

Car-less or car-free? Socioeconomic and mobility differences among zero-car households



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ABSTRACT

Transportation professionals have long identified the important division between choice and constraint in modal decision-making. However, while heterogeneity within some modal groups such as transit riders is well documented, intragroup differences in other groups have been largely ignored. In particular, significant heterogeneity exists among zero-car households, who may not own a car due to choice (car-free) or constraint (car-less). Recognition of intragroup heterogeneity among zero-car households yields policy implications as cities consider where to invest their ever more precious and more limited transportation resources. Using activity diary data from the 2012 California Household Travel Survey, I investigate two research questions: first, how do car-less households compare to car-free households in terms of both their socioeconomic characteristics and their relative share of zero-car households? Second, how do motivations behind not owning a car translate into mobility differences - including daily trip counts and miles traveled? I find that, contrary to media reports that the number of car-free households—that is, households that choose not to own a car—is “booming”, 79 percent of zero-car households do not own a car because of economic or physical constraints. Car-less households in many ways mirror the captive transit population, in that they have significantly lower household incomes, lower educational attainments, and are disproportionately non-white compared to car-free households. Observed socioeconomic variations translate into mobility differences, with car-free travelers taking more trips and traveling more miles per day. Policy makers should consider extending access to carshare services, which are positively associated with more trips and miles traveled among both car-free and car-less households.

1. Introduction

Transportation professionals have long identified the important division between choice and constraint in modal decision-making. Specifically, the socioeconomic differences between—along with the divergent policy responses to serving—choice and captive transit riders has long presented a conundrum to transportation professionals seeking to garner support from choice transit riders for a system used primarily by captive riders (Taylor and Morris, 2015). While the classification of transit riders as choice or captive recognizes the heterogeneity within the modal group, other groups continue to be treated as homogenous. In particular, zero-car households are typically lumped into a single category, despite varying reasons for not owning a car, ranging personal and household characteristics, and diverging mobility outcomes among group members. Although they continue to be treated as a homogenous group by both scholars and the media, zero-car households have recently undergone a semantic shift. Once viewed as mobility-constrained, many now brand zero-car households as “car-free”, signaling their liberation from the costs

and hassle of car ownership. But what if—despite a media hype to the contrary—the majority of zero-car households are not car-free, but rather car-less, and not owning a car continues to represent a mobility burden rather than a chosen freedom?

While perhaps seemingly a question of semantics, the distinction between car-free and car-less translates into far more concrete mobility outcomes and policy imperatives. Labeling all zero-car households as car-free or car-less ignores intragroup heterogeneity, including different motivations underlying a household's zero-car status, and their varied mobility outcomes, such as the number of trips or miles traveled per day, which may proxy for opportunity access. Rather than simple semantics, car-free versus car-less indicates a divide between choice and constraint: the former do not own a car because they choose not to, and the latter do not own a car out of financial or physical necessity. Similar to the long-recognized socioeconomic distinctions between choice and captive transit riders, the heterogeneity among zero-car households—and a recognition of the relative size of each the car-less and car-free group—yields policy implications as cities consider where to invest their ever

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more precious and more limited transportation resources.

In this research, I use travel diary data and self-reported reasons for why households do not own a car from the 2012 California Household Travel Survey to classify zero-car households into two categories: car-less and car-free. Using these classifications, I investigate two research questions: first, how do car-less households compare to car-free households in terms of both their socioeconomic characteristics and their relative share of zero-car households? And second, how do motivations behind not owning a car translate into mobility differences - including daily trip counts and miles traveled? To answer these questions, I employ descriptive statistics and multiple linear regression models. Findings yield important policy implications for both spending priorities and how policy makers plan for and discuss zero-car households.

2. Literature review

2.1. From car-less to car-free

For decades, not owning a car in the U.S. has been nearly synonymous with reduced access to opportunities, and researchers have expended considerable efforts to document the economic and mobility outcomes among zero-car households. Researchers have found that individuals without cars travel fewer miles (Blumenberg and Pierce, 2012) and experience reduced job access even in the most transit-rich neighborhoods (Blumenberg and Ong, 2001; Grengs, 2010). By contrast, car ownership in the U.S. is causally linked with positive economic outcomes such as being employed (Gurley and Bruce, 2005; Ong, 2002), gaining employment (Sandoval et al., 2011), working more hours (Gurley and Bruce, 2005), and earning higher wages (Raphael and Rice, 2002). More recently, however, attentions have increasingly shifted from the constrained mobility outcomes among car-less travelers, to policies and environments aimed at “freeing” people from their cars in pursuit of sustainability and congestion relief goals. The semantic shift away from a car-less plight towards car-free liberation is clearly discernible in research. For example, some researchers frame households that transition from one to zero cars not as losing a car, but as “becoming car free” (Clark et al., 2016, p. 589). In other research, a choice-implicating “car-free” label has been attached to neutral zero-car household categories within survey and census data (see for example Becker, Ciara and Axhausen (2017); Buehler (2012)).

The shifting focus from car-less to car-free is not limited to scholarly research; rather, researchers are a small subset of a booming car-free lifestyle narrative that has captivated the popular media and galvanized car-free policies across the country. Authors in *The New York Times* and *The Wall Street Journal* trumpet “the end of car culture” and “the end of car ownership” (Higgins, 2017; Rosenthal, 2013). Op-eds abound in major newspapers across the county documenting professional workers’ forays into the car-free lifestyle: contributors to *The Los Angeles Times* report feeling “unburdened, even liberated, and sometimes joyful” traveling the city without a car (Gatto, 2017), while contributors to *The Washington Post* write about their “radical” car-free experiment (Shneiderman, 2016). In many of these cases, going car-free is presented as an exotic adventure, or a temporary experiment motivated by a friendly dare (Gatto, 2017).

While such press paints an optimistic view of our cities and zero-car lifestyles, they likewise reveal a significant blind-spot in public—or at least published—perceptions of living without a car. Popular articles are ubiquitously written by individuals who *choose* to forgo car-ownership and have the resources to purchase automobility in other ways, such as renting a car or hailing ridesource vehicles like Uber and Lyft. In some articles, the choice to forgo a car is right in the title: a tagline in a *Texas Monthly* article about going car-free in Houston reads “the heretical choice to not own a vehicle in a city that worships the automobile” (Tatke, 2015). By contrast, the discourse fails to recognize that not owning a car in the United States is neither revolutionary nor an adventurous experiment for millions of American households; rather, not

owning a car is both a simple fact of life and a mobility constraint for many who cannot drive or cannot afford a car.

What might explain the attention paid to choice travelers and researchers’ optimistic interpretation of a “no vehicle available” census classification as a choice-based car-free existence? I present two primary reasons for the shifting focus in both research and the public dialogue from car-less to car-free travelers: perceived changes in driving behavior among young adults, and a long-established focus on choice rather than constrained travelers in transportation policy due to politics and egocentric anchoring.

2.2. How changing travel patterns helped shape a car-free narrative

Two travel behavior observations have advanced the narrative that Americans—particularly younger Americans—are eschewing cars and embracing car-free lifestyles: reduced rates of licensure and driving among youth, and falling vehicle miles traveled (VMT). However, economic factors that explain both trends highlight that the car-less narrative should not be discarded so quickly in favor of a car-free story. First, teens are less likely to be licensed and are driving less compared to earlier generations: between 1995 and 2009, the percentage of licensed 17 year olds fell from 59 to 49 percent, partly due to stricter licensing laws in many states, such as increased licensing ages and restricted nighttime driving (Blumenberg et al., 2012). Young adults are also driving less than they did in previous generations, which some attribute to changes in attitudes and preferences. For example, McDonald (2015) finds that factors such as “changing attitudes and use of virtual mobility” explain 35 to 50 percent of reduced driving among young Americans (p. 90). But if changing attitudes and preferences are responsible for young adults driving less and owning fewer cars, reduced driving and car ownership rates should persist into the future as young adults age. Instead, researchers find that young adults receive licenses at similar rates—albeit a few years later than in the past—and drive as much as previous generations did at similar ages (Blumenberg et al., 2012). Additionally, researchers find that economic factors and constraints remain the strongest influences on travel behavior (Blumenberg et al., 2012) and that lower car ownership among young adults is due to lagging economic independence rather than changing attitudes, preferences, or licensing laws (Klein and Smart, 2017).

Also proffered as evidence for car-free lifestyle preferences was the fall of national VMT from a historic high of 3.03 trillion miles in 2009 to 2.96 trillion miles in 2012 (U.S. Department of Energy, 2016). Researchers have speculated at length over this potential “peak” in car travel, which represents a dramatic halt in previously steady growth in car ownership and driving (Millard-Ball and Schipper, 2011). In addition to a potential reflection of changing attitudes and preferences, some researchers speculated that peak car travel reflected a period of transition from largely car-based travel to technology-based activities and accessibility (van Wee, 2015). However, the national VMT has since rebounded and surpassed pre-Recession levels, reaching a new historical high of 3.1 trillion miles in 2016 (Federal Highway Administration, 2017). Researchers conclude that instead of attitudes and preferences driving the fall in VMT, the “balance of evidence [for reduced driving] points to economic rather than cultural factors” (King et al., 2016, p. 14). McDonald (2015) provides additional evidence that falling VMT during the Recession was not accompanied by an embrace of other modes; rather than offsetting reduced driving with trips on other modes, young adults simply traveled less.

In sum, although changing attitudes and preferences and falling VMT underpin the narrative of a car-free movement, research suggests that economic constraints rather than choice continue to dominate travel behavior and car ownership decisions.

2.3. Choice travelers in transportation policy

Why else might the press, and particularly scholars, fixate on a car-

free over a car-less narrative? The promotion of “car-free” lifestyles and cities is hardly the first time transportation policy has focused on choice rather than constrained travelers. Transit has long demonstrated a tug-of-war between serving “captive” riders—those with no modal alternatives to transit—and “choice” riders—those with other travel options. Choice transit riders, because of their parallels to car-free travelers—and because car-free travelers may in fact be choice transit riders—offer insight into two primary reasons on how and why policy often focuses on choice rather than captive travelers, and how in some cases, a fixation on relatively few choice travelers may supplant policies that would improve service for the majority of travelers who are captive.

First, although transit is utilized by a minority of travelers, it requires high subsidies to operate and must therefore appeal to the broader public by stressing the benefits of transit for non-riders such as increasing ridership and reducing congestion (Taylor and Morris, 2015). Of course, to achieve either strategy, transit agencies must coax *more* riders onto transit (i.e., choice riders who switch modes onto transit) rather than better serving those who already use transit (i.e., captive riders with no other modal options). One part of this strategy is to promote car-free lifestyles by providing supportive infrastructure—such as new rail lines—or outreach to encourage people to leave driving behind and embrace transit, biking, and walking. Cities may promote car-free lifestyles many ways such as launching “car-free Friday” media campaigns (City of Santa Monica, 2016), offering free transit passes (Abou-Zeid and Ben-Akiva, 2012; Beale and Bonsall, 2007), and building transit-oriented developments. While many car-freeing programs may also enhance the mobility of the car-less, the focus—at least publicly—is to “free” people from cars, not better serve those who already ride transit out of necessity. In other words, many existing transportation programs, transit spending, and agency objectives, already cater to the choice transit riders and focus on enabling “car-free” lifestyles rather than bolstering, say, network reliability in neighborhoods in which people are car-less.

Second, policy and research may focus more on choice travelers due to egocentric anchoring in which people project their own experiences when making judgements about others. Because transportation professionals are disproportionately multimodal and urban compared to the general population (Ralph and Delbosc, 2017), it is possible that personal experiences may inadvertently lead planners and professionals to discount or downplay the car-less narrative in favor of the car-free one, which is more likely to reflect personal experiences. Evidence of biases anchored in personal experiences exists in transportation. For example, transit professionals tend to overestimate the share of multimodal travelers based on their own, more multimodal, social circles (Ralph and Delbosc, 2017). While biases are unlikely to be malicious, they may nevertheless influence transportation research and planning (Lyons, 2016) and result in a policies oriented towards freeing people from cars rather than enhancing mobility for those with few modal alternatives.

Together, the politics of transportation finance and egocentric anchoring help to explain why policy and planning so often focuses on choice travelers—both choice transit riders and the car-free—even though they comprise the minority of travelers. Planning for “car-free” cities with abundant transit, biking, and walking opportunities can provide robust alternatives to car travel and help increase mobility opportunities for both those looking to shed a car and become “car-free”, and those without a car due to constraint who are “car-less.” But while policies can advance the mobility opportunities for both groups, assuming that all households are car-free—that is, they do not own a car out of choice—may distract from the real mobility needs faced by the majority of zero-car travelers, who are car-less, not car-free. This paper seeks to untangle the choice from captive zero-car households to recognize that, similar to the heterogeneity present among transit riders, substantial socioeconomic and mobility differences exist among zero-car households. Observed differences require planners and policy makers to consider the relative size and mobility outcomes of each group to develop mobility solutions for each.

3. Data & methodology

3.1. Data

In this research, I utilize data from the 2012 California Household Travel Survey (CHTS), a travel diary survey that provides detailed responses on travel behavior on a single survey day. Survey respondents are randomly selected by address and weighted to be representative of the statewide population. This study includes only adults (aged 20 or older), resulting in 84,926 individuals in California. Of these, 4.2 percent ($n = 3545$) do not own a car. All reported results are weighted at the household level.

3.2. Separating car-less from car-free

In addition to socioeconomic and travel information, the CHTS asks zero-car households why they do not own a car. CHTS respondents may indicate up to eight reasons for not owning a car. Merriam-Webster defines freedom as “the absence of necessity” (Merriam-Webster, 2017). By this definition, a car-free person does not forgo car ownership out of necessity, but rather out of choice. By contrast, a person who does not own a car out of necessity—such as physical or financial limitations—cannot by this definition be considered free to choose between owning and forgoing a car. Thus, instead of being “car-free” with car ownership representing a choice, a person for whom not owning car represents a constraint should be called “car-less.”

Table 1 lists responses that I classified as “choice” or “constraint” reasons for not owning a car. I categorized respondents as “constrained” if they indicated one or more constraint reasons for not owning a car, regardless if they indicated other choice reasons as well. For example, if a respondent stated that they did not own a car because it was “too expensive to buy” and they were “concerned about impact on the environment”, I categorized the person as not owning a car due to constraint. I refer to these “choice” and “constrained” groups alternatively as “car-free” and “car-less”, respectively. Respondents who refused to answer the survey question, stated “I don’t know,” or indicated “other,” were excluded from analysis ($n = 1209$) because it was impossible to classify them as car-free or car-less. In sum, 2336 adults from across California are included in this analysis. The majority (80%) are car-less, while only 20 percent are car-free.

Car-less and car-free individuals may travel very differently depending on why they chose not to or were unable to own a car. Therefore, I break the car-free and car-less categories further into five motivation groups, as illustrated by Table 1.

3.3. Socioeconomic and travel differences among car-owning, car-less, and car-free households

I first use descriptive statistics to compare the socioeconomic and

Table 1
Categorizing car ownership by choice or constraint.

Choice/ Constraint	Motivation Group	Reason	Sample size
Choice (Car-free)	Environmental	(1) Concerned about impact on environment	$n = 40$
	Unneeded	(1) Do not need a car and to do what I need and want to without a motor vehicle (2) Use public transit/car share/bike/walk	$n = 445$
Constraint (Car-less)	Economic	(1) Too expensive to buy (2) Too expensive to maintain (3) Cannot get insurance	$n = 1222$
	Health	(1) Health/age related reasons	$n = 251$
	Can't Drive	(1) No driver's license (2) Cannot drive	$n = 478$

travel differences between car-owning and zero-car households in California. I employ t-tests to test for significant differences between car-less and car-free individuals.

3.4. Measuring mobility

To understand the effects of choice versus constraint on mobility and the heterogeneity present among zero-car households, I first present descriptive statistics for each of the five zero-car groups. I estimate two additional multiple linear regression models to estimate the effects of personal and neighborhood characteristics on two mobility outcomes: 1) number of trips per day, 2) total number of miles traveled. For each person i :

$$M = G_i + F_i + E_i + A_i + S_i + R_i + B_i + N_i + Y_i + C_i + D_i$$

where: M = Mobility outcome (number of trips, total miles)

- G = Zero car group
- F = Female (Y/N)
- E = Employed (Y/N)
- A = Carshare membership (Y/N)
- S = Student (Y/N)
- R = Race/ethnicity
- B = Bachelor's degree or higher (Y/N)
- N = Household income (\$ thousands) (Y/N)
- Y = Young adult (ages 18-34) (Y/N)
- C = Citizen status (Y/N)
- D = Population density of home zip code (thousands/sq. mile)

I selected the number of daily trips and total miles per day as measures of mobility. The number of daily trips reflects the number of destinations a traveler reaches each day and thus the number of opportunities accessible to them. The number of miles traveled each day can likewise reflect trip frequency, but also incorporates how far people may travel on each trip to reflect access to opportunities and destinations.

4. Findings

4.1. What determines being car-free vs. car-less

Mirroring nationwide socioeconomic patterns of car ownership

Table 2
Characteristics of car owning, car-less, and car-free individuals.

	Total Population	Own 1 + Car	Own No Car	Car-less (Constraint)	Car-free (Choice)	Sig.
<i>Individual Characteristics</i>						
% Employed	58%	59%	32%	32%	37%	NS
<i>Race/Ethnicity</i>						
% NH White	61%	63%	39%	35%	45%	***
% NH Black	4%	4%	11%	12%	9%	NS
% NH Asian	7%	7%	4%	2%	6%	**
% Hispanic	25%	24%	43%	48%	35%	***
% Other	2%	2%	3%	3%	2%	NS
% Young Adult (20-34)	23%	23%	19%	18%	19%	NS
% Female	53%	52%	58%	59%	54%	**
% Student	9%	9%	7%	7%	5%	NS
% Citizen	76%	77%	63%	59%	66%	**
% Bach Degree or Higher	41%	42%	19%	16%	25%	***
% with Carshare Membership	1%	1%	3%	2.7%	6.9%	***
<i>Household Characteristics</i>						
Mean HH Vehicles	1.8	2.0	0.0	0.0	0.0	NS
Mean HH Income	\$81,077	\$85,816	\$25,455	\$20,671	\$30,890	***
Sample Size (individuals)	84,926	81,381	3545	1851	485	
Percent of Sample	100%	96%	4%	2%	1%	
Percent of Zero Car Households†			100%	79%	21%	

†Note: 1209 carless individuals provided no reason for why they did not own a car or could not be classified. *Indicates statistical differences between car-less and car-free; *p < 0.1, **p < 0.05, ***p < 0.01, NS not significant.

(NHTS, 2009), zero-car households in California are, on average, lower-income, have lower educational attainment, lower employment rates, and disproportionately non-white compared to car-owning households (see Table 2). Importantly, however, Table 2 also reveals the heterogeneity among zero-car households. First, less than one-quarter (21%) of zero-car households are car-free, while the majority (79%) are car-less. Compared to car-free travelers, car-less individuals are significantly lower income, have lower rates of citizenship, lower educational attainment, and are more likely to be non-white compared with car-free individuals. A far higher share of car-free individuals hold carshare memberships (7%) compared to either the car-less (about 3%) or car-owners (1%).

Fig. 1 underscores the income differences between both zero-car and car-owning households, as well as the income differences between car-free and car-less households. Zero-car households are dramatically overrepresented in the lowest income groups and underrepresented in higher income groups compared to the general population. In fact, nearly three-quarters (72%) of all zero-car households earn below \$25,000 compared to just 15 percent of car-owning households. At the same time Fig. 1(b) shows that—although car-less households outnumber car-free households nearly 4 to 1—car-free households are overrepresented in higher-income groups, and the relationship between income and share of households is positive for car-free but negative for car-less households. In other words, as income goes up, not having a car appears to shift from being motivated by constraint to being motivated by choice. Interestingly, Fig. 1(b) closely mirrors the distribution of captive and choice transit riders by income, in which being a captive rider is negatively associated with income and vice versa (Polzin et al., 2000).

4.2. Motivations matter: heterogeneity and mobility outcomes among car-free and car-less households

Zero-car household are clearly distinct from car-owning households, and considerable socioeconomic differences likewise exist between car-free and car-less individuals as discussed above. Further examining motivations underlying not owning a car reveals considerable heterogeneity even within the choice and constraint categories. Table 3 breaks car-free and car-less travelers down by the motivations given by CHTS respondents. First, economic constraint is notably the largest reason that people don't own cars, with nearly half (48%) of all zero-car households reporting an economic constraint as a reason for not owning a car. Also notable are the very small share of car-free who indicate “concern about

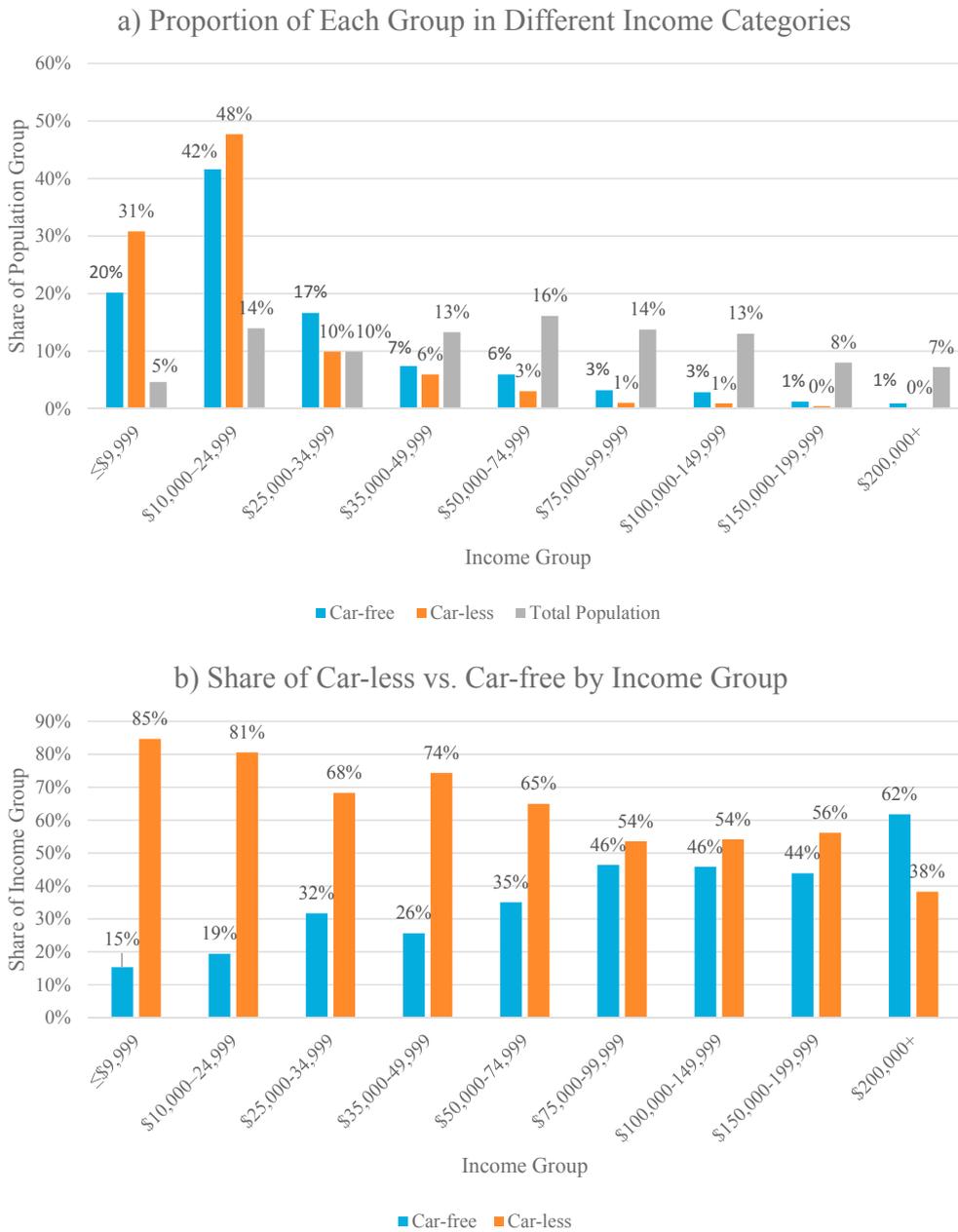


Fig. 1. Distribution of car-free and car-less households across income groups.

impact on environment” (Environmental group); although the environmental benefits of a car-free lifestyle is widely promoted (see for example Willsher (2015) and Nieuwenhuijsen and Khreis (2016)), car-free households motivated by environmental concerns comprise less than 2 percent of zero-car households. The Environmental group is an outlier among all zero-car households, even other car-free households. Car-free environmentalists are disproportionately employed, citizens, more educated, more male, almost entirely white (92%), and have higher incomes compared to other zero-car households. In addition, while only 1 percent of the total population, and about 4 percent of zero-car households have a carshare membership, a whopping 39 percent of car-free environmentalists hold a carshare membership.

Differences by motivation also manifest in mobility outcomes. Again, car-free environmentalists stand out from other zero-car travelers, including car-free travelers who state that they do not need a car or use other modes. Car-free environmentalists take nearly 20 percent of all trips by bike, and a higher share of trips by walking compared to other zero-car travelers. While their transit use is very in-line with other zero-

car travelers, car-free environmentalists take only about 4 percent of their trips by car, compared to other groups who take closer to one-quarter of trips by car. Increased walking and biking by car-free environmentalists is reflected in shorter average trip distances by this group, although they travel nearly twice the daily distance and take two times as many trips per day, suggesting increased mobility by this group. The least mobile group—in terms of number of daily trips—are car-less travelers constrained by age or health. This group is, on average, older than other travelers, and less likely to be employed; thus, this group likely represents elderly retired travelers. Although this group of travelers makes a lower share of their trips by walking and biking, as would be expected, they nevertheless make longer than average trips primarily by motorized modes (i.e., car and transit).

Do motivations for not owning a car actually affect mobility outcomes? Table 4 shows that compared to economically constrained car-less households, who comprise the plurality (48%) of zero-car households, being a car-free environmentalists increases the number of daily trips, while belonging to other car-less groups reduces daily trips.

Table 3
Socioeconomic and travel characteristics across zero-car groups.

	Car-free (Choice)		Car-less (Constraint)			Overall ^a
	Environmental	Don't need Car/Use Other Modes	Economic	Age/Health	Can't Drive/No License	
<i>Socioeconomic</i>						
Mean Age	45.4	55.7	49.6	65.8	55.2	53.8
% Female	29.2%	55.6%	56.2%	61.9%	65.2%	58.3%
% with Bachelor's Degree+	68.2%	22.2%	15.0%	24.8%	12.7%	17.7%
% Citizen	89.8%	64.6%	56.3%	77.0%	54.5%	60.3%
% Student	6.7%	5.4%	9.0%	4.7%	5.6%	7.0%
% Employed	76.9%	33.9%	38.8%	13.5%	28.4%	33.3%
Median Household Income	\$62,499	\$17,499	\$17,499	\$17,499	\$17,499	\$17,499
<i>Race/Ethnicity</i>						
% Asian	0.0%	6.6%	1.9%	2.4%	3.1%	3.1%
% Black	0.0%	10.2%	10.8%	12.6%	13.9%	11.4%
% White	91.0%	43.0%	32.2%	55.2%	30.1%	37.1%
% Other	4.3%	2.4%	2.9%	1.6%	2.3%	2.6%
% Hispanic	4.7%	37.9%	52.3%	28.2%	50.7%	45.8%
% Carshare Membership (Y)	38.6%	4.7%	4.3%	1.1%	0.0%	3.6%
<i>% of Trips by^b</i>						
Car	3.6%	22.4%	20.9%	23.1%	25.7%	22.1%
Transit	17.7%	17.3%	17.4%	20.9%	17.5%	17.7%
Bike	19.6%	3.9%	5.4%	0.4%	2.0%	4.2%
Walk	57.2%	52.8%	54.8%	42.7%	48.4%	52.0%
Number of Daily Trips	8.5	4.2	4.4	2.9	3.5	4.0
Avg. Trip Distances (miles)	2.6	4.0	3.3	4.9	6.7	4.3
Total Daily Miles Traveled	21.8	10.0	11.0	10.4	12.8	11.3
<i>Sample size (n)</i>						
Sample size (n)	40	445	1122	251	478	2336
% of Total Sample	1.7%	19.0%	48.0%	10.7%	20.5%	100.0%

^a Of those who gave reason for not owning a car.

^b Trips do not sum to 100% as “other” modes are excluded from table.

Motivation for not owning a car, however, has no significant effect on total daily miles traveled. Controlling for motivations, personal and built environment characteristics have a much stronger influence on the number of trips a person makes rather than on the total miles traveled. The exception to this is carshare membership, which is a stronger positive predictor for mobility outcomes than any other personal or built environmental characteristic. Having a carshare membership is associated with two extra trips and ten more miles traveled per day. Increased density of a traveler's home zip code is also positively associated with the number of trips taken, controlling for other factors. This conforms with findings from transportation literature, in which number of non-automobile trips is higher in denser neighborhoods (Ewing and

Cervero, 2001). Model results also predict significantly more trips for women, which likely reflects the uneven and gendered division of household-serving travel in most households (Smart et al., 2017). Being employed significantly increases the number of daily trips and total miles traveled regardless of motivation for not owning a car. This is likely because the commute itself adds daily trips and miles, and because being employed provides income needed to make additional discretionary trips. Finally, travelers holding a bachelor's degree or higher make significantly more trips and travel more miles, regardless of motivation for not owning a car. Longer travel distances may occur if workers with bachelor's degrees have to travel farther distances to reach a job matched to their skills. By contrast, service jobs, for example, are much more uniformly distributed across space and thus may explain shorter travel distances by workers in these industries (Hanson and Johnston, 1985).

Table 4
Mobility outcomes among zero-car households.

	Number of Trips		Total Miles Traveled	
	Coeff.	Sig.	Coeff.	Sig.
<i>Zero-car Category (Baseline: Constraint Economic)^a</i>				
Choice: Environmental	2.05	**	6.63	NS
Choice: Unneeded	-0.24	NS	-0.18	NS
Constraint: Health	-0.79	**	0.41	NS
Constraint: Can't Drive	-0.59	*	0.16	NS
Is a Young Adult (age 20-34)	0.10	NS	1.09	NS
Has Carshare Membership	1.84	***	10.00	**
Zipcode population (1,0000/sq. mile)	0.05	***	-0.08	NS
Household Income (\$1,000s)	0.00	NS	-0.03	NS
Female	0.41	*	-0.77	NS
Citizen	0.10	NS	-2.25	NS
Bachelor's Degree or Higher	1.13	***	3.37	**
Employed	1.83	***	4.29	***
Student	0.57	NS	-0.83	NS
<i>Race/Ethnicity (Baseline: White)^a</i>				
Asian	0.10	NS	4.10	NS
Black	-0.91	NS	-1.06	NS
Other	0.33	NS	0.98	NS
Hispanic	0.83	NS	1.78	NS
Constant	11.03	***	11.03	***

*p < 0.1 **p < 0.05 ***p < 0.01.

^a Baseline category is the largest group. Sample: Zero-car households (n = 2336).

5. Conclusion

Although some zero-car households opt into a “car-free” lifestyle, the majority of zero-car households (79%) do not own a car because of economic and/or physical constraints. When weighing projects and investments, planners should consider both the great need and relatively larger number of car-less travelers. Findings from this study reveal both the positive relationship between carshare membership and mobility, and that the most mobile zero-car group—car-free environmentalists—made a disproportionate share of their trips by bike (20%) compared to the average zero-car household (4%). These results suggest that targeted efforts to expand access to carshare services and quality bike infrastructure can accomplish dual missions in transportation policy and planning. First, they can enable car-owning households to shed their cars and thus increase the share of residents who are truly “car-free.” Second, they can bolster the modes available to car-less households, who comprise the majority of zero-car households and face limited or restricted mobility opportunities.

Carshare memberships have a larger positive effect on trips taken and miles traveled than any other individual characteristic. Regardless of the motivation for not owning a car, carshare membership is associated with two more trips and ten more miles traveled per day. Expanding carshare

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