs in the East Bay, but fareless transit would expand her job search into San Francisco or even to places like Richmond and Concord. Emma said she had friends who struggled to pay for transportation to get to their job or to job interviews and felt that fareless transit would have been an immense help: "what if you can just hop on transit, and have that access to unlock the things that you really need, which are to get to your place of work and to be productive there."

Fareless transit would also have benefits on overall quality of life. Though Robert currently only pays $20 a month for public transit with his discounted AC Transit pass, he said that free transit would still help immensely and he could put the extra money towards groceries instead. In fact, between his second and third interviews, Robert said he was inspired to take the AC Transit bus, which was free over the summer, from downtown Oakland to Berkeley to spend time outside and feed the squirrels on campus. Robert said about fareless transit: "[My quality of life] would improve immensely, because I would be more active, I would get out more."

Mobility Wallets and Mobility-as-a-Service

MaaS or MOD "Mobility Wallet" concepts that build on regional public transit passes enable users to have a more integrated travel experience and seamlessly compare travel time and cost across modes.

Finally, we asked interviewees about a "Mobility Wallet" or mobility as a service (MaaS, also called mobility on demand or MOD) membership or subscription mode for shared mobility and public transit. This concept was similar to the regional public transit card or "transportation credit card" concept that participants in our East Oakland focus groups discussed. We asked interviewees what they found appealing about a "one-stop shop" where they could pay a monthly subscription for access to rides on shared modes and public transit. Most interviewees liked the convenience of seeing different types of transportation and different public transit agencies under one platform. The integration on a single platform would make it

easier to budget for transportation and give users an easy way to compare between different options. For example, both Damian and Matthew said that they felt like they were always switching between different apps to see what option was cheaper or faster. Putting all the options under one umbrella would reduce the amount of decision-making and route-planning. Similarly, Jennifer finds it difficult to compare "apples to apples" across different apps that all have different passwords and methods of payment. Margaret also thought it would be more convenient to take trips on public transit across different counties in the Bay Area.

Incentives and strategies to reduce car ownership

After talking about each of the incentives, we asked interviewees whether these incentives would reduce their car ownership. The sample was split, with some interviewees saying that certain options would be enough for them to give up their car, and others still wanting to keep their car. Seven interviewees said that fareless transit would either encourage them to give up their car or postpone the purchase of a car. Gwen thinks of her car as a "luxury" since she does not use it to commute and just keeps it for the convenience of being on her own time. If transit were free, she would not feel like she needed the car at all. Erica, who also uses public transit to commute, said that if transit were free, she would give up her car and use Uber instead. Tiffany would postpone the purchase of a car if transit were free, though she already enjoys taking transit and likes that it is more environmentally friendly than driving. Overall, the interviewees who could see themselves getting rid of their cars with fareless transit do not use their cars to commute and instead use the car only for grocery shopping, errands, and recreational trips.

Two interviewees said the Mobility Wallet concept would incentivize them to get rid of their car. Matthew has one car in his family and finds it convenient for running errands, travel with his two young children, and in emergencies. He likes the flexibility of the Mobility Wallet and the ability to customize transportation options to meet his needs. In particular, the inclusion of subsidized Uber rides would replace the times when he needs his car: "Uber rides are essentially used for getting these last-minute ad hoc errands or meetings or things where you just have to get somewhere and the bus is just not efficient. You can have that Uber to kind of use as backup." Tiffany felt that the Mobility Wallet would be cheaper and less hassle than owning a car because she would not have to worry about maintenance.

For four other interviewees, fareless transit did not impact their decision to own a car. In fact, for three interviewees, fareless transit would allow them to save money towards the purchase of a car. Dylan said that if transit were free, he would save a few thousand dollars a year and with that money, "I would be purchasing a used car, 100% and putting it towards maintenance for a car, no doubt. Because that money is for transportation, so that money would be allocated towards the car and its needs." Kristen also felt that free transit would allow her to save more for her future, with a car being her first priority. Interestingly, Lee would only purchase a car if transit were discounted but not if it were free. He wants to purchase a car soon so that he could also use it to generate more revenue as an Uber or Lyft driver. With discounted transit, Lee said: "I feel like the money I spent on [public transit], if it's discounted, I would have more savings and maybe I could achieve my goals within a shorter period of time. My dream is to have a car, so I think, yeah I could be having it very soon." In the case where all public transit is free, however, he thinks that demand for TNCs

will be lower and he would not be able to make money as an Uber driver. In the case of free transit then, he would not want to have his own car.

Four interviewees would not get rid of their car with free transit due to issues with public transit that do not have to do with cost. For Gabrielle, the time spent on public transit was more prominent in her mind: "I just thought about the cost of my time. Sometimes I'd be half an hour late or I'd be an hour late to places and that would cause delay, that adds an extra hour or two. So, in that way, that was more expensive than the fee hikes themselves." Jordan has issues with taking public transit due to removal of bus stops and benches at bus stops. Additionally, they sometimes use a wheelchair which makes taking BART difficult because of how often the elevators are out of service. Mindy would not want to get rid of her car because she would sometimes have to take long trips on public transit involving transfers or when carrying items, which would be inconvenient.

Section 7. Conclusion and Policy Recommendations

In this research, we first provided an overview of the current landscape of equity in shared mobility through a literature review and expert interviews. Our findings suggest that while more transit agencies and mobility companies are becoming more aware of disparities in transportation use and use of shared mobility, current pilot project approaches to resolving these disparities are flawed. The majority of pilot projects we evaluated research use quantitative metrics to assess the effectiveness of equity programs to increase the use of shared mobility by low-income groups. However, a quantitative approach misses how and why low-income people use shared mobility to fill their needs. The approach also does not consider the broader transportation needs of low-income groups and whether shared modes are the best strategy to meet their needs.

One expert interviewee presented three attributes of shared mobility that must be considered when advancing equity: awareness of shared modes, access to shared modes, and usage of shared modes. Using these three attributes as a guiding framework, we analyzed findings from focus groups, in-depth interviews, and an online survey to further understand how rent burdened Oakland residents use transportation, what their major accessibility barriers are, how shared mobility might help them, and what incentives could make shared mobility more accessible to them.

Awareness of shared modes such as TNCs, scooter sharing, and bikesharing was high while awareness of carsharing was lower. As a whole, Spanish-speaking focus group participants had less awareness of different shared mobility options, particularly carsharing, but after learning more about the service, expressed interest in using shared mobility. However, while many participants had seen vehicles on the street or in their neighborhoods, some participants did not know how to use these modes and wanted more hands-on education or training to feel comfortable trying the shared mode for the first time.

We found geographic differences in public transit and shared mobility accessibility. Participants living closer to Downtown Oakland, Lake Merritt, and West Oakland reported having better access to shared vehicles and generally did not face many problems using shared mobility or public transit. In contrast, participants living in East Oakland by Coliseum or closer to the border of San Leandro, especially those without their own car, reported feeling "trapped" or constrained,

faced with long walks to bus stops without benches and dependent on public transit that was often crowded and unreliable.

We found infrastructure and issues with driver behavior made interviewees feel unsafe with active transportation. Some interviewees mentioned lack of quality infrastructure as reasons for feeling unsafe while biking. For some interviewees, more protected bike lanes would make it safer to bike, while interviewees who lived in East Oakland also felt that the road conditions, such as potholes and uneven pavement, were also a significant barrier. Perhaps the biggest barrier to biking for residents of East Oakland was the unpredictable and unsafe behavior of drivers.

Participants are using shared mobility to make trips more quickly and reliably, including connections to public transit. Despite some issues with access to shared modes and awareness of how to use shared modes, many participants reported that some types of shared mobility enabled them to make trips more quickly and easily. Shared mobility is particularly useful for participants who commute outside of standard work hours when public transit unreliable. The most common shared mode that participants used was TNCs, which helped participants if they were running late, traveling somewhere not covered by public transit, or making a trip carrying items such as groceries. The cost of TNCs was a major factor in limiting the number of trips participants could take using TNCs. Scooters were also useful to some participants who would take a scooter to get to BART. However, the majority of participants used scooters mostly for recreational activities and had trouble finding scooters in areas outside of Downtown Oakland and Lake Merritt. Participants reported similar access issues with bikesharing, with only one participant in the sample having used bikesharing regularly to commute to work. Some participants had their own bikes and did not need to use bikesharing, and two participants expressed interest in bikesharing but did not know how to sign up or use the service. Another shared micromobility option in Oakland is shared electric mopeds, and one participant started using this service during the pandemic to avoid taking public transit and to reduce driving. Finally, some participants used one-way carsharing to run errands and liked using it more than TNCs because it felt more like a personal vehicle.

Based on these barriers to using shared mobility and public transit that we identified in our research, we propose the following policy strategies.

Investing in programs that go beyond addressing spatial accessibility, and instead focus on awareness of shared mobility and existing discount programs, can increase adoption by rent burdened residents. Some suggestions from respondents include increasing the presence of shared mobility companies at large community events (e.g., street fairs) and hosting informational sessions about shared mobility options at public libraries. Offering and advertising free trials can also be a low-risk way for new users to try a service for the first time and gain confidence.

To address safety for active transportation, educational campaigns would be helpful to not only teach bikers how to navigate the roads safely but also teach drivers how to drive around bikers. Exploring educational campaigns to target both bikers and drivers, particularly in neighborhoods without a strong culture of biking could be beneficial to increase adoption of active transportation modes.

Monthly rental pricing options for shared micromobility can address spatial accessibility issues. For participants who lived in areas with less access to shared electric scooters, bikesharing, and shared electric mopeds, monthly rental options that provide long-term, unlimited access to a personal vehicle were an attractive option.

Integrated Mobility Wallets (i.e., mobility-as-a-service or mobility on demand) that build on existing regional public transit passes can better support multi-modal lifestyles. The majority of research participants use a combination of transportation modes to meet their unique travel needs. Participants felt that platforms that integrate many different transportation options would make it easier for trip planning and budgeting by enabling users to compare travel time and cost more easily across modes.

Incentives for shared mobility connections to public transit. Some participants are already using shared mobility to connect to public transit, while others said that ticket bundles for shared mobility and public transit would encourage adoption and increase use of shared modes. Mobility Wallet concepts should include discounts or incentives that prioritize connections to public transit.

Increase the reach of programs that provide subsidies and discounts for "narrowly" defined low-income populations to also capture the rent burdened population. When discussing transportation barriers and transportation budgeting and expenses, it became apparent that participants feel that there is no support for them. Especially with such a high cost of living in the Bay Area, existing low-income qualifications for discounts on public transit and shared mobility exclude a group of people who may not meet the cut-off for CalFresh or PG&E CARE, but are still struggling with their everyday expenses. As Katie said in her interview, even though on paper her income might be considered "middle class," after rent, food, and transportation, she does not have money left over to just enjoy life. By focusing specifically on rent burdened residents as a proxy for low-income in our research, we found that people earning $20,000 or $30,000 over the income cut-off for social services still struggle to make ends meet and feel a constant pressure to earn more or pick up an extra job. One of the incentives explored in this research was free transit, which most participants said would benefit them financially and not only enable them to save more money, but also potentially reach more jobs, social events, and improve their quality of life. Even if transit were not free but discounted, participants still felt that this would reduce the cost burden of transportation, especially for BART. Though discounts for public transit exist, for example the Clipper START program that launched in 2020, many participants do not qualify under the existing criteria; in fact, one interviewee tried to apply for the program but was denied. Expanding the eligibility for discount programs such as Clipper START to capture more rent burdened households in the Bay Area could improve productivity and quality of life for these residents.

Discounted or fareless transit can potentially postpone or reduce the need for a personal vehicle. In addition to enabling residents to reach more jobs and improve quality of life, discounts on public transit would benefit rent burdened residents financially. These financial savings would make public transit a more attractive option than owning a personal vehicle, and several interviewees said they would either get rid of their car or postpone the purchase of a car if public transit were discounted or fareless.

Invest in place and build collaborations with research teams and organizations outside of transportation. By focusing on rent burdened residents, our research explored the connections between housing and transportation and revealed larger issues of accessibility and disinvestment in communities of color that are broader than just transportation. For example, our research shows the benefits of the 15-minute city and how that ideal is only attainable for residents of certain neighborhoods in Oakland. For residents in Deep East Oakland and some residents of West Oakland in particular, lack of access to quality grocery stores and jobs results in long trips on public transit and reliance on their private vehicle. To make the Bay Area dream of the 15-minute city available to everyone requires thinking beyond transportation and instead an equally important emphasis on investing in place and building up communities where they are. This may require collaborating with researchers and organizations working on housing issues, access to food, and broader economic issues.

Finally, our research shows the power of qualitative methods to develop a deeper understanding of the complex issues surrounding transportation equity. For example, the online survey found a higher percentage of zero-vehicle households compared to the general population in Oakland, and the interview sample had even more zero-vehicle households. However, through interviews, we found a difference in participants who chose to get rid of a car and participants who could not afford a car, and that the difference between "car free" and "car less" households is a product of economic circumstance and geographic location. Though qualitative methods often necessitate a smaller sample size compared to quantitative work, the diversity of the sample in this research and quality of interview data indicate that policymakers and researchers should consider more qualitative approaches to researching transportation equity.

Our research is limited to exploring the access, awareness, and usage of transportation in a single geographic context of Oakland, California. The research methods were also reliant on access to internet for the online survey and access to the internet or a cellphone for the phone and video interviews. As such, the population of respondents included in this research report may not be representative of all rent burdened Oakland residents. Future work could employ other methods such as paper surveys and in-person interviews that would do a better job meeting more vulnerable populations where they are. Future work can also explore access, awareness, and usage of transportation in other geographic contexts to better understand the nuances in what impels people to adopt and use innovative transportation modes. Finally, we use rent burdened as a proxy for low-income. However, especially in a region such as the Bay Area, rent burden exists across a wide variety of income levels. Future work can explore how rent burden at different income levels impacts financial and transportation decision-making differently.

Appendix A. Shared Mobility Equity Framework

Table A1. User Barriers to Shared Mobility, from Kodransky and Lewenstein (2014)

Barrier	**Examples**
Structural	● Physical access: lack of stations in low-income communities ● Logistical access: lack of internet or smartphone access, valid driver's license
Financial	● User costs: high up-front membership fees, high recurring fees ● Lack of access to bank accounts
Informational and cultural	● Informational: lack of information or education about benefits of shared mobility and how to sign up and use shared mobility ● Cultural: distrust of authority, discomfort with using shared services, symbolism of ownership

Appendix B. Supporting Material for Equity Pilots in Shared Mobility

Table B1: Key Characteristics of Equity Pilots

Pilot	Definition of Success	Target Population	Recruitment/Outreach	Evaluation Methods	Lasting Impacts
Nice Ride Neighborhood	Change perception of biking for transportation, ensure participant satisfaction with program	Neighborhood, people of color, low-income people, areas with low usage of existing bikesharing system	Partnership with CBO, community liaisons	Participant observation, focus groups, interviews	Evaluation done within one month of program completion
Citi Bike	Increase number users who are people of color or low-income, improve health outcomes	Neighborhood, people of color, low-income people	Partnership with CBO, advertising at affordable housing units, health care providers, targeted marketing	Trip data, intercept survey, focus groups	Plan to repeat intercept survey from before pilot
BIKETOWN for All	Increase number of members who sign up for BIKETOWN for All	EBT card holders, residents of affordable housing units, recipients of utility assistance, other public assistance	Partnership with CBO, affordable housing units	Trip data	No formal ex post evaluation
Indego	Increase engagement from people of color and low-income people	People of color, low-income people, EBT card holders	Partnership with CBO, targeted marketing	Trip data, user survey, community feedback	No formal ex post evaluation
BlueLA	In 3 years, recruit 7,000 members who shed 1,000 vehicles and reduce 2,150 tons of greenhouse gas emissions annually	Low-income people	Partnership with CBO, targeted marketing	Trip data, user survey, user feedback	Evaluations ongoing

Table B2: Strategies for Operationalizing Equity

Pilot	**Strategies for Operationalizing Equity**
Nice Ride Neighborhood	Local partnerships, educational workshops, community ambassadors, community events, accessories to enable use
Citi Bike	Local partnerships, community-led program design, community events, discount program, alternate payment options
BIKETOWN for All	Local partnerships, educational workshops, discount program, alternate payment options, accessories to enable use
Indego	Local partnerships, educational workshops, community ambassadors, discount program, alternate payment options
BlueLA	Local partnerships, community-led program design, community ambassadors, discount program, alternate payment options

Appendix C. Supporting Materials for Background on Oakland, California

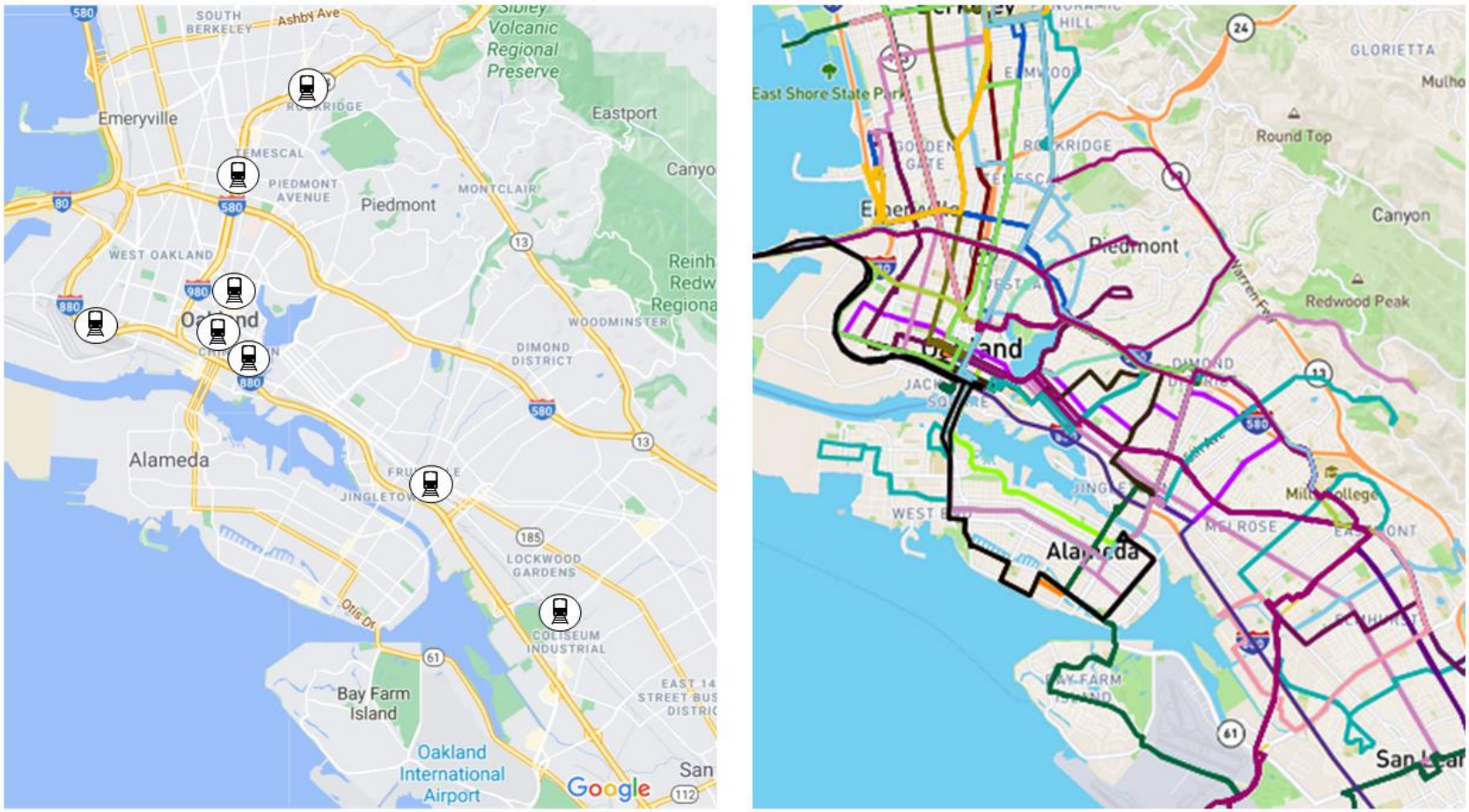

Figure C1: BART (heavy rail; left) and AC Transit (public bus; right) service area in Oakland, California

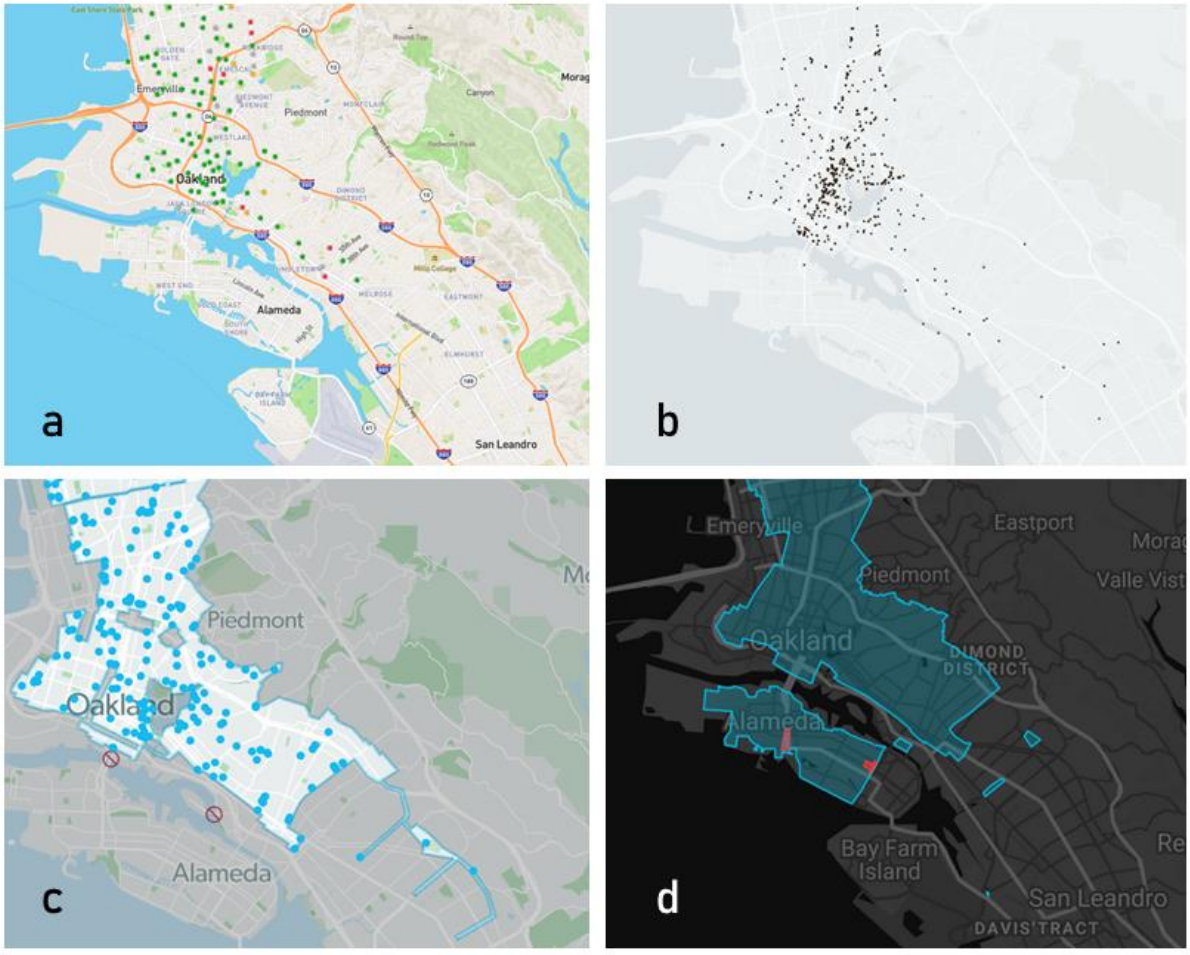

Figure C2: Service area and station or vehicle location for shared mobility systems operating in Oakland. (a) Location of Bay Wheels Bike Share stations. Screenshot taken from company website, March 2021. (b) Location of available scooters on a weekday morning, March 2021. Scooter locations were scraped by the authors from the public API of three scooter companies provided through the Oakland Department of Transportation website. (c) Service area and location of available shared electric mopeds. Screenshot taken from Revel app, March 2021. (d) Service area for one-way carsharing. Screenshot taken from company website. March 2021.

Proposed Communities of Concern Framework for Plan Bay Area 2040

Disadvantage Factor	*% Regional Population*	*Concentration Threshold*
1. Minority	58%	70%
2. Low Income (<200% Federal Poverty Level - FPL)	25%	30%
3. Limited English Proficiency	9%	20%
4. Zero-Vehicle Household	10%	10%
5. Seniors 75 Years and Over	6%	10%
6. People with Disability	9%	25%
7. Single-Parent Family	14%	20%
8. Severely Rent-Burdened Household	11%	15%
Definition – census tracts that have a concentration of BOTH minority AND low-income households, OR that have a concentration of 3 or more of the remaining 6 factors (#3 to #8) but only IF they also have a concentration of low-income households.		

Table C1: Communities of Concern Factors and Thresholds. Source: Plan Bay Area 2040: Final Equity Analysis Report, *2017*.

Appendix D. Interview Participant Summary Table

Name	Neighborhood	Car	Use of transportation	Age	Gender	Race/Ethnicity	Income
Matthew	Fruitvale	Own	Carpool	35 - 44	Male	Asian	$50,000 to $74,999
Dylan	Downtown Oakland	Own	BART, bus, bike	25 - 34	Male	Caucasian/White	$15,000 to $24,999
Erica	Lynn	Own	BART, drive	25 - 34	Female	Black/African American	$50,000 to $74,999
Damian	West Oakland	Own	BART, bike, scooter, drive	25 - 34	Male	Hispanic/Latino	$35,000 to $49,999
Steven	Fruitvale	Own	BART, drive	35 - 44	Male	Caucasian/White	$75,000 to $99,999
Joseph	Downtown Oakland	Own	Drive, BART	45 - 54	Male	Caucasian/White	$50,000 to $74,999
Alice	Rockridge	Shared mobility	Bus, TNC	45 - 54	Female	Caucasian/White	$15,000 to $24,999
Tiffany	West Oakland	Partner has car	Bus, bike	25 - 34	Female	Asian	$25,000 to $34,999
Kristen	West Oakland	Shared mobility	BART, TNC, carshare	25 - 34	Female	Hispanic/Latino	$25,000 to $34,999
Emma	Eastlake	Partner has car	Bus, bikeshare	18 - 24	Female	Caucasian/White	$25,000 to $34,999
Jennifer	Eastlake	Own	BART, bus, bike, drive	45 - 54	Female	Mixed race, Hispanic/Latino	$50,000 to $74,999
Kimberly	West Oakland	Own	Drive	35 - 44	Female	Black/African American	$25,000 to $34,999
Tyler	Fruitvale	None	BART, bus	25 - 34	Male	Black/African American	Less than $10,000
Katie	Deep East Oakland	Shared mobility	TNC, bus, scooter	25 - 34	Female	Black/African American	$35,000 to $49,999
Janet	West Oakland	None	BART, bus, TNC	45 - 54	Female	Asian	$75,000 to $99,999
Robert	Downtown Oakland	None	Bus	55 - 64	Male	Caucasian/White	$15,000 to $24,999
Melissa	Coliseum	Own	Drive	25 - 34	Female	Hispanic/Latino	$25,000 to $34,999
Mindy	Eastlake	Own	Drive, bus, BART, scooter	45 - 54	Female	Black/African American	$15,000 to $24,999

Megan	Eastlake	Shared mobility	Drive, BART, scooter	45 - 54	Female	Mixed race	$35,000 to $49,999
Jordan	Coliseum	Own	Drive	45 - 54	Non-binary	Mixed race, Hispanic/Latino	Less than $10,000
Gabrielle	Fruitvale	None	Drive, BART	35 - 44	Female	Asian	$25,000 to $34,999
Derek	West Oakland	Own	BART, TNC	45 - 54	Male	Black/African American, Hispanic/Latino	$35,000 to $49,999
Alex	Downtown Oakland	Own	Drive	55 - 64	Male	Black/African American, Hispanic/Latino	Less than $10,000
Lee	Downtown Oakland	Shared mobility	BART, bus, TNC	25 - 34	Male	Black/African American	$15,000 to $24,999
Margaret	Deep East Oakland	Own	Drive, bus, BART, shared moped	55 - 64	Female	Black/African American	$35,000 to $49,999
Tanya	Deep East Oakland	Own	Drive	25 - 34	Female	Black/African American	$35,000 to $49,999
Gwen	Fruitvale	Own	BART, bus, drive	25 - 34	Female	Black/African American	$50,000 to $74,999
Linda	Oakland Hills	Own	Drive	45 - 54	Female	Caucasian/White	$50,000 to $74,999
Sarah	West Oakland	Shared mobility	BART, bus, carshare	18 - 24	Female	Asian	Less than $10,000
Erin	Eastlake	Own	Bus, bike, drive	25 - 34	Female	Caucasian/White	$50,000 to $74,999
Rebecca	Deep East Oakland	Shared mobility	Bus, BART, TNC	55 - 64	Female	Black/African American	Less than $10,000

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