RESEARCH REPORT

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Early Results from an Electric Vehicle Carsharing Service in Rural Disadvantaged Communities in the San Joaquin Valley

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16. Abstract In rural areas, cost-effective transit service is challenging to provide due to greater travel distances, lower population densities, and longer travel times than in cities. The people who rely on public transit contend with infrequent and slow service. Access to a personal car is often essential to the quality of life for most residents, enabling them to more easily access work, health care, education, healthy food, and other essential services. However, keeping two (or sometimes even one) car in reliable working order can consume an estimated 22% to 56% of the household budget for low-income families in California. Rural residents often have lower incomes than their urban counterparts, and the most fuel-efficient vehicles, particularly electric vehicles (EVs), are often outside their financial reach. An EV carsharing pilot, called Míocar, was launched in August 2019 to explore the potential of a shared mobility service to offer a cost-effective mobility option for residents of rural disadvantaged communities and to help reduce greenhouse gas emissions. Affordable housing complexes host the round-trip EV carsharing hubs in southern San Joaquin Valley (CA) communities with low levels of intercity transit service and personal vehicles. The goals of the pilot program are (a) to provide carsharing at a price point that is more affordable than owning a personal vehicle to price-sensitive populations with low transit access; and (b) to help reduce greenhouse gas emissions. This report summarizes the data collected during the 10-month operational ramp-up of the Míocar service—the entire dataset links members and their service use data with results from member and post reservation surveys. The results provide initial insights into who, how, and why members are using Míocar.		
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Disclaimer

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Executive Summary

In rural areas, cost-effective transit service is challenging to provide due to greater travel distances, lower population densities, and longer travel times than in cities. The people who rely on public transit contend with infrequent and slow service. Access to a personal car is often essential to the quality of life for most residents, enabling them to readily access work, health care, education, healthy food, and other essential services. However, keeping two (or sometimes even one) car in reliable working order can consume an estimated 22% to 56%[1] of the household budget for low-income families in California. Rural residents often have lower incomes than their urban counterparts, and the most fuel-efficient vehicles, particularly electric vehicles (EVs), are outside their financial reach.

An EV carsharing pilot, called Míocar, was launched in August 2019 to explore the potential of a shared mobility service to offer a cost-effective mobility option for residents of rural disadvantaged communities and help reduce greenhouse gas emissions. The pilot represents an inversion of the dominant carsharing model, which is a for-profit operation in affluent urban communities with high-quality transit. Affordable housing complexes host the round-trip EV carsharing hubs in southern San Joaquin Valley (CA) communities with low levels of intercity transit service and personal vehicles. (In round-trip EV carsharing, the user must return the car to the original pick-up point after using it.) The project seeks to provide carsharing at a price point that is more affordable than owning a personal vehicle to price-sensitive populations with low transit access.

In this report, we summarize the data collected from the 10-month (i.e., May 2019 to March 2020) operational ramp-up of the Míocar service—the entire dataset links members[2] and their service use data with results from member surveys (administered when participants enrolled to use the service) and post-reservation surveys (administered after a specific reservation). The results provide initial insights into the member characteristics and vehicle use. These results are preliminary and intended to be exploratory.

The results of member and use data show that membership levels increased from 0 to 153 members. At the same time, the number of EVs in service increased from 1 to 27. See Figure ES-1 below. On average, per month, a user member[3] will make 1.25 reservations and travel 92 miles over 18 hours. The median reservation distance is 46 miles, and the duration is about 4 hours. The program averaged 63 reservations per month during the ramp-up period. Summary statistics for program use show a wide variation among users in the number of reservations, vehicle miles traveled and reserved hours. The pilot needs more time to operate at its full capacity before we can make more reliable estimates of use.

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[1] U.S. Department of Housing and Urban Development Location Affordability Portal. Geographies: census tracts.
[2] "Members" include three types of participants: A. active members who are still able to use the service; B. inactive members who used the service at least once but the current Míocar status is inactive; C. canceled members who used the service at least once but are no longer members now.
[3] "User Members" are those who used the service at least once. "Users" are used alternatively in this report.

Of the user members, 27% (29/108) were willing to travel more than 5 miles from their homes to access Míocar hubs (Figure ES-2). Post-reservation survey data indicate that 45% walked to Míocar hubs, while 33% used a vehicle, and 12% used public transit.

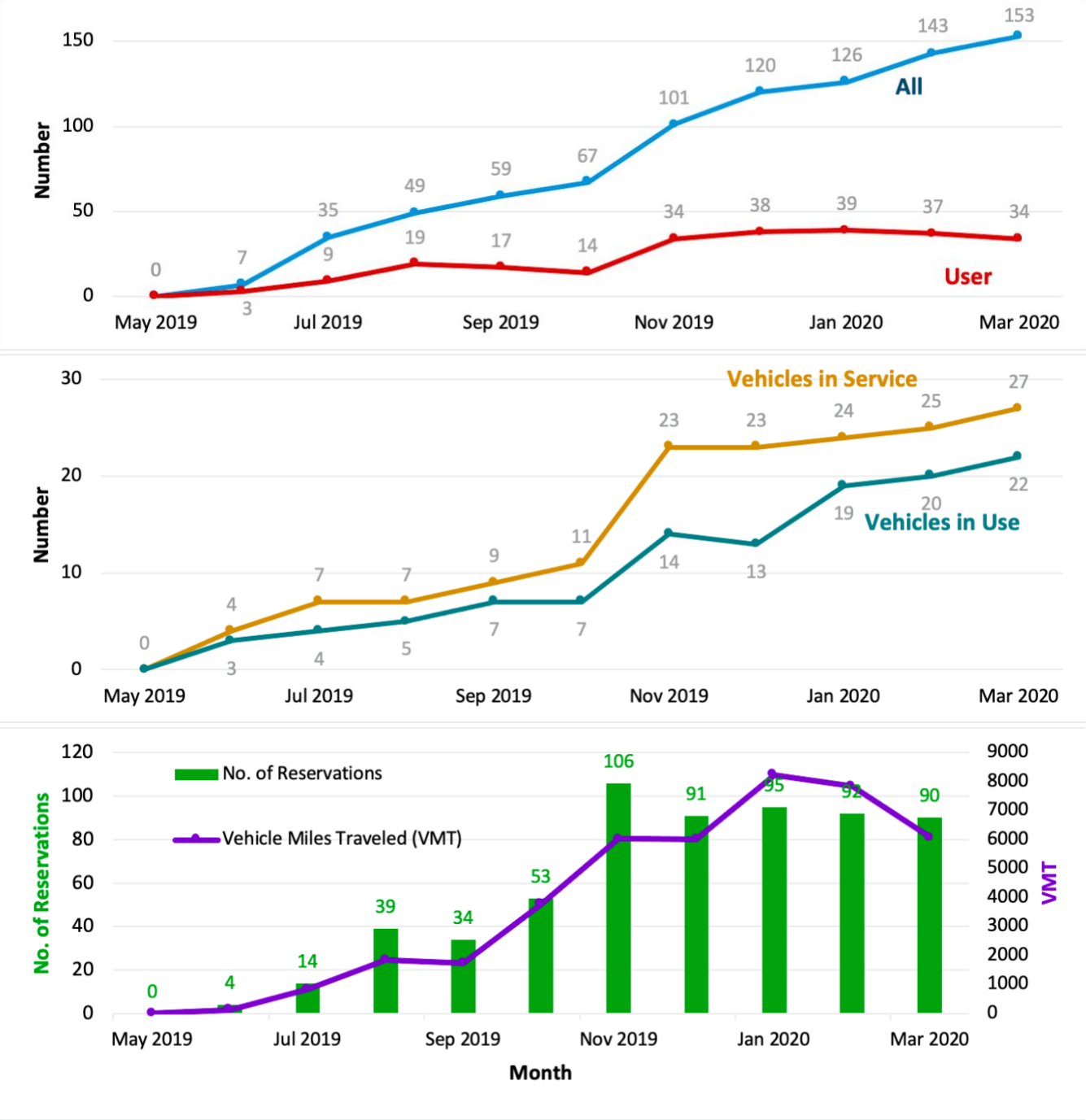

Figure ES-1. Changes over the First Ten months of the Míocar Ramp-Up: *(top)* Numbers of Registered Members and Members who Used the Service ("Users"); (*middle*) Total Number of Fleet Vehicles in Service and Vehicles Used; (*bottom*) Number of Reservations (green bars) and VMT (purple line).

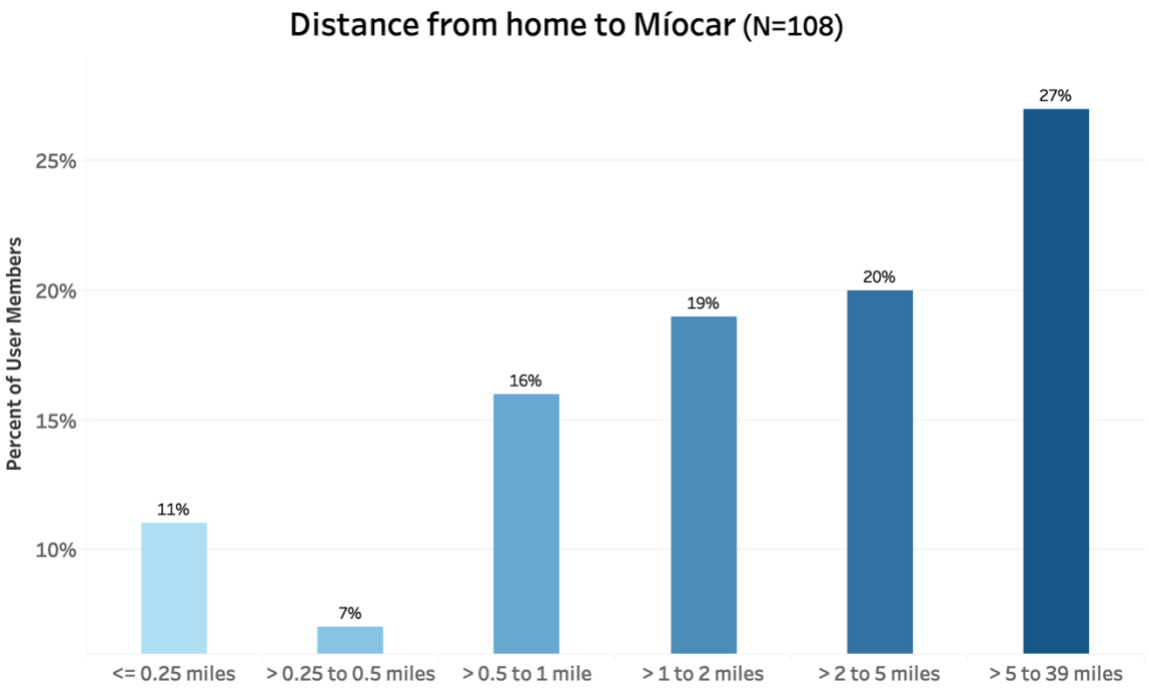

Figure ES-2. Distance from Member's Home Location to Nearest Míocar Hub.

These usage results suggest some possible trends. Members who use the service frequently may substitute the service for a personal vehicle that they cannot afford. The willingness of members to travel further than a quarter-mile from their home to access a Míocar vehicle (Figure ES-2) suggests the need for and potential sustainability of the rural EV carsharing model tested in this study, i.e., lower population densities supporting fewer hubs. On the other hand, access distances of more than five miles may suggest the need to add more Míocar hubs in surrounding communities. The map in Figure ES-3 shows the Míocar hubs and the percentage of users in different towns in the San Joaquin Valley. Many Míocar members live in communities without Míocar hubs. Finally, the long distances traveled during the reservations indicate that members use the service for inter-city and inter-county trips that cannot be accomplished with available transit service.

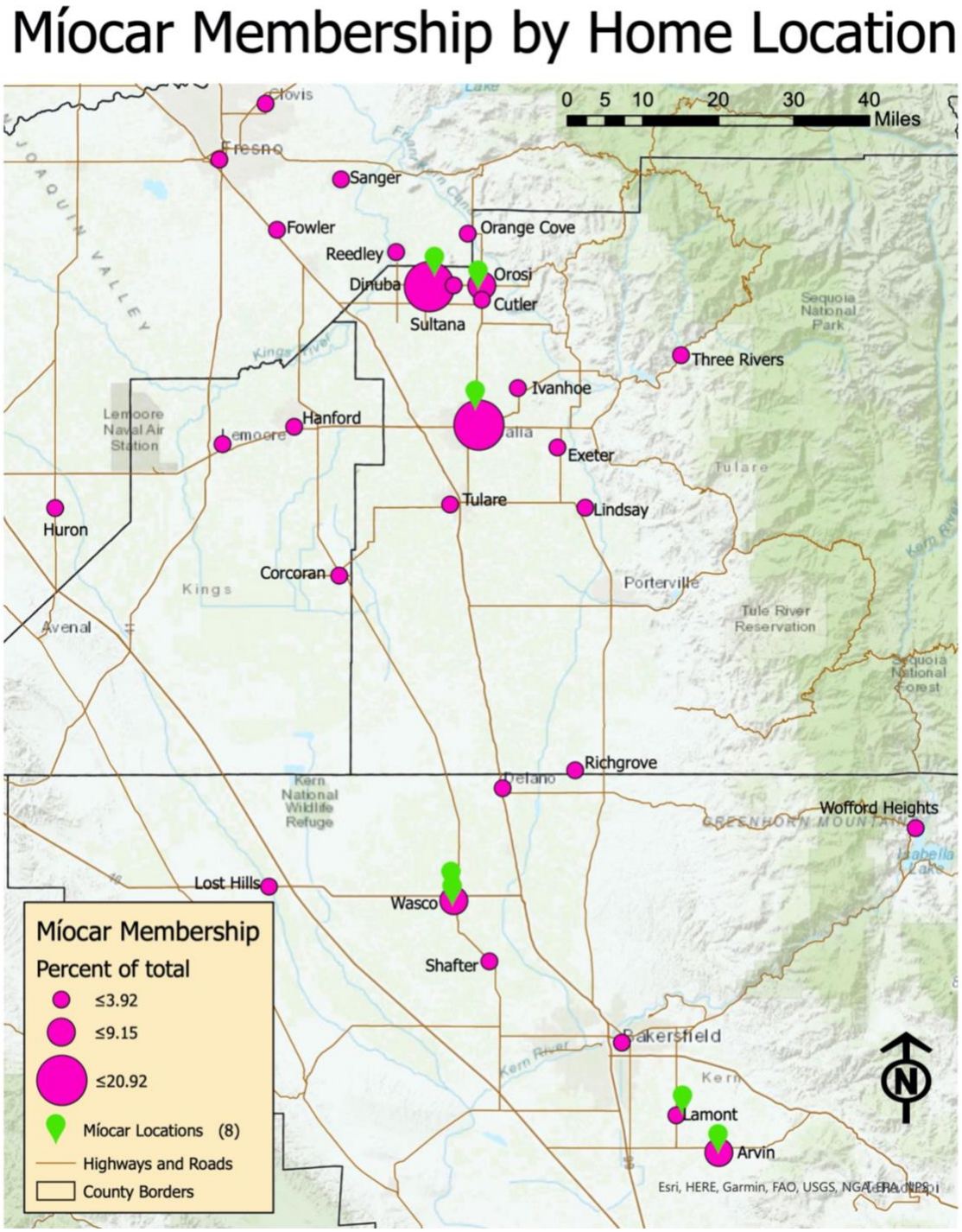

Figure ES-3. Membership by Home Location

The timing of two launch media events that garnered significant TV, radio, and print news coverage corresponds to two big spikes in membership in Figure ES-1. The first was the local launch, in Míocar communities, in August 2019, and the second was the regional system launch in November 2019. The results of the member survey also indicated that most members learned about the service through those media outlets.

The results of the member surveys provide insight into members' demographic attributes. Most member households include four or more people with at least two adults. Most users have a household income of less than $50,000. The median household income is approximately $37,500, which is lower than the average median income ($46,721) reported for the census block groups that correspond to respondents' home location. In addition, 65% (31 out of 48) users have a household income that is lower than the median income of the corresponding census block. Almost half of all members have less than one vehicle available to their household, and the median age of members' vehicles is 10 years. Members report that their primary motivation for using Míocar is lack of access to a vehicle.

The demographic information from member survey data is integrated with member usage data to gain early insight into potential factors that predict the frequency of using Míocar. We found that very high frequency users in our sample are more likely to have three or more adults in their households than are low, medium, and high frequency users. High and very high frequency users are less likely to have vehicle sufficiency (i.e., a number of vehicles in the household that is equal to or greater than the number of adults) than low and medium frequency users. Most high and very high frequency users have an income of less than $15,000 per adult in the household.

We asked Míocar members to fill out surveys after they completed a reservation. Survey responses indicated that, without the availability of Míocar, most respondents (59%) would not have been able to travel to the primary destination, 20% said they would have used a different mode of travel (for example, another vehicle or bus), and 22% stated that they were unsure. These results are generally consistent with expectations from the member survey: 53% said that with Míocar available they would make more trips, 24% said they would not, and 24% were unsure. Integration of member's post-reservation survey data with their usage data indicated that 75% of Míocar miles traveled result from induced trips[4], and 15% of the miles substituted EV travel for vehicles that use gasoline. Both the member usage data and the post-reservation surveys indicated that the service is likely to be used for a variety of trip purposes, including for work and school.

Interestingly, the member survey revealed significant interest in purchasing electric vehicles, even though the rates of EV ownership and leasing are much lower in the Valley than in the rest of California. Many of the users completed the member survey after they had used the service, and it may be that the exposure to EVs as part of the pilot sparked their interest in EVs. On the other hand, it may be that the service attracts members who are interested in EVs or "early adopters" without the resources to follow through on their inclinations.

[4] Induced trips are trips that would not have been made in the absence of Míocar.

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Introduction

In rural areas, cost-effective transit service is challenging to provide due to greater distances, lower population densities, and longer travel times than in cities. The people who rely on public transit contend with infrequent and slow service. Access to a personal car is often essential to the quality of life for most residents, enabling them to access work, health care, education, healthy food, and other essential services. However, keeping two (or sometimes even one) car in reliable working order can consume an estimated 22% to 56%[5] of the household budget for low-income families in California. Rural residents often have lower incomes than their urban counterparts, and the most fuel-efficient vehicles, particularly electric vehicles (EVs), are outside their financial reach.

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In this report, we summarize the data collected from the 10-month operational ramp-up of the Míocar service—the entire dataset links members and their service use data with results from member and post reservation surveys. The results provide initial insights into the member characteristics and vehicle use. These results are preliminary and intended to be exploratory.

Background

The San Joaquin Valley (Valley) is the most productive agricultural region in California and one of the most in the U.S. However, the Valley also has some of the worst air quality in the nation and high rates of childhood asthma. California has classified most of the census tracts in the Valley as some of the most economically and environmentally disadvantaged in the State (see Figure 1 below).

California, as well as other states in the U.S., implemented a cap-and-trade system as an alternative to a carbon tax to meet its greenhouse gas (GHG) reduction goals. This system caps companies' GHG emissions and trades their surpluses and deficits. California legislation (Senate Bill 535 and Assembly Bill 1550) requires that the state invests at least 25% of cap-and-trade revenues in projects within and benefitting disadvantaged communities

[5] U.S. Department of Housing and Urban Development Location Affordability Portal. Geographies: census tracts.

and at least an additional 10% for low-income households and communities. This legislation recognizes that the feasibility of shifting to more fuel-efficient vehicles and modes is significantly harder for disadvantaged communities. Figure 1 shows the locations of communities affected by the legislation.

Figure 1. Disadvantaged and Low-income Communities in California.[6]

In California, legislation (Senate Bill 375) requires metropolitan planning organizations (MPOs) to develop land use and transportation plans (or Sustainable Community Strategies) to reduce GHG emissions from passenger vehicle travel. Initially, the Valley MPOs expressed concern about creating regional community plans with measures typically applied in major urban areas, for example, transit-oriented development and expanded fixed-route transit. The MPOs were skeptical about the effectiveness of these measures, given the large share of the

[6] Source: https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/lowincomemapfull.htm

Valley's population that resides in rural and very-low-density areas. As a result, in 2014 the California Department of Transportation funded a study to examine new technology alternatives to transit in rural communities that might better meet mobility gaps and reduce emissions.

Researchers at UC Davis, in partnership with Caltrans and eight San Joaquin Valley MPOs, identified shared-use alternatives in rural disadvantaged communities that might reduce transit costs, increase access, and reduce GHGs. Researchers quantified the quality and cost of transit services relative to shared-use options. They worked to gain regional consensus on the most promising shared-use mobility concepts and pilot locations. Researchers implemented surveys and focus groups exploring the need and interest for pilot services and undertook extensive stakeholder outreach to understand study-related concerns, goals, and analyses.

Project partners then applied to the California Air Resources Board's (ARB) Clean Mobility Options funding program. Partners proposed small scale pilots—concepts developed in the planning study—in highly disadvantaged (top 20% of all census tracts) rural communities with low inter-city transit access and low levels of vehicle availability. One of the proposed pilots was a round-trip EV carsharing service in affordable housing units.

Pilot Description

There are eight Míocar hubs in six Míocar communities in Tulare and Kern county. See Table 1 and Figure 2 below for the location of the communities, the number of units at the affordable housing complex, and the number of installed level 2 dual-port EV chargers. The EV carsharing pilot includes 27 vehicles, including BMW i3s, Chevy Bolts, and three hybrid Pacifica minivans. Many of these vehicles were purchased used, with less than 30,000 miles on them. These pure electric vehicles have ranges that are suitable for rural driving (140-200 miles per charge).

The pricing for Míocar includes a $20 member processing fee, a $4 hourly rental rate, a $35 daily weekday rental rate, and a $45-weekend daily rate. There is a 35 cent per mile fee after the vehicle travels 150 miles during one reservation. The price of the rental includes insurance, roadside assistance, and electricity. Residents apply or reserve vehicles by a smartphone app, website, or phone call. Members must have a clean driving record (i.e., no major violations, excessive speeding, reckless driving, multiple moving violations, or driving without a license) and be 21 years of age or older.

Table 1. Description of Míocar affordable housing complex locations, including units, level 2 dual-port charges, and vehicles

Complex	City	County	Units	Dual Port Chargers	Vehicles
1	Dinuba	Tulare	44	1	2
2	Orosi	Tulare	60	2	3
3	Visalia	Tulare	36	2	2
4	Wasco	Kern	44	2	3
5	Wasco	Kern	40	1	2
6	Wasco	Kern	226	4	8
7	Lamont	Kern	44	2	3
8	Arvin	Kern	46	3	4
Total				17	27

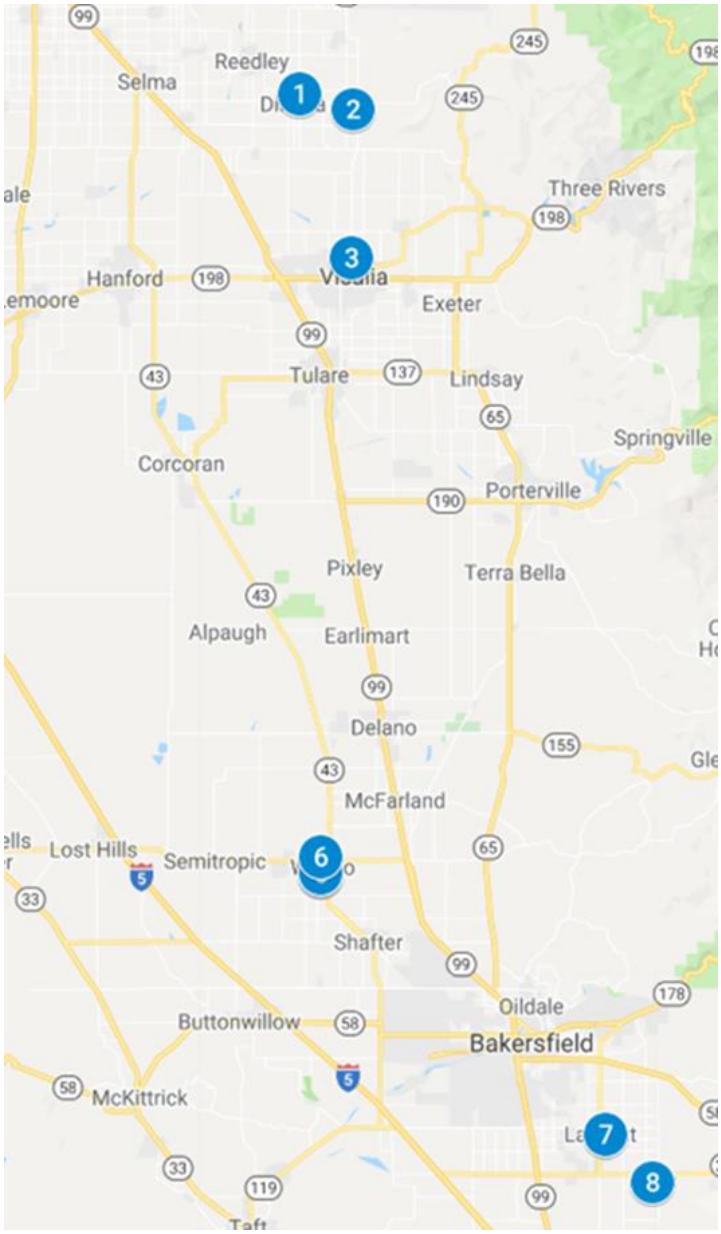

Figure 2. Map of Míocar Locations in Kern and Tulare Counties

The results of member and use data show that membership levels increased from zero members and one EV to 153 members and 27 EVs over the 10-month ramp-up period (details in Data Summary, Figure 3). Míocar operated for these 10 months before the service paused at the beginning of the COVID-19, in March of 2020. The service publicly launched in August 2019. Vehicles were added to the fleet until the total fleet size reached 27 in March 2020.

The pilot operated through a local partnership that included a local vanpool operator (California Vanpool Authority), an affordable housing developer (Self-Help Enterprises), and an experienced carsharing operator (Mobility Development). California Vanpool Authority was the fleet operator throughout the 10 months of the

project. Self-Help Enterprises was the site host for all of the Míocar hubs except for one of the hubs in Wasco, which is an affordable complex run by the Wasco and Kern Housing Authorities. In the spring of 2020, Míocar transitioned from this partnership to a non-profit, San Joaquin Valley Community Shared Mobility, Inc. (doing business as Míocar), that now owns, insures, and maintains the fleet and manages carsharing operations.

Data Collection

The data collected to evaluate this study include information contained in Míocar member applications, data collected through user surveys, and telematics data recorded during the use of Míocar. We describe these data as follows.

Member Data

During the enrollment process, the operators asked all Míocar applicants to provide demographic information, including their date of birth, gender, and address. Míocar converted addresses to census blocks before analysis, allowing for the calculation of metrics such as members by census block, distance to the closest Míocar hub, and distance to other hubs and major cities.

Míocar Utilization Data

Míocar equips its vehicles with telematics software that allows for GPS tracking and on-board recording of vehicle usage (referred to as "Utilization Data"). Thus, the program can collect precise and comprehensive data for each Míocar vehicle, reservation, and member. The information recorded and stored during each Míocar reservation includes:

- Member ID,
- Date and time of reservation start and end,
- Date and time of vehicle pick-up and drop-off,
- Revenue from the reservation,
- Duration of reservation (hours),
- Duration of travel (hours during which vehicle was moving), and
- Total miles traveled during the reservation.

The data also contain information about each vehicle, including year, make, model, and hub.

Member Surveys

A survey was administered to members after they joined Míocar to ask about their planned use of the service and their demographics attributes. Survey invitations for these surveys were sent out by Míocar to the program

members, and surveys were completed online through Qualtrics. As an incentive to complete the survey, responding members received 5 hours of Míocar driving credit for their next reservation. Member surveys collected the following information:

- Member ID,
- Information about member's personal vehicle(s) (i.e., number of vehicles available to their household and each vehicle's year, make, model, and estimated annual miles driven),
- Composition of member's household (i.e., population, number of adults, relationship to other household members),
- Member's reason for joining the service,
- Member's expected use of the service (i.e., whether it will allow them to make more trips, expected types of trips, what mode they will use to access the Míocar hubs),
- How the member first heard about the program,
- Member's level of education, and
- Household income.

Míocar asked members to complete these surveys after enrollment and before using the service. However, many members who did not initially respond later completed the member survey after starting to use the Míocar service.

The member survey response rate, calculated as the ratio of people who completed member surveys to the total number of members in the program, was 44.4%. We conducted t-tests to test whether the group of users who filled out the member survey (N1) are significantly different from the group of users who did not fill out the member survey (N2) using the member and utilization data (Table 2). The p-values of the t-tests are greater than 0.05. As a result, we failed to reject the hypothesis that the means of the two groups are the same. It is reasonable to conclude that users who completed the member surveys are representative of the population of pilot participants, as there is no significant difference between the members who completed the survey and those who did not, with respect to the values in Table 2.

Table 2. Descriptive Statistics for Members who Did (N1) and Did Not (N2) Complete the Member Survey

	Variable	N1	N2	t-statistic	p-value
Demographics	Age	55	53	0.566	0.573
	Driving Distance to Nearest Míocar (miles)	54	49	-0.041	0.967
	Driving Distance to Nearest Major City (miles)	54	49	-0.159	0.874
Usage	Frequency of Use (reserved hours/day)	55	53	1.066	0.289
	Frequency of Use (trip hours per day)	55	53	1.120	0.266
	Total Reserved Hours	55	53	1.719	0.091
	Median Reserved Hours	55	53	0.473	0.637
	Total Trip Hours	55	53	1.708	0.093
	Median Trip Hours	55	50	0.461	0.645
	Total Distance	55	53	1.787	0.078
	Median Distance	54	50	1.360	0.179
	Revenue	55	53	1.756	0.084

Post-Reservation Surveys

To capture information related to individual Míocar reservations, we developed a survey to be completed after a reservation (i.e., a "Post-Reservation Survey"). Invitations for these surveys were sent out by email to Míocar members who had completed a reservation within the previous week. As an incentive to complete the survey, Míocar rewarded responding members with one hour of Míocar driving credit for their next reservation. Post-reservation surveys were completed online through Qualtrics and collected the following information:

- Member ID,
- Purpose of reservation,
- Number of passengers in Míocar vehicle,
- Mode of travel to pick up Míocar vehicle,
- Counterfactual travel options (i.e., would travel have occurred without the Míocar service, and if so, with what mode), and
- Vehicle cleanliness rating and comments about the service.

Though the post-reservation survey does not ask members to indicate which Míocar reservation they are referencing for their responses, the survey instructs respondents to provide information about their *most recent*

reservation at the time of completing the survey. This means that each post-reservation survey completed by an individual member should refer to a separate Míocar reservation, which can be determined by reviewing the Míocar utilization data associated with that member.

A post-reservation survey was sent to each user for each reservation completed. Therefore, there could be multiple reservation surveys from the same user. There are 102 reservation surveys in total, filled out by 35 unique users. The total number of reservations is 618, made by 108 individual users. The response rate for all trips is 16.5%, and the proportion of users who responded to the reservation survey is 32.4%.

Analysis of the data indicated that as the number of reservations increases, the survey response rate declines. In other words, users are less likely to fill out the reservation survey if they have made many trips. As a result, we do not consider the set of completed post-reservation surveys to be representative of total reservations included in our utilization data. We present these data for exploratory purposes only in this report.

Data Summary

Member and Usage Data

In total, 776 individuals began an application for the Míocar service, and 153 of those became members, 108 of those used the service, and 45 persons did not use the service. It appears that many did not join because of the limited geographic locations of the hubs, the request for payment information, and failure to meet membership qualifications. We also noted big jumps in applications after the service made news on TV and radio and in the papers, first during the local launch events in August and September 2019 and again during the regional launch in November of 2019.

Table 3 and Figure 3 show monthly summaries of the total number of vehicles in the fleet, vehicles used in the fleet, members, reservations, reservation VMT, reservation hours, and revenue from Míocar user fees over the pilot ramp-up period.

Table 3. Summary Statistics: Totals by Month for the Míocar Ramp-Up Period

Month	Vehicles in Service	Vehicles Used	Members	Users	Reservations	VMT	Hours	Revenue ($)
May-19	0	0	0	0	0	0	0	0
Jun-19	4	3	7	3	4	123	66	39
Jul-19	7	4	35	9	14	832	103	105
Aug-19	7	5	49	19	39	1,836	264	521
Sep-19	9	7	59	17	34	1,731	265	365
Oct-19	11	7	67	14	53	3,776	347	827
Nov-19	23	14	101	34	106	6,029	1,169	1,751
Dec-19	23	13	120	38	91	6,011	1,793	2,622
Jan-20	24	19	126	39	95	8,226	2,146	2,546
Feb-20	25	20	143	37	92	7,839	2,007	2,741
Mar-20	27	22	153	34	90	6,086	1,843	2,716
Average per Month	16	11	86	24	63	4,249	1,000	1,423

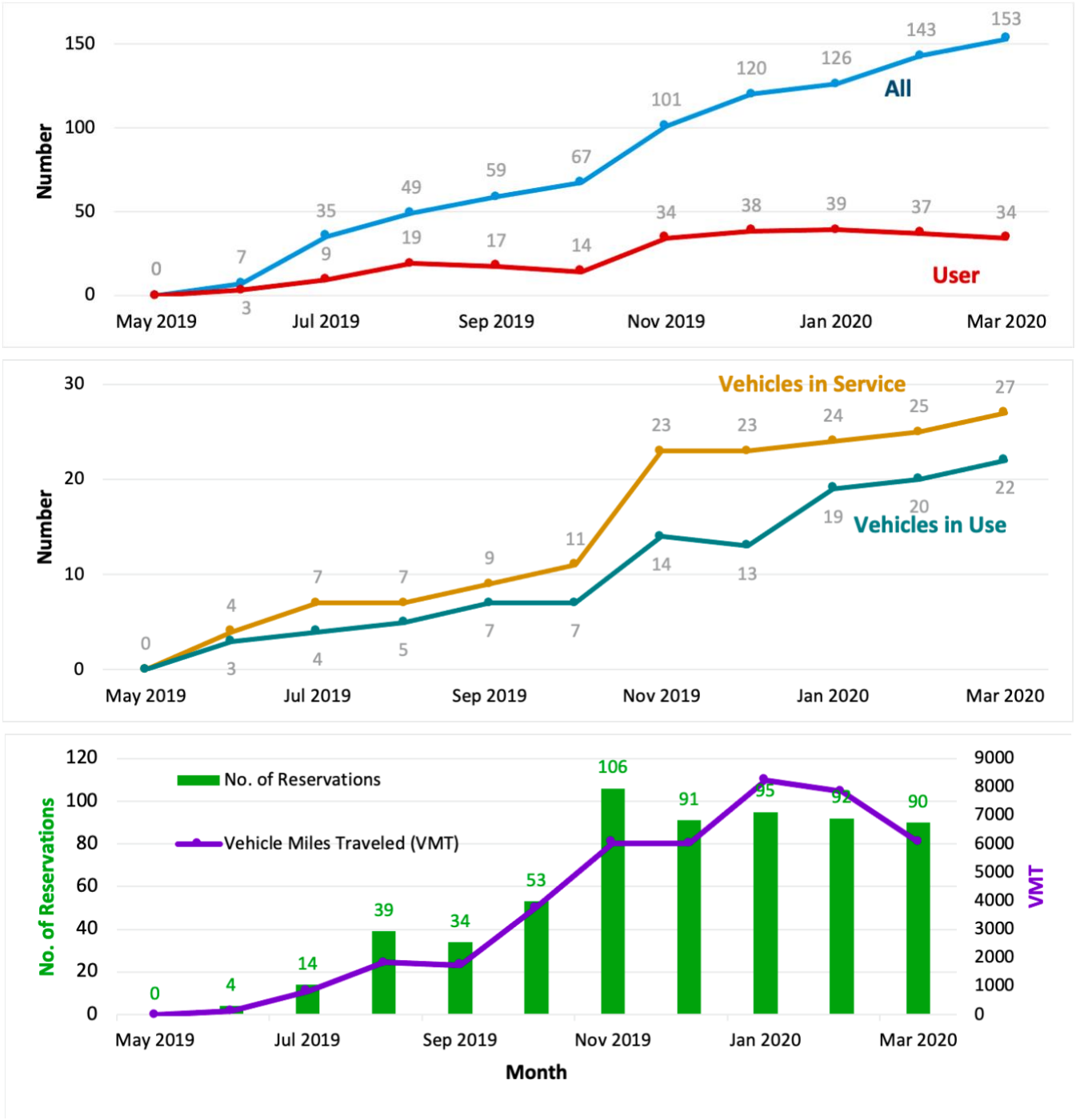

Figure 3. Changes over the First Ten months of the Míocar Ramp-Up: *(top)* Numbers of Registered Members and Members who Used the Service ("Users"); (*middle*) Total Number of Fleet Vehicles in Service and Vehicles Used; (*bottom*) Number of Reservations (green bars) and VMT (purple line).

Table 4 presents the summary statistics for user members, including monthly numbers of reservations, VMT, and hours of service use. Values vary because many members do not use the service every month, and some members use the service very intensively. On average, per month, a user member will make 1.25 reservations and travel 92 miles over 18 hours. The median value (50th percentile) is 0.6 reservations per month, 33.6 miles per month, and 4.25 hours per month. Table 5 presents the summary statistics for each reservation. The median reservation distance is 46 miles, and the duration is about 4 hours. The maximum value is high because there are users who reserved Miocar for as long as a week and make many trips during their reservations.

Table 4. Monthly Use Statistics for User Members (N=108)

	No. of Reservations/Month	VMT/Month	Hours of Use/Month
Mean	1.25	91.83	18.16
Standard Dev	2.16	191.66	63.59
Minimum	0.10	0.00	0.00
25th percentile	0.33	15.09	1.39
50th percentile	0.60	33.60	4.25
75th percentile	1.25	78.53	11.31
Maximum	19.20	1,703.75	484.73

Table 5. Summary Statistics for Reservations

	VMT	Hours	Revenue
Count	558	590	618
Mean	76.15	16.20	22.97
Standard Deviation	119.40	38.35	53.72
Minimum	0.00	0.00	0.00
25th percentile	22.00	1.60	0.00
50th percentile	46.00	3.90	7.53
75th percentile	83.00	14.38	20.47
Maximum	1,149.00	337.10	493.68

Figure 4 shows the percentages of user members (total 108) according to their travel distance from a Míocar hub. Of user members, 27% were willing to travel more than 5 miles from their home to access Míocar hubs. The average distance is 7 miles, and the median is 2 miles. The minimum distance is 0.07, and the maximum distance is 39 miles. Figure 5 shows the Míocar hubs and the percentage of users in different towns in the San Joaquin Valley. Many Míocar members live in communities without Míocar hubs.

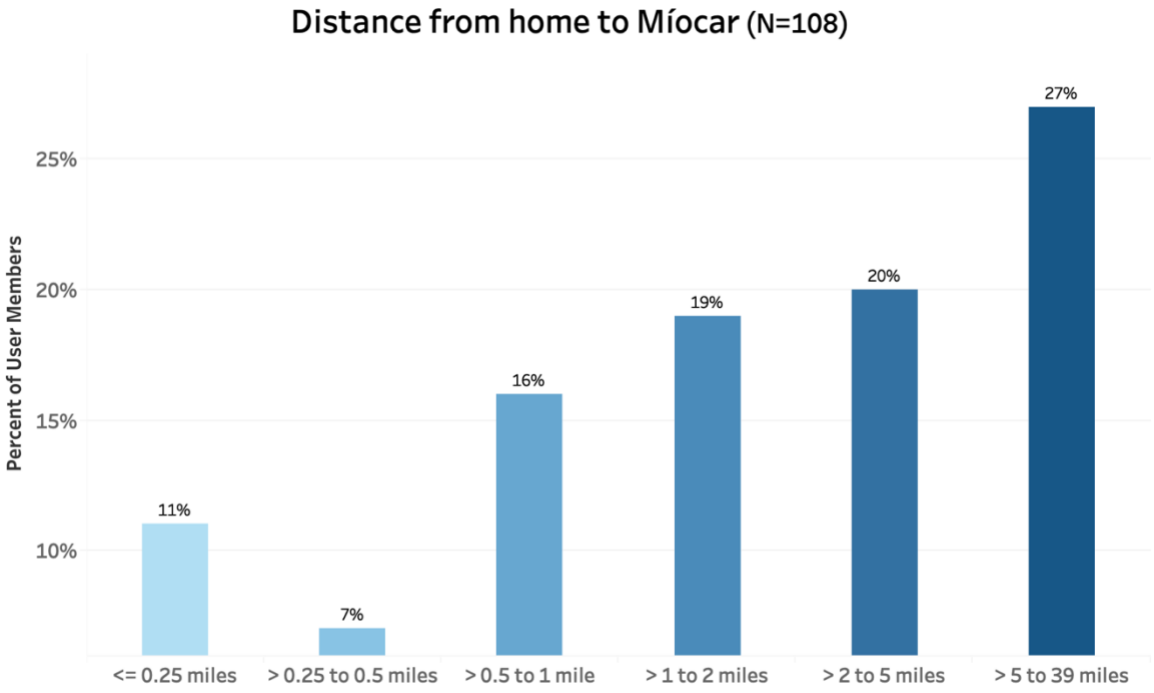

Figure 4. Distance from User Member's Home Location to Nearest Míocar Hub

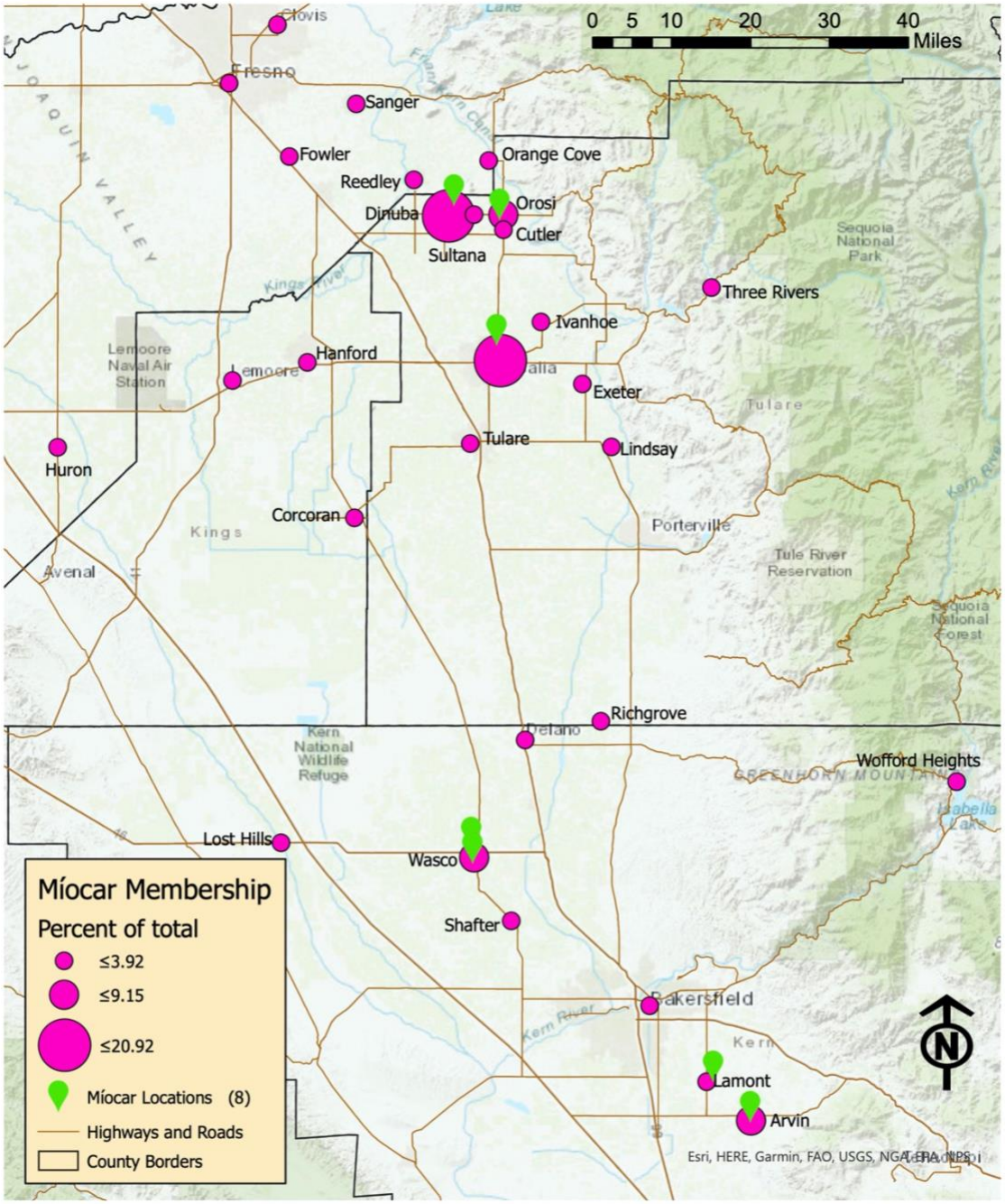

Figure 5. Members by Home Locations

In total, we collected 55 responses to the member survey of Míocar users. The results described above in Table 2 suggest that this sample is representative of the Míocar member population for mean values. However, in addition to mean values, we report responses by category with small sample sizes for exploratory purposes.

New members who responded to the member survey provided information related to their household composition and other demographic variables. As shown in Table 6, most respondents have four or more people

living in their households. About 53% (27 out of 51[7]) users have a household size larger than their census blocks group's average household size. The median household size of users is 4, which is larger than the average household size (3.6) of the 36 block groups, as well as the average household size of Tulare county (3.34) and Kern county (3.18)[8].

Table 6. Total Population of User Households

Including yourself, how many people live in your household?	Percent of Respondents (n = 55)
1	9%
2	9%
3	15%
4	35%
5	20%
6 or more	13%
Average*	3.5
Median*	4.0

*Average and Median assume 6 occupants for a response of "6 or more".

In terms of adults, most respondents indicated that they have one other adult living with them in their home (two adults in total). See Table 7.

[7] There are 38 census block groups where the 55 users live in, and 2 of them have missing data. Therefore, users living in the 2 census block groups are not included for comparison.
[8] Sources: U.S. Census Bureau, American Community Survey (ACS) and Puerto Rico Community Survey (PRCS), 5-Year Estimates, 2014-2018.

Table 7. Adult Population of User Households

How many people 18 years or older live in your household?	Percent of Respondents (n = 33)
1	15%
2	52%
3	9%
4	12%
5	6%
6 or more	6%
Average*	1.5
Median*	2.0

*Average and Median assume 6 occupants for a response of "6 or more".

We asked respondents to describe their relationship to other members of their household. As shown in Table 8, most stated that they live with their children and spouse, while nearly half of respondents reported that they lived with parents or other relatives.

Table 8. Household Population Relationships to Users

Who are the other people in your household?	Percent of Respondents (n = 51)*
Children	57%
Spouse/Partner/Significant Other	55%
Parents	24%
Relatives (e.g., siblings, etc.)	24%
Housemates/Roommates	4%
Other	4%

*Respondents were able to select multiple responses, and the percentages shown represent the percent of respondents rather than percent of responses. Thus, the sum of percentages exceeds 100%.

The member survey asked respondents to indicate their level of education, and Table 9 displays the responses with similar categories grouped. Responses were fairly evenly split between education levels of associate degree or above (39%), some college or trade or vocational school (35%), and high school graduates (24%).

Table 9. User Education Level

What is your level of education?	Percent of Respondents (n = 54)
Associate degree or above	39%
Some college, trade or vocational school	35%
High school graduate	24%
No schooling completed	2%

The survey also asked users to provide information about their household's income level, as displayed in Table 10. Most users (68%) have a household income of less than $50,000, and 65% (31 out of 48) users have a household income lower than their census block group's median income. The median household income of users is approximately $37,500, which is lower than the average median income ($46721) of the 35 block groups, as well as the median household income of Tulare county ($47,518) and Kern county ($52,479)[9].

[9] Sources: U.S. Census Bureau, American Community Survey (ACS) and Puerto Rico Community Survey (PRCS), 5-Year Estimates, 2014-2018.

Table 10. User Household Income

What is your household's income level?	Percent of Respondents (n = 51)
Less than $10,000	8%
$10,000 to $24,999	29%
$25,000 to $49,999	31%
$50,000 to $99,999	20%
$100,000 to $199,999	12%
Average*	$49,656
Median*	$37,500

*Average and Median assume the midpoint value of income for any stated range (e.g., "$10,000 to $24,999" uses a value of $17,499.50).

The survey asked users about the personal vehicles available to their households. As shown in Table 11, a majority of users have two or fewer vehicles available to their households (78%), with a typical user having about two vehicles available to their household (average 1.7, median 2). Eleven percent of users stated that they do not have any private vehicles available to their household. About 65% (34 out of 52) users have vehicles per household fewer than their census block group's average number of vehicles per household. Users' average number of vehicles per household is 1.7, which is fewer than that of the 35 block groups (1.8), as well as the vehicle ownership in Tulare County and Kern County (2 vehicles per household)[10].

[10] Sources: Data USA. https://datausa.io/profile/geo/tulare-county-ca?compare=kern-county-ca

Table 11. Number of Vehicles Available to User Households

How many vehicles are available (owned, leased, or regularly borrow) for use by your household?	Percent of Respondents (n = 55)
0	11%
1	36%
2	31%
3	16%
4	4%
6 or more	2%
Average*	1.7
Median*	2.0

*Average and Median assume 6 vehicles for a response of "6 or more".

We calculated the average vehicle age for all vehicles of each user member. If the number of vehicles is six or more, we used six to calculate the average value. Table 12 summarizes the average vehicle age for vehicles reported by 49 respondents.

Table 12. Summary Statistics for Average Age of Vehicles Owned by Users in Years (N=49)

Minimum	2.50
25th percentile	7.50
Median	10.50
Average	10.94
75th percentile	13.67
Maximum	23.00

Nearly all of the private vehicles cited by users were traditional internal combustion engines (ICE) vehicles. When asked whether they had considered purchasing or leasing an electric vehicle, most users stated that they were at least interested or considered doing this, and 4% of users stated that they had already purchased or leased an electric vehicle (see Table 13).

Table 13. User Consideration of Owning or Leasing an Electric Vehicle

Have you considered purchasing or leasing an electric vehicle?	Percent of Respondents (n = 53)
I am interested but have not taken any steps to get one.	32%
I have not considered it, but maybe someday I will.	30%
I have started to gather information but have not gotten serious yet.	15%
I would like to purchase or lease an electric vehicle, but they are too expensive.	9%
I am unsure.	6%
I have purchased or leased an electric vehicle.	4%
I have shopped for one, including a visit to a dealership for a test drive.	4%

The member survey included a series of questions related to new members' motivation and expected use of Míocar. The survey asked members why they decided to join Míocar and provided a list of typical reasons for joining a carsharing service. As shown in Table 14, most users (51%) selected a response related to the lack of reliability or availability of personal vehicles ("I don't always have access to a car when I need it" or "As a back-up, in case my car breaks down"). The few other responses indicated a desire to reduce vehicle emissions, another enjoyed driving, and the last indicated that a vehicle was not always available when needed.

Table 14. Reasons for Joining Míocar

Which of the following best describes the reason you joined Míocar?	Percent of Respondents (n = 31)
I don't always have access to a car when I need it	32%
As a back-up, in case my car breaks down	19%
Reduce the number of miles I put on my car	19%
Save money on gas	13%
Other	10%
Interested in driving an electric vehicle	6%

When asked how they found out about Míocar, respondents cited a variety of sources with the most common sources being advertisements or news sources (35%). More than one-quarter of respondents (27%) stated that they heard about Míocar through word of mouth, e.g., from a family or friend (Table 15).

Table 15. How Users Heard about Míocar

How did you find out about Míocar?	Percent of Respondents (n = 55)*
Radio/TV Advertisement, Print Advertisement, News	35%
Family/Friend (word of mouth)	27%
Self-Help Enterprises	25%
Internet/Social Media	24%
Other	9%
CalVans	4%

*Respondents were able to select multiple responses, and the percentages shown represent the percent of respondents rather than percent of responses. Thus, the sum of percentages exceeds 100%.

The survey included a series of questions related to new members' expected use of the service. First, we asked users whether they thought Míocar would increase the number of trips their household would make. As displayed in Table 16, most respondents (53%) expected that the service would increase their number of trips.

Table 16. Expected Change in Trip Making due to Míocar

Will Míocar increase the number of trips your household makes?	Percent of Respondents (n = 34)
Yes	53%
No	24%
I am unsure	24%

We then asked the subset of respondents who expected to make more trips what types of new trips they would make with Míocar. Table 17 shows that nearly all of these respondents expected to make additional trips related to personal or social activities (family/personal errands, social/recreational, shopping). Most of these respondents also expected to make additional trips related to work or school (59%).

Table 17. Expected Trip Types Enabled by Míocar

For these new trips that Míocar allows you to make, where will you go?	Percent of Respondents (n = 17)
Family/Personal; Shopping; Social/Recreational	94%
Work/School	59%
Medical	41%

*Respondents were able to select multiple responses, and the percentages shown represent the percent of respondents rather than percent of responses. Thus, the sum of percentages exceeds 100%.

When asked how they expected to travel to pick up Míocar vehicles, respondents most commonly indicated that they would use a private vehicle (38%) or walk (31%) to the Míocar hub (Table 18). All Míocar hubs are located within or near apartment buildings or housing developments to improve walkable access to the vehicles. They also indicated that they would use transit, taxis, and ride-hailing services to get to the Míocar hubs.

Table 18. Expected Mode of Travel to Míocar Hubs

How do you think you will most frequently travel to pick up Míocar?	Percent of Respondents (n = 15)
Private Vehicle (car or truck)	33%
Walk	27%
Transit (bus or train)	13%
Taxi, Uber, or Lyft	13%
Unsure	7%
Other	7%

*The question included additional options that no one selected, including “Bicycle”, “Scooter or skateboard”, and “Motorcycle”.

Post-Reservation Survey

The post-reservation survey was administered every week from December 2019 through March 2020, after initially being administered on a less regular basis during August 2019. In total, we collected 102 responses to

this survey from 35 unique Míocar users. This section summarizes the tabulated results of the post-reservation survey. As discussed above, we do not view the results of the post-reservation survey as representative of the larger population of Míocar users. These findings are a summary of the data collected before the end of March 2019 for the subset of users who completed the survey. The analysis is for exploratory purposes only.

The survey asked users to indicate the primary purpose of their last Míocar reservation to understand why people are using the service. As shown in Table 19, respondents most commonly stated that the primary purpose of their reservation was to conduct family or personal errands (39%). Grouping similar categories show that most reservations (54%) had a primary purpose related to personal or social activities (family/personal errands, social/recreational, shopping). Work-related activities were the second most commonly cited reservation purpose (28%).

Table 19. Primary Purpose of the Most Recent Reservation

What was the primary purpose of your last Míocar reservation?	Percent of Responses (n = 102)
Family/personal errands	38%
Work-related	28%
Social/recreational	10%
School	8%
Medical	7%
Shopping	6%
Other	3%

When asked to report how many passengers, including themselves, were in the Míocar vehicle during the reservation, most users (69%) stated that two or fewer people were in the vehicle (Table 20). As indicated by the average and median values, Míocar vehicle reservations typically consisted of the driver and one other passenger.

Table 20. Number of People in Vehicle for Most Recent Reservation

Including yourself, how many passengers were in the vehicle during your reservation?	Percent of Responses (n = 99)
1	30%
2	39%
3	22%
4	6%
5	2%
Average	2.1
Median	2.0

The survey asked several questions to gain insight into users' possible counterfactual decisions about travel in the absence of Míocar. These questions related to alternative transportation options. First, we asked how users traveled to the Míocar hub to pick up the vehicle that they had reserved. Table 21 shows that users most commonly walked to Míocar hubs (45%), nearly one-third of reservations (31%) used a private vehicle. Users also used public transit (12%) and ride-hailing services (12%). Three percent of reservations were accessed using multiple modes of transportation (e.g., public transit bus followed by walking).

Table 21. Mode of Travel to Míocar Hub for Most Recent Reservation

How did you travel to pick up the Míocar?	Percent of Respondents (n = 95)*
Walk	45%
Private Vehicle (car or truck)	31%
Public Transit Bus	12%
Taxi, Uber, or Lyft	12%
Bicycle	2%
Other	2%

*Respondents were able to select more than one response. The percentages shown are the percentage of respondents rather than the percentage of responses. Thus, the total is greater than 100%.

The primary question we used to determine the likely counterfactual travel scenario simply asked users if they would have made the particular trip in question had Míocar not been available. Most respondents stated that

the trip would not have occurred in the absence of Míocar, suggesting that 59% of trips were induced by the availability of Míocar (Table 22).

Table 22. Counterfactual Trip Decision in the Absence of Míocar

If Míocar was not available, would you have made the trip?	Percent of Responses (n = 102)
No	59%
Unsure	22%
Yes	20%

For the 20% of responses stating that the trip would have occurred in the absence of Míocar, the survey asked users how they would have made these trips under this counterfactual. A high majority of users in this subset (95%) indicated that they would have used a different mode of travel to make this trip (Table 23).

Table 23. Counterfactual Trip Behavior in the Absence of Míocar

How would you have made this trip without Míocar?	Percent of Respondents (n = 20)*
I would have used a different mode of travel (for example, my own car or bus).	95%
I am unsure.	5%
I would have gone to a different location.	5%

*Respondents were able to select more than one response. The percentages shown are the percentage of respondents rather than the percentage of responses. Thus, the total is greater than 100%.

Without Míocar, all respondents indicated that they would have used a vehicle for the trip. None of the users stated that they would have made their Míocar trips using other modes such as transit or active transportation. See Table 24 below.

Table 24. Counterfactual Trip Mode in the Absence of Míocar

What mode of travel would you have used?	Percent of Responses (n = 18)
Driven my own car	78%
Rented a car	17%

Finally, the post-reservation survey asked users to rate the cleanliness of the Míocar vehicle they had used during their reservation on a scale of 1 (very dirty) to 5 (very clean). Ratings were fairly high, with an average score of 4.1 (Table 25).

Table 25. Cleanliness of Míocar Vehicle During Most Recent Reservation

Please rate the cleanliness of the Míocar vehicle used on your last reservation from 1 (very dirty) to 5 (very clean):	Percent of Responses (n = 102)
1	5%
2	4%
3	12%
4	33%
5	47%
Average	4.1

The surveys provided users with the opportunity to make recommendations or further comments about their Míocar experience. Seventeen percent of respondents provided responses in this section, and comments most commonly related to issues with vehicle cleanliness (7 responses), charging issues (5 responses), and suggesting that a Míocar hub be added to the city of Tulare (2 responses by a single user). Concerns about cleanliness centered around dirt on the outside of the car and pet hair and some food (sunflower seeds) on the seats. Issues around charging related to the vehicles not being plugged and/or fully charged before use.

Counterfactual Travel and Avoided or Induced VMT

This section presents the results of the counterfactual travel analysis. These results are a summary of the current data set and are not intended to reflect the larger population of Míocar users or to suggest any broader trends related to carsharing services or mode choice. They are presented for exploratory purposes only.

Using the responses within the post-reservation survey related to counterfactual travel options and decision making, we developed a counterfactual travel score for each user who responded to this survey. For each post-reservation survey, we categorized the reservation being discussed as Induced Travel, Avoided ICE Travel, Avoided Non-ICE Travel, or Unknown Travel. These categories are defined as follows:

- Induced Travel: A trip that would not have occurred at all in the absence of Míocar.
- Avoided ICE Travel: A trip that would have occurred using an ICE vehicle in the absence of Míocar.
- Avoided Non-ICE Travel: A trip that would have occurred using a mode other than an ICE vehicle in the absence of Míocar.

- Unknown Travel: A trip that may or may not have occurred in the absence of Míocar; a determination cannot be made due to lack of data.

This assignment is based on users' responses to the following questions:

- Q3: If Míocar was not available, would you have made this trip?
- Q5: What mode of travel would you have used?

Where,

- A response of "No" to Q3 categorizes the reservation as "Induced Travel" (i.e., the trip would not have occurred in the absence of Míocar);
- A response of "Yes" to Q4, AND a response of "Driven a private vehicle", "Rented a car", "Taken a taxi, Uber, or Lyft", "Borrowed someone else's car" OR "Gotten a ride from someone" to Q5 categorizes the reservation as "Avoided ICE Travel" (i.e., the user would have taken the trip using an ICE vehicle in the absence of Míocar);
- A response of "Yes" to Q4, AND a response of "Walked", "Biked", "Taken a bus", "Taken a train" or "Other" to Q5 categorizes the reservation as an "Avoided Non-ICE Travel" (i.e., the user would have taken the trip using a mode other than an ICE vehicle in the absence of Míocar); and
- A response of "Unsure" to Q3 categorizes the reservation as "Unknown Travel".

Table 26 displays the travel categories assigned to the 95 survey responses that were linked to a specific reservation, based on counterfactual survey responses. We found that most Míocar trips (63%) are Induced Travel and would not have occurred in the absence of Míocar, according to users. We also found that none of the trips met the criteria for Avoided Non-ICE Travel as all users who indicated that they would have taken their trip in the absence of Míocar stated that they would have used a mode involving an ICE vehicle. Avoided ICE Travel accounts for 17% of all surveys linked to a specific reservation.

Table 26. How Availability of Míocar Affected Travel (Based on Counterfactual Survey Responses)

Based on counterfactual responses, trips taken using Míocar represent…	Avoided ICE Travel	Avoided Non-ICE Travel	Induced Travel	Unknown Travel*	Total
n	16	0	60	19	95
Percentage	17%	0%	63%	20%	100%

*Insufficient survey data to make a determination for these trips.

Table 27 presents the results of applying the counterfactual travel analysis for each user to the total Míocar distance traveled within that user's linked reservations. The 73 survey responses that we confidently linked to a specific reservation account accounted for a total of 9,088 miles traveled. According to users, the majority of miles traveled for these reservations (75% or 6,828 miles) were induced and would not have occurred in the

absence of the service. Of the total miles traveled, 15% (1,406 miles) would have been traveled using an ICE vehicle in the absence of the service.[11]

Table 27. How Availability of Míocar Affected Miles Traveled (Based on Counterfactual Survey Responses)

	Avoided ICE Miles	Avoided Non-ICE Miles	Induced Miles	Unknown Miles*	Total
Miles	1,406	0	6,828	854	9,088
Percentage	15%	0%	75%	9%	100%

*Insufficient survey data to make a determination for these trips.

Table 28 and Table 29 summarize the counterfactual travel analysis by reservation purpose. This involved cross-referencing the counterfactual survey responses with the stated reservation purpose from the post-reservation survey. We found that induced travel most commonly falls under the category of "Family/personal errands" (48% of all induced trips). This is also the most commonly cited reservation purpose, accounting for 38% of all post-reservation surveys. All of the respondents who indicated "School" as their reservation purpose said this trip would not have occurred without Míocar, and thus are induced. Seventy-four percent of "Work" purpose reservations were induced.

Table 28. Counterfactual Trip Summary by Purpose of Reservation

Trip Purpose	Induced	Avoided	Unknown	N
School	100%	0%	0%	3
Work-related	74%	16%	11%	19
Family/personal errands	63%	13%	25%	32
Shopping	50%	0%	50%	2
Other	33%	33%	33%	3
Social/recreational	30%	60%	10%	10
Medical (for example, doctor's appointment)	0%	50%	50%	4

[11] Two of the reservations linked to survey responses had a recorded distance of 0 in the utilization data. We found that this was due to an error with the telematics software, and therefore removed these 0 values prior to completing this portion of the analysis. Both of these reservations were completed by users who had completed a single survey, so the removal of these distance values does not affect the calculations for any other reservations.

Table 29. Counterfactual Trip Summary by Purpose of Reservation, Grouped

Trip Purpose	Induced	Avoided	Unknown	N
Family/personal errands; Social/recreational; Shopping	55%	23%	23%	44
Medical (for example, doctor's appointment)	0%	50%	50%	4
Other	33%	33%	33%	3
Work-related or school	77%	14%	9%	22

User Profiles

As shown in Table 30, frequency of use (i.e., the ratio of total reservation hours to the membership duration) is used to classify users into different categories based on their usage. Using the frequency categorizations describe in Table 30 below, we identified 38 users in the low or medium frequency group and 16 users in the high or very high frequency group who also completed the member survey. We then assessed user characteristics from the member survey by Míocar frequency of use from the usage data.

Table 30. Usage Frequency Categories

Frequency of Use (total reservation hours/total membership hours)	Frequency Category
0-1%	Low Frequency
1-5%	Medium Frequency
5-10%	High Frequency
>10%	Very High Frequency

Overall, we found strong similarities in member survey responses between users in the two lower frequency categories and the two higher frequency categories, and thus each of these pairs of frequency categories are combined in some instanced. None of the high/very high frequency users have more than two vehicles available to their households. Households with three or more vehicles available characterizes 32% of the low/medium frequency users versus 0% of high/very high frequency users. Very high frequency users in our sample are more likely to have three or more adults in their households than low/medium/high frequency users. Households with three or more adults characterizes 27% of low/medium/high frequency users versus 50% of very high frequency users. Most users in each of the low, medium, and high frequency categories have two or fewer adults in their households (77%, 71%, and 63%, respectively). Vehicle sufficiency is defined as having the same (or greater) number of vehicles in a household as adults. Vehicle sufficiency is more common among low/medium frequency

users than among high/very high frequency users (75% versus 55%). Most high/very high frequency users have an income of less than $15,000 per adult in the household. Having an income less than $15,000 per adult in the household characterizes 71% of very high frequency users but only 39% of low/medium/high frequency users.

In summary, high/very high frequency users appear to have less vehicle sufficiency, fewer vehicles overall, more adults per household, and a lower income per adult. However, we emphasize that these are preliminary results, presented as a summary of findings limited to the current sample of users and surveys. These findings are for exploratory purposes only.

Conclusion

The results of member and use data show that, over the 10-month ramp-up of the program, membership levels increased from 0 to 153 members and the number of EVs increased from 1 to 27. On average, per month, a user member will make 1.25 reservations and travel 92 miles over 18 hours. The median reservation distance is 46 miles, and the duration is about 4 hours. The program averaged 16 reservations per month during the ramp-up period. Summary statistics for program use show wide variation in the number of reservations, vehicle miles traveled and reserved hours. The pilot needs more time to operate at its full capacity before we can make more reliable estimates of use.

Of the user members, 27% (29/108) were willing to travel more than 5 miles from their homes to access Míocar hubs. Post-reservation survey data indicate that 45% walked to Míocar hubs, while 33% used a vehicle, and 12% used public transit.

These usage results suggest some possible trends. Members who use the service frequently may substitute the service for a personal vehicle that they cannot afford. The willingness of members to travel further than a quarter-mile from their homes to access a Míocar vehicle suggests the need for and potential sustainability of the rural EV carsharing model tested in this study, i.e., lower population densities supporting fewer hubs. On the other hand, access distances of more than 5 miles may suggest the need to add more Míocar hubs in surrounding communities. Many Míocar members live in communities without Míocar hubs. Finally, the long distances traveled during the reservations indicate that members use the service for inter-city and inter-county trips that cannot be accomplished by available transit service.

The timing of two media launch events that garnered significant TV, radio, and print news coverage corresponds to two big spikes in membership. First was the local launch, in Míocar communities, in August 2019, and second was the regional system launch in November 2019. The results of the member survey also indicated that most members learned about the service through those media outlets.

The results of the member surveys provide insight into members' demographic attributes. Most member households include four or more people with at least two adults. Most users have a household income of less than $50,000, and the median household income is approximately $37,500. Almost half of all members have less

than one vehicle available to their household, and the median age of members' vehicles is 10 years. Members report that their primary motivation for using Míocar is lack of access to a vehicle.

The demographic information from member's survey data is integrated with member's usage data to gain early insight into potential factors that predict the frequency of using Míocar. We found that very high frequency users in our sample are more likely to have three or more adults in their households than low, medium, and high frequency users. High and very high frequency are less likely to have vehicle sufficiency in their households than are low and medium frequency users. Most high and very high frequency users have an income of less than $15,000 per adult in the household.

We asked Míocar members to fill out surveys after they completed a reservation. Most survey responses indicated that, without the availability of Míocar, most respondents (59%) would not have been able to travel to the primary destination, 20% said they would have used another vehicle, and 22% stated that they were unsure. These results are generally consistent with expectations from the member survey: 53% said that with Míocar available they would make more trips, 24% said they would not, and 24% were unsure. Integration of member's post-reservation survey data with their usage data indicated that 75% of Míocar miles traveled result from induced trips, and 15% of the miles substituted EV travel for vehicles that use gasoline. Both the member usage data and the post-reservation surveys indicated that the service is likely to be used for a variety of trip purposes, including for work and school.

Interestingly, the member survey showed significant interest in purchasing electric vehicles, even though the rates of EV ownership and leasing are much lower in the Valley than in the rest of California. Many of the users completed the member survey after they had used the service program, and it may be that the exposure to EVs as part of the pilot sparked their interest in EVs. On the other hand, it may be that the service attracts members who are interested in EVs or "early adopters" without the resources to follow through on their inclinations.