

Appendix 1 - Shared Mobility Overview

Shared mobility is a term that refers to any type of shared transportation service “that enables users to gain short-term access to transportation modes on an as-needed basis”¹ This includes the use of vehicles that are both operated as fleets or owned privately and shared using a dedicated platform. The focus of shared mobility has changed as our nation’s transportation system has evolved. Previously, more traditional shared transportation modes like public transit and taxis were the only types of shared modes users could engage in. However, in recent years, several new options have appeared in the marketplace. Carsharing, bikeshare, and ridehailing, and have risen to prominence as major transportation options for those who live in places where such services are available.

Traditional carsharing and bikesharing are a type of mobility program in which users typically pay membership fees for access to shared vehicles, automobiles and bicycles respectively, and that can be reserved for private use. The fleet vehicles are owned, maintained, and insured by a 3rd party entity that operates the system. These operators range from private companies to public entities, such as transit agencies or municipal governments, as well as non-profit organizations. While the specific operations models vary from system to system, in all cases, users reserve the vehicle they seek to use and use it in a rental capacity for a given period of time. Additionally, both modes are on-demand options and do not require pre-planning by users.

In recent years, however, non-traditional models have emerged in this market. Instead of utilizing fleet vehicles for the shared service, non-traditional shared mobility leverages personally owned vehicles and make them available to shared users. This has been particularly pronounced in carsharing where ‘peer-to-peer’ services such as Turo or GetAround offer automobiles to users that are owned and maintained by existing vehicles owners. While no equivalent, privately facilitated alternative has emerged in bikesharing, dockless bikesharing has come about in the market. Unlike traditional bikesharing systems, dockless systems do not require custom racks and other infrastructure that bicycles can lock to.

Ridehailing is one of the newest concepts introduced to the shared mobility realm. Also known as ridesharing or ridesourcing, ridehailing is a coordinated, on-demand service provided by transportation network companies through the use of subcontracted drivers using their personal vehicles². Rides are ordered and fares are collected via mobile applications, thus making the concept tied to the use of smartphones for both users and drivers alike. Ridehailing is the newest shared mode examined in this study with the entire industry growing out from a concept within the past five years. The ridehailing landscape is dominated by two companies, Uber and Lyft, both of which offer comparable services in almost all markets nationwide.

¹ Shared Mobility Definitions.” Federal Transit Administration. December 07, 2016. Accessed November 28, 2018. <https://www.transit.dot.gov/regulations-and-guidance/shared-mobility-definitions>.

² Shared Mobility Definitions.” Federal Transit Administration. December 07, 2016. Accessed November 28, 2018. <https://www.transit.dot.gov/regulations-and-guidance/shared-mobility-definitions>.

Carsharing, bikesharing, and ridehailing each offer new and innovative ways for people to get around. The implications of these new mobility options are developing every day and must be examined through an inclusive lens.

Appendix 2 - Existing Conditions

Physical

Physical barriers refer to a wide array of physical conditions and limitations that would prevent a user from being able to take advantage of a transportation service. Physical barriers may refer to both physical disabilities and cognitive barriers that a user faces which prevent them from utilizing a given service. Physical examples of this may be the need to use a mobility device, physical inability to actively use the mode, or a design that lacks accessibility while cognitive examples may include mobile applications not designed for inclusion or inability to become comfortable or familiar using a service.

Physical barriers are perhaps the most visible barriers to access. The inability to ride a bicycle, lack of wheelchair accessible carshare or ridehailing vehicles, non-adaptive mobile applications, among others are clear barriers to mobility. Solutions to physical barriers must be tailored to fit the individual needs of users as there is such a wide array of physical barriers to overcome with great variation across the user base of people with physical or cognitive disabilities.

Conventional means of overcoming physical barriers happens in several ways depending on the program. An example of this is the level of active service. Services such as bikeshare and carshare are stationary and require the user to move to them. Most ridehailing and some alternative ridesharing services, including many municipal vanpooling services, are curb-to-curb, meaning users still must meet the vehicle at the roadside³. Some volunteer transportation services, and oftentimes paratransit, is door-to-door with assistance to the user given as they leave their residence⁴. The varying levels of assistance given to users is a determining factor as to whether or not they are accessible to segments of the target population that need this service.

Geographic

When services are provided that allow for great inclusion, often the service is so limited that it is not available in a way that fosters access for a wide swath of the target population. This problem stems from several operational factors. Generally, adaptive equipment costs more to own, operate, and maintain - limiting the number of vehicles a system can acquire⁵. With a limited amount of inclusive equipment, whether in a wheelchair accessible vehicle, adaptive bicycle, or any related vehicle type, operators simply cannot make their deployment so ubiquitous that they can be accessed by all users.

Even when adaptive technologies are integrated into shared systems, their placement becomes the determining factor as to whether they are actually in locations that are convenient for target

³ Rep. No. Federal Highway Administration-PL-18-007 at 66 (2017).

⁴ "Niagara Frontier Transportation Authority Interview." Interview by author. October 16, 2018.

⁵ Galligano, Michael. "Buffalo CarShare Interview." Interview by author. September 20, 2018.

users. Additionally, if they are located at an easy to access spot, their number may be so few that there is not consistent availability of the adaptive models. These issues are systemic of the “one-size fits all” approach generally used by shared mobility operators in terms of fleet planning and placement.

Specific mobility barriers vary from user to user, heightening the barrier of geography. Direct access to the service tends to be the most effective means to overcoming this challenge. Service modes include door-to-door paratransit or volunteer transportation services. A service that cannot be accessed by a target user is wholly ineffective at advancing mobility. Many forms of shared mobility are not door to door and instead utilize a self-service model wherein users are solely responsible for the facilitation and execution of their trip.

Policy also greatly influences the geographic landscape for specific services. For instance, a handful of large cities such as Chicago and Philadelphia have mandated wheelchair accessible vehicle availability from ridehailing services⁶. In these select markets, ridehailing operators have complied with the policy requirements but have made little effort to expand these programs to areas without mandates. However, in response to municipal mandates, Uber has announced a partnership with MV Transportation, an independent transportation entity, to provide wheelchair accessible vehicle services in New York City, Boston, Philadelphia, Washington, D.C., Chicago and Toronto with plans for additional expansion⁷. Ridehailing is a versatile service that allows for inclusive options to be offered on demand and across locations, something that static services like bikesharing and carsharing cannot do.

Economic

The cost of shared services can sometimes be prohibitive to low-income or fixed-income users. The AARP has reported that 6.4 million older adults live at or below the poverty line in the United States⁸. A 2016 report from the University of New Hampshire also states that 21.2% of working-age Americans with disabilities lived at or below the poverty line compared with just 13.8% of the general working population⁹.

This barrier manifests itself in a number of ways. First, the individual cost of using shared services may be high and issue accelerated by responsive pricing structures that increase the price during peak usage times. Also, if target populations find themselves far removed from the goods and services they need to access, their cost to use shared systems will increase based

⁶ Calabro, Tina. “In Cities like Philly, Wheelchair Users Can Easily Hail an Uber or Lyft. Not in Pittsburgh. - PublicSource | News for a Better Pittsburgh.” PublicSource. March 20, 2019. Accessed March 22, 2019. <https://www.publicsource.org/in-cities-like-philly-wheelchair-users-can-easily-hail-an-uber-or-lyft-not-in-pittsburgh/>.

⁷ Dickey, Megan Rose. “Uber Aims to Offer More Wheelchair-accessible Rides with Shorter Wait times.” TechCrunch. November 20, 2018. Accessed December 13, 2018. <https://techcrunch.com/2018/11/20/uber-aims-to-offer-more-wheelchair-accessible-rides-through-partnership-with-mv-transportation/>.

⁸ Barbranda Lumpkins Walls. “Effect of Poverty on Older Adults Revealed in Aging Conference.” AARP. March 24, 2016. Accessed October 10, 2018. <https://www.aarp.org/politics-society/advocacy/info-2016/effect-of-poverty-on-older-adults.html>.

⁹ Kraus, Lewis. (2017). 2016 Disability Statistics Annual Report. Durham, NH: University of New Hampshire.

on distance and time. This problem could appear in urban, suburban, or rural areas based on the service in question.

Additionally, the cost of service for public transit is subsidized for many users in the target population. Based on one interview with a paratransit provider, a rider only covers approximately 4% of the operating trip cost out of pocket¹⁰. The remaining costs are subsidized by the transit provider using public funds. This large subsidy works to provide an essential mobility option for users that is not found in shared mobility programs.

The cost of access to technology also affects users. Mobile applications used with smartphones have become the preferred method for operators of shared mobility to offer their service in lieu of more traditional forms of customer service. While this is not ubiquitous, it is normative. Not all users have access to this technology, thereby leaving them either unable to access shared services or much more difficult to do so using desktop computers and other alternative means depending on the specific program.

Lastly, access to electronic payment methods poses a challenge for those with low-credit and no formalized banking. Credit and debit cards are the sole method of payment over mobile applications in shared mobility. Without those, the user is unable to make payment for the ridehailing service.

Operational

Operational barriers stem from operators of shared mobility in several ways. In many cases, operators are simply not focused on making their services more inclusive. This is not to say that they aim to make access exclusionary, rather it is not an area of familiarity. The lack of attention given to inclusivity for older adults and people with disabilities can be seen in the lack of targeted marketing, staff training, and operational design that creates barriers within programs.

Examples of operational barriers include the use of smartphones, mobile applications, digital payment methods, and technology on the shared vehicles. The lack of understanding, awareness, and accessibility of these technologies stands as a major barrier for the target population. This barrier is heightened by system limitations that do not allow for alternative methods of access such as over the phone or desktop computer as well as alternative payment methods like cash or benefits cards.

The research team will explore these barriers with the target population and operators throughout the continuation of the research process.

¹⁰ "Niagara Frontier Transportation Authority Interview." Interview by author. October 16, 2018.

Appendix 3 - Existing Transportation Options

Public transit has long been the most affordable method of transportation for individuals who do not own a personal vehicle. However, multiple barriers are faced by older adults and riders with disabilities of all ages¹¹. The American Disabilities Act (ADA) requires public transit systems to offer complementary paratransit service to individuals with disabilities who cannot use fixed-transit¹²; the overall expense and subsidies pose significant challenges to operating efficient and reliable services.

Andrea Lubin et. al project using 2008-2012 American Community Survey estimates that 39% of the U.S. population age 65 and older of 41 million report at least one disability and one fourth of that of those respondents admitted to have two or more disabilities¹³. Lubin et. al project that the senior population will soar to approximately 88 million by the year 2050¹⁴. Based on Lubin et. al's assessment, public transit may continue as a viable transportation options for this demographic, however, certain existing physical and social barriers may deter an individual from using a fixed route system.

The fixed route transit lines are effective if the user's destination is directly located along or in a short walking distance from the line. For aging populations or people with disabilities, that distance may be too far of a walk or possibly the streetscape conditions may not accommodate a safe walk from the transit stop to the final destination. Additionally, as health and wellness services--those destinations that inspire most trips for older adults--move to locations not easily accessible by fixed-route lines, older adults face more difficulties in relying on public transit as an efficient option. The reduced fare trade-off, while enticing to riders with fixed incomes, the time required to get from point A to point B along with the challenges associated with the proximity of transit stops to each destination and overall accessibility, is challenging to those in need of transit services¹⁵.

Often integrated into public transit networks, paratransit services have served individuals who need transit assistance and are unable to use fixed line transit services due to a physical or mental disability. These services tend to be low-cost options to users, but incur significant

¹¹ Turner, Joshua J., Carolyn E. Adams-Price, and Lesley Strawderman. "Formal Alternative Transportation Options for Older Adults: An Assessment of Need." *Journal of Gerontological Social Work*, 2017, Vol. 60, No. 8, 619-646.

¹² "ADA & Paratransit What is ADA complementary paratransit?" nadtc, <https://www.nadtc.org/about/transportation-aging-disability/ada-and-paratransit/>.

¹³ Lubin, Andrea, Karen Alexander, and Elizabeth Harvey. "Achieving Mobility Access for Older Adults Through Group Travel Instruction." *Transportation Research Record. Journal of the Transportation Research Board*, No. 2650, 2017, pp. 18-24.

¹⁴ Lubin, Andrea, Karen Alexander, and Elizabeth Harvey. "Achieving Mobility Access for Older Adults Through Group Travel Instruction."

¹⁵ Turner, Joshua J., Carolyn E. Adams-Price, and Lesley Strawderman. "Formal Alternative Transportation Options for Older Adults: An Assessment of Need." *Journal of Gerontological Social Work*, 2017, Vol. 60, No. 8, 619-646.

expenses from an operational standpoint. The users pay significantly less per trip than what the actual expense would be, making it difficult for paratransit services to operate at an optimal level. Most paratransit providers operate at a loss or channel funds to sustain the program from other transit sectors such as bus and rail^{16,17}.

Transit authorities and paratransit companies across the country continue to grapple with the disproportionate expense incurred by offering traditional bus or van paratransit services. Depending on the resources available, paratransit services have decreased their fleets, purchased vans or minivans with lower operating costs, reconsidered maintenance procedures, outsourced rides to taxi companies willing to add paratransit services to their operations and account for the subsidized rides, encouraged first and last mile services for users who are able to use public transit for at least a portion of the trip, among many other cost-cutting options^{18,19}. The operational and maintenance costs associated with smaller vehicles drastically reduced the expense the transit authority would need to subsidize to maintain affordable fares for their users. While use of taxi services reduces operating costs, are easier to schedule and may offer better comfort for some users, they may lack certain service options such as door-to-door assistance, wheelchair accessibility, and drivers trained to appropriately assist users with a variety of needs or disabilities.

While public transit and third party taxi services continue to seek affordable alternatives to paratransit services, carsharing, ridehailing and van pooling may provide better options for aging populations and people with disabilities.

¹⁶ Di Fei, Xueming Chen. "The Americans with Disabilities Act of 1990 (ADA) paratransit cost issues and solutions: Case of Greater Richmond Transit Company (GRTC)." *Case Studies on Transport Policy*. 3 (2015) 402-414.

¹⁷ Bejleri, Hir, Soowoong Noh, Zongni Gu, Ruth L. Steiner and Sadra M. Winter. "Analytical Method to Determine Service Gaps for Transportation Disadvantaged Populations." *Transportation Research Board*. 2018.

¹⁸ Turner, Joshua J., Carolyn E. Adams-Price, and Lesley Strawderman. "Formal Alternative Transportation Options for Older Adults: An Assessment of Need." *Journal of Gerontological Social Work*, 2017, Vol. 60, No. 8, 619-646.

¹⁹ Di Fei, Xueming Chen. "The American Disabilities Act of 1990 (ADA) paratransit cost issues and solutions: Case of Greater Richmond Transit Company (GRTC)." *Case Studies on Transport Policy*, 3 (2015) 402-414.

Appendix 4 - Carsharing

Shaheen et. al partnered with the Nissan Motor Company from 2009 to 2011 to lead a pilot electric car-sharing program study at the Rossmoor Senior Adult Community, a non-profit gated mixed senior residential community of approximately 9,500 individuals in Walnut Creek, CA. The partnering groups sought to understand how current aging residents, many of whom are Baby Boomers, would respond to the introduction of electric car-sharing as an alternative to personal vehicle use, public transit or other traditional modes geared towards their age demographic, and the feasibility of sustaining a car-sharing program in their community²⁰.

The study entailed a mixture of in-depth household interviews, focus groups, a community-wide survey, and a six-question paper survey. The data generated from each assisted the research team in understanding the travel behavior of individual participants, general demographics, and the likelihood that a given resident may consider using the car-sharing program. Participants were also asked to record a 7-day travel journal of all trips taken. From these methods, the research team learned that individuals in the community make more frequent and shorter trips than longer ones. The majority of the users, 83%, made five or more 8km trips per month, indicating a need for affordable short-trip transportation options. The Electric Vehicles (EVs) manufactured by Nissan were stationed within Rossmoor, where they would be most accessible to residents²¹.

The study yielded a diversity of results, some expected, but others surprised the research team. First, of the surveys completed by the 357 community-wide surveys 97% of the residents owned a personal vehicle with 65% of them being manufactured in 2001 or later indicating that there would be eventual need for costly maintenance and looming forfeiture due to age. Second, the quest to maintain one's independence is expected to be heightened due to this generation's experience in operating personal vehicles, the fact that public transit, paratransit, taxis and van pooling have become increasingly less reliable, difficult to navigate and offer fewer choices in destinations than a personal car. Third, in the case of this study, EV manufacturing companies were still researching best approaches to extend the battery life and shorten the time in which an EV requires to recharge. Many aging users were concerned about operating an EV that was not fully charged for the fear they would be stranded if the battery died during their trip. Fourth by the end of the study, very few residents who signed up for the pilot program continued to use the car-sharing service and, the vast majority of them were women. Lastly, numerous respondents admitted to possessing greater interest in using the car-sharing program if the vehicles were non-EV but rather fuel injected²².

²⁰ Shaheen, Susan, Lauren Cano, and Madonna Camel. "Exploring electric vehicle carsharing as a mobility option for older adults: A case study of a senior adult community in the San Francisco Bay Area." *International Journal of Sustainable Transportation*. 2016, Vol. 10, No. 5, 406-417.

²¹ Shaheen, Susan, Lauren Cano, and Madonna Camel. "Exploring electric vehicle carsharing as a mobility option for older adults: A case study of a senior adult community in the San Francisco Bay Area."

²² Shaheen, Susan, Lauren Cano, and Madonna Camel. "Exploring electric vehicle carsharing as a mobility option for older adults: A case study of a senior adult community in the San Francisco Bay Area."

This study provided valuable insight in measuring where the current aging population is in terms of transportation needs and desires. Car-sharing may be an appropriate option as younger aging populations move into retirement. However, at this moment in time, the current population as illustrated by the sample size analyzed by Shaheen et. al does not have the confidence and familiarity with this level of technology. More must be done by operators to tailor their service to meet the needs of older adults and people with disabilities. Many users were not familiar with smartphones and heavily relied on receiving information through printed text or by using a landline to request transportation service.

Carsharing programs have used their position in the mobility landscape in order to enhance mobility options for older adults and people with disabilities. Buffalo CarShare (BCS), a social equity focused carsharing program, focused a great deal of its operations efforts on adapting and retaining older and disabled members. According to Executive Director Michael Galligano, operational processes and protocols adapted over time in order to provide service to this target population. Adaptations included allowing caretakers to serve as drivers, in person assistance with ride scheduling, and the formation of a volunteer driver program that had members provide rides to those in need using carshare vehicles in exchange for membership credit²³.

During its six years of operation, Buffalo CarShare's staff were trained to adapt and work better with its older members and members with disabilities to coordinate their memberships as well as address associated drivers, and other concerns. This focus was built upon the program's social equity focus to provide mobility options to underserved communities. However, this focus is not always the attitude of mobility operators. Often, the needs of older adults and people with disabilities unaccounted for.

Additionally, BCS sought to bring mobility innovations to their target population. During a program demonstration pilot of electric fleet vehicles, BCS worked with local elderly community centers and living facilities to allow older adults to interact with, test drive, and be exposed to electric vehicles where they lived. BCS used its position as a progressive, shared transportation operator to work with other community organizations to advance mobility options for underserved populations in Western New York.

Galligano and his team developed solutions like this over the course of BCS' seven years in operation with membership statistics reflecting their successes. Approximately ¼ of all BCS members were over the age of 55 years old and nearly 15% of members identified as having a disability. BCS transferred its operations and service model to Zipcar in 2015.

Beyond this, an example of inclusive carsharing vehicles is the AccessMobile program launched by San Francisco's CityCarShare in 2008. AccessMobile provided wheelchair-accessible shared vans to its members in the Bay Area and even was able to expand the program to more underserved communities in the East Bay area with funding from the Metropolitan Transportation Commission in 2014. The program also provided access to hand control devices for its members²⁴. The program was one of the first of its kind in the nation to offer the service

²³ Galligano, Michael. "Buffalo CarShare Interview." Interview by author. September 20, 2018.

²⁴ Berkeley Daily Planet. "CarShare Now Offering Wheelchair-Accessible Vans." CarShare Now Offering Wheelchair-Accessible Vans. Category: Page One from The Berkeley Daily Planet. Accessed November 10, 2018. <http://www.berkeleydailyplanet.com/issue/2008-04-22/article/29787>.

for users with disabilities. The vans were shared between municipal and private use with trips being offered to members for only \$6.50/hour. Users reported the program gave them an additional, affordable mobility option in lieu of expensive wheelchair accessible taxis or inconvenient paratransit trips²⁵. Following the 2016 acquisition of CityCarShare by GetAround, AccessMobile was discontinued, leaving its users without the reliable shared service they had counted on for the eight years prior²⁶.

²⁵ "City CarShare to Expand Carsharing in East Bay Through \$1 Million Grant Awarded by MTC | News." Metropolitan Transportation Commission. Accessed March 10, 2018. <https://mtc.ca.gov/whats-happening/news/city-carshare-expand-carsharing-east-bay-through-1-million-grant-awarded-mtc>.

²⁶ "City CarShare's Getaround Transition Causes Headaches For Longtime Members, Disabled Users." Hoodline. Accessed November 29, 2018. <https://hoodline.com/2016/11/city-carshare-s-getaround-transition-causes-headaches-for-longtime-members-disabled-users>.

Appendix 5 - Bikesharing

Adaptive BIKETOWN is a program of the Portland-based bikesharing program, BIKETOWN, sponsored by Nike. Adaptive BIKETOWN offers a variety of designs including hand-powered bikes, foot-powered bikes, electric assist bikes, multi-person bikes, tandems, coupes, and double and single surreys²⁷. Each design caters to a different need and, in some cases, creates an opportunity to share the bikesharing experience.

The rental process is similar to that of traditional bikesharing in that a user can reserve a bicycle or tricycle through their website. Unlike traditional bikesharing, users must arrive at the rental site fifteen minutes prior to their scheduled rental to sign a waiver, be fitted for the bicycle, pick up a helmet and if the user arrives with their own mobility device, store it in a secure location. BIKETOWN also offers crating service for service animals if needed for the rental duration²⁸. Rentals range in cost from \$12.00 to \$35.00 per hour depending on which bicycle the user chooses. Discounted rates are available to users who qualify for a TriMet Honored Citizen Pass, which is reserved for individuals receiving Medicare, are age 65 or older, or to individuals who self-identify that they are unable to ride a traditional two-wheeled bicycle due to injury, illness or ability²⁹. Reduced fares are set at \$5.00 per hour, \$12.00 for three hours and \$5.00 for each individual hour beyond. Adaptive bicycles are available to the general public, however, discounts are reserved for users with disabilities or other impediments as described above.

Adaptive BIKETOWN offers ability-specific fitness and wellness opportunities for users in Portland, however, the program has its limitations, all of which may be temporary until the program evolves and matures. Currently, Adaptive bike users must start and finish at the selected BIKETOWN locations, limiting where users may ride, and pay higher rental fees than traditional two-wheeled bicycles, which, depending on the socioeconomic status of the rider, may deter them from participating in the program.

Adaptive MoGo in Detroit, Michigan is an adaptive bicycle program through the company, MoGo. Adaptive MoGo is a 6-month pilot program in partnership with Programs to Educate all Cyclists (PEAC) and Wheelhouse Detroit that provides options for riders with varying abilities. Much like Adaptive BIKETOWN, Adaptive MoGo offers recumbent tricycles, upright cargo tricycles and tandem tricycles options for its users³⁰. The fleet consists of 13 different models. Users have the option to purchase a Single Trip pass, which allows them to ride up to 2 hours for \$12.00. Each additional hour costs \$8.00, or an Adaptive MoGo Seasonal Pass for \$30.00, which allows them to take an unlimited number of 2-hour trips from the time of purchase until October 31st of the same year. Each additional hour in a trip beyond two hours will cost \$8.00.

All rides begin and end at Wheelhouse Detroit's riverfront location on Atwater Street. Similar to the Adaptive BIKETOWN, member of the Wheelhouse Detroit staff meet the adaptive bicycle

²⁷ "Our Bikes". Adaptive BIKETOWN. <http://adaptivebiketown.com/our-bikes>

²⁸ "How Adaptive BIKETOWN's Bicycle Program Works." Adaptive BIKETOWN. <http://adaptivebiketown.com/how-it-works>

²⁹ "Pricing." Adaptive BIKETOWN. <http://adaptivebiketown.com/pricing>

³⁰ "Adaptive MoGo." MoGo. <https://mogodetroit.org/adaptive-mogo/>

rider prior to the rental time and assist them with fitting the bike, storing mobility devices, and explaining how the bikes function³¹. MoGo offers incentives for rider companions. Recognizing that some riders may feel more comfortable from or require assistance on their ride, MoGo encourages this level of support by offering a free day pass to the one companion. MoGo does not supervise adaptive bicycle riders during their rental time. Should a problem occur with the equipment or a rider is unable to complete the ride back to Wheelhouse Detroit, a companion would be there to support the rider³².

Another adaptive bikesharing model has been used by nationwide bikeshare operator Zagster. Zagster has brought adaptive bikes to a number of its large systems including Ohio State University, Pennsylvania State University, and Rochester, New York³³. Zagster offers a number of different adaptive bike types including handcycle, side-by-side tandem, heavy duty cruiser, standard tricycle, recumbent tricycle, and cargo tricycles. This approach aims to be able to offer biking options that could allow users with different physical limitations to become active riders. Even with this holistic approach, offering adaptive bikeshare options is still limited because not all bikes can be available to all users at all locations.

Both adaptive bicycle programs are similar in that they offer a range of designs to cater to a broader ridership, are strategically located in places where adaptive bicycles can be used with ease, and provide a framework that encourages safety and dialogue between the bikesharing company and ridership. Unlike traditional two-wheeled bicycles, adaptive bicycles require additional time to ensure they are the correct fit for individual riders. While little scholarship currently exists, the implementation of both of these programs is evidence enough that there is a need for more inclusive recreational bicycles and adaptive bikesharing could pave the way for increased bicycling in urban areas.

There is much to learn from innovations in alternative transportation for aging populations and people with disabilities.

³¹ "How it works." MoGo. <https://mogodetroit.org/adaptive-mogo/>.

³² "How it works." MoGo. <https://mogodetroit.org/adaptive-mogo/>.

³³ "How to Create an Accessible Bike Share." Shareable. Accessed November 11, 2018. <https://www.shareable.net/blog/how-to-create-an-accessible-bike-share>.

Appendix 6 - Volunteer Transportation Operations

Many of the problems faced by older adults and people with disabilities are deeply related to the structure of the core shared mobility options. While these recommendations are a good start for operators, they cannot alleviate all the physical, geographic, economic, and operational barriers in place. An alternative shared option that has great potential to help the target population is volunteer transportation.

Volunteer Transportation Organizations (VTOs) are not new, nor are they particularly popular--or even relevant--to young trending populations with disposable incomes. They are, however, proven. According to Kerschner's report, to this day, aging passengers dominate user typology and remain a constant in terms of populations requiring low-cost to free non-transit assisted options to live a healthy life³⁴. Where many older adults once relied on family members or close friends to transport them to meet their daily needs, VTOs for well over one-hundred-fifty years have offered a consistent low-cost alternative. As Baby Boomers trickle into retirement, consideration for transportation alternatives to support older populations will inevitably move to the forefront of shared mobility conversations.

Ridehailing, bikesharing, and carsharing are all trendy and innovative methods to move those with flexible incomes from point A to B. However, many circumstances remain constant for older populations: a large portion live on some fixed income (Social Security, a retirement fund or other public benefits); are positioned to live to an older age than similar populations from past generations; will require frequent medical and social services; and will forfeit their vehicle once it becomes unsafe or too expensive to maintain. Older adults do not have the same economic flexibility as younger demographics with access to more disposable incomes and technology, therefore, their transportation options should better fit their budgets and needs.

VTOs exist in every single state in the United States and largely operate in rural settings where resources are located in larger urban settings and older populations may be significantly more isolated³⁵. Programs generally coordinated by rural non-profits or faith-based organizations recruit, train and provide incentives to volunteer drivers to assist older and disabled adults make their medical and other needs-based trips to facilities in urban areas.

The rides may be low-cost, donation-based or entirely free to the passenger, operating such programs comes at an expense to sponsoring organizations, even with volunteer drivers, but one still significantly less than paratransit operations. A project sponsored by The National Academies of Science and Engineering Medicine, "Maximizing Benefits and Addressing Challenges of Volunteer Driver Transportation Programs" asserts that VTO budgets range from

³⁴ Kerschner, Helen. "Volunteer Drivers". Grantmakers in Aging. <https://www.giaging.org/issues/volunteer-driver-programs/>

³⁵ "Map of Volunteer Driver Programs". National Center for Mobility Management. <https://nationalcenterformobilitymanagement.org/volunteer-transportation-providers/>

“\$65,000 to \$5,000,000 depending on the breadth of services offered and the geography of which it covers³⁶. Most companies with paid employees as drivers spend approximately 50% of their budget simply on operating costs³⁷. Hiring volunteer drivers slashes operating costs largely since sponsoring organizations are not responsible for drivers’ salaries or expenses associated with vehicle ownership, maintenance and other expenses. While some organizations offer incentives including mileage reimbursement, compared to salaried drivers, these expenses are minimal³⁸.

The rural VTO model--and the most common VTO model--varies based on funding sources, revenue and distance covered, however, it generally follows the same infrastructure: users register for the program, users contact the sponsoring organization a week or two before a scheduled pick up, the sponsoring organization has a set list of destinations to where a volunteer is allowed to transport the user, and the extent to which a volunteer driver may assist the user (i.e. door-to-door pick up and drop off, waiting at the destination until the user finishes the appointment, etc.)³⁹.

Urban VTOs employ similar programming models to those of rural VTOs, however they are established to cover a far greater geography and population than their rural counterpart. Each of the VTOs examined through this research paper had followed a similar formula: 1) A non-profit organization dedicated to providing free to low-cost services to aging populations establishes a volunteer driver program to escort passengers to medical appointments, grocery stores, and run other errands; 2) The program has all the components of a rural program including driver incentives, door-to-door service, the ability to wait with the passenger at the scheduled appointment, an advanced scheduling system, etc; 3) Connects aging populations to their own and partnering services that can vastly improve the person’s quality of life. In addition to this well-known formula, the program services a much larger metro area and population than the mid- to large- city the program is anchored⁴⁰. Subsequently, urban VTOs are better characterized as metropolitan rather than urban, since they have a far-reaching service area than the respective city boundaries.

³⁶ “Maximizing Benefits and Addressing Challenges of Volunteer Driver Transportation Programs”. The National Academies of Science and Engineering Medicine. <https://rns.trb.org/details/dproject.aspx?n=15380>

³⁷ Kerschner, Helen and Joan Harris. “Better Options for Older Adults.” Public Roads. Vol. 70 No. 5Mar/Apr 2007.

³⁸ Kerschner, Helen and Joan Harris. “Better Options for Older Adults.” Public Roads. Vol. 70 No. 5Mar/Apr 2007.

³⁹ “Maximizing Benefits and Addressing Challenges of Volunteer Driver Transportation Programs”. The National Academies of Science and Engineering Medicine.

Oneida County Volunteer Transportation Program: <http://www.ocgov.net/ofa/Transportation>

“Volunteer Models”. Rural Health Information Hub. <https://www.ruralhealthinfo.org/toolkits/transportation/2/models-to-improve-access/volunteer-models>

“Volunteer Transportation Program”. Madison County Office of Aging. <http://www.ofamadco.org/volunteer-transportation-program.aspx>

“Volunteer Driver Program”. Cooperative Alliance For Seacoast Transportation. <https://coastbus.org/portsmouth-senior-transportation-program/volunteer-driver-program>

“Via’s Volunteer Driver Program meets transportation needs; volunteers enjoy helping others”. Via Mobility. <https://viacolorado.org/2016/03/volunteer-driver/>

⁴⁰ “Older Adult Services.” Family Services of Western Pennsylvania. <http://olderadults.fswp.org/assistance-older-adults>

“Transportation.” Seniors’ Resource Center. <https://srcaging.org/services/transportation>

It is unclear why urban VTOs design programs run beyond city boundaries, however, further investigation would expose their rationale. It would be advantageous to contact various VTOs to inquire about this method. Based on the examples described above, VTOs focused on urban areas are far less common. Family Services of Western Pennsylvania and Seniors' Resource Center show a more broadly focused effort to connect aging people across municipalities and even counties.

Appendix 7 - Focus Group Results

Of the three target modes, focus group participants were most familiar with ridehailing with 57% reporting prior use of the service and only 18% identifying as completely unfamiliar with the service. Compare this to just 4% of participants that have used bikesharing and no participants having used carsharing. This was coupled with at least 75% of participants feeling completely unfamiliar with each mode.

However, despite the general lack of usage and familiarity, participants were generally familiar with many of the associated technologies required to use these shared modes. 93% of participants use a smartphone and 82% were at least generally familiar with using mobile applications, both major components of shared mobility programs. Nearly 90% of participants had access to a credit or debit card, the only eligible payment types for many of the studied programs. In addition, nearly 80% of participants reported having to schedule their transportation in advance. Approximately 4 out of 10 participants reported having to do so frequently.

These conditions show a distinct access issue to shared mobility services, which are by-and-large on-demand services requiring account-based scheduling and payment. Despite the need to schedule transportation in advance access to smartphones and digital payment methods, the target population does not have significant engagement with shared mobility, bikesharing and carsharing in particular. Because neither is a door-to-door or even curb-to-curb transportation option and both are almost exclusively self-service, they lag behind ridehailing in terms of accessibility to many older adults and people with disabilities.

This would support not only the alteration of these programs to enhance inclusivity but also the potential creation of new programs to serve the target population. Any new service should focus on providing access on the terms of older adults and persons with disabilities, using their input. The research team will explore alternative program options as part of its second phase of research.

In additional outreach sessions, the research team met with and interviewing members of the people with disabilities and Deaf communities. Deaf people interviewed shared their experiences in shared mobility in a smaller focus group setting. The Deaf community members concerns was highly centered on the user experience in all three modes. The safety of biking and driving as well as communication with ridehailing drivers were the primary concerns. Participants suggested that additional means of communication be established to enable better customer service for both in-person and remote actions. One prominent example given was the inability to communicate with a ridehailing driver during the trip efficiently. This problem may also remedied through additional driver training so that they would be more aware of the deaf user's needs.

People with cognitive disabilities and those who provide services to them expressed a wide range of experiences in shared mobility. This generally stems from the range of abilities from folks within this community. Most interviewed felt that all three primary modes could be used

as a viable transportation option for those who are able to use them. One avenue people the research team spoke with keyed in on was travel training programs for both users and drivers. Travel training is a primary avenue for people with cognitive impairments to gain mobility independence and traditionally has focused on fixed route and paratransit. Including shared mobility options in these programs would give people in the community more familiarity with the services and could assuage the concerns of many caretakers who are uncomfortable with the use of these programs for their clients/relatives. Similar travel training for shared mobility operators could also ensure more familiarity with the target population.

A common theme throughout all outreach was the difference of experiences between younger people with disabilities and older adults with disabilities. Younger people were generally more receptive to new technologies and sought to use shared transportation to enhance their community mobility. Younger participants were generally more familiar with programs already and could speak to their existing experiences with the programs whereas older adults tended to have more structural questions about shared mobility to ponder their potential uses.

Overall, the focus group event and additional research interviews enabled the research team to directly engage with the target population about their personal experiences, barriers, and opportunities for using shared mobility. The project's recommended outputs are largely a direct result of these conversations and are aimed at catalyzing change to make shared transportation networks more accessible and usable for older adults and people with disabilities.

Pre-Survey

Figure 1

Do you use a mobility device for community mobility?

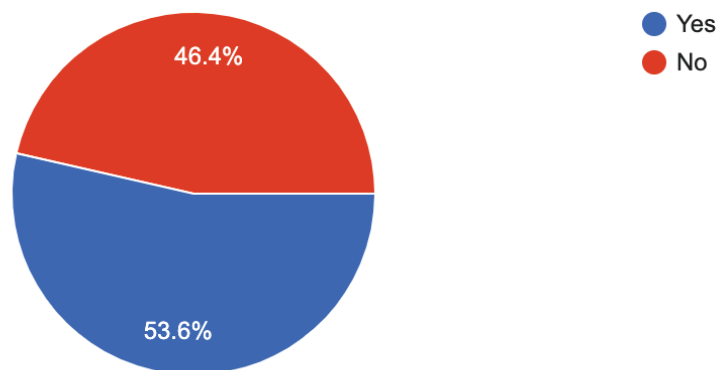


Figure 2

Do you have a visual impairment?

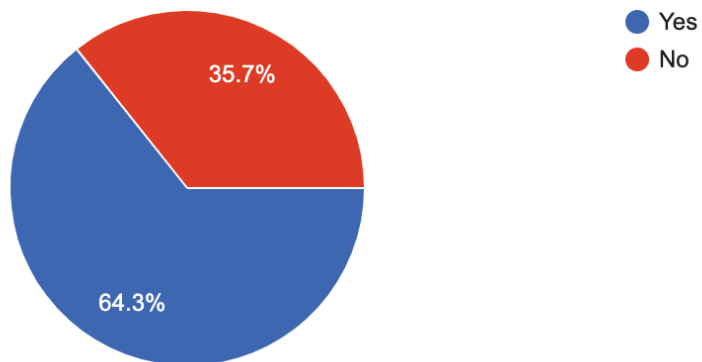


Figure 3

Are you a United States military veteran?

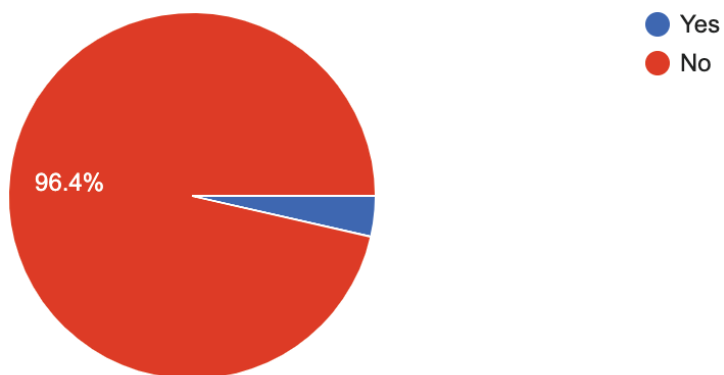


Figure 4

How often do you have to schedule your transportation in advance?

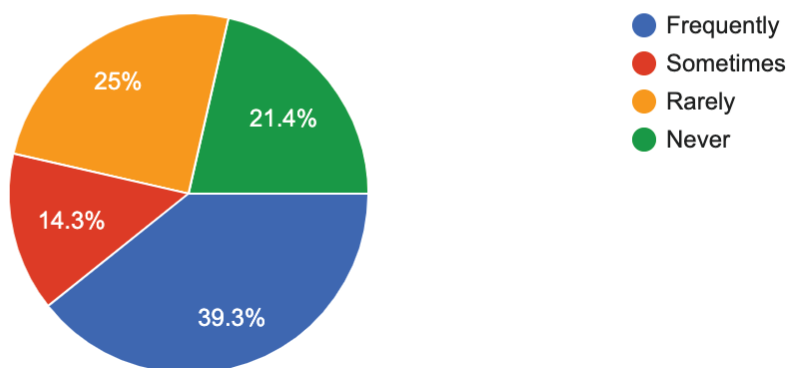


Figure 5

Do you use a smartphone?

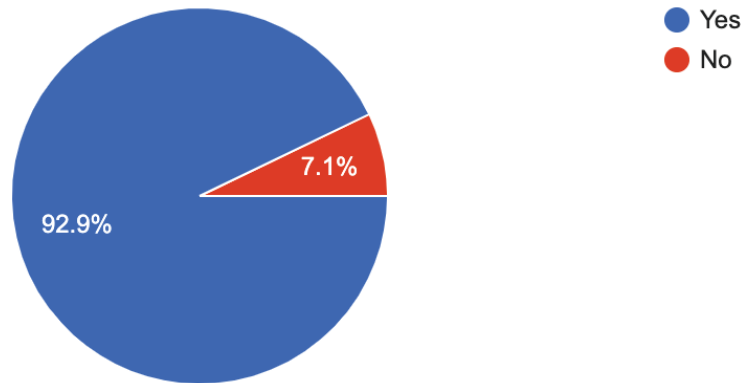


Figure 6

How familiar are you with using applications on a smartphone?

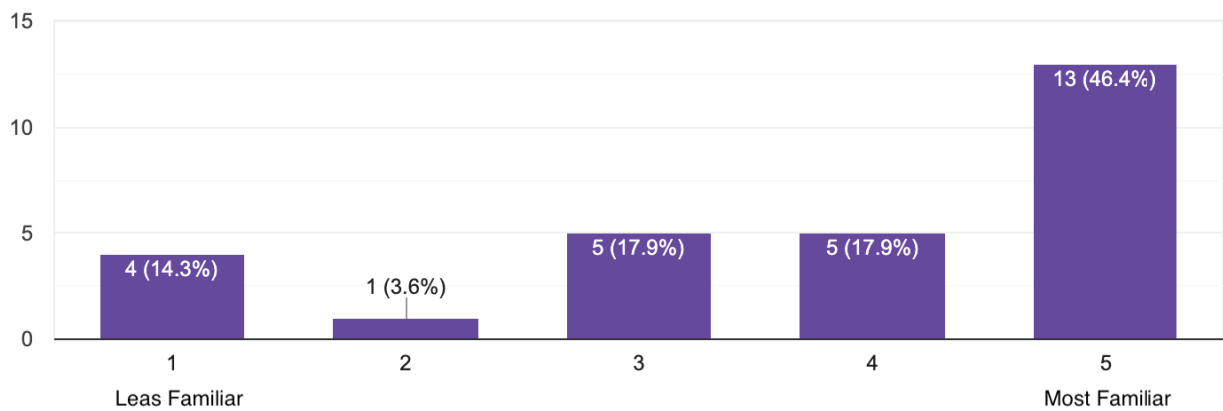


Figure 7

Do you have access to electronic payment methods such as a debit or credit card?

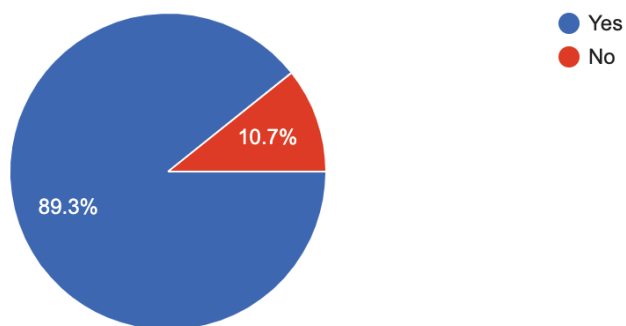


Figure 8

How familiar are you with using electronic payment methods such as a debit or credit card to make purchases on your phone?

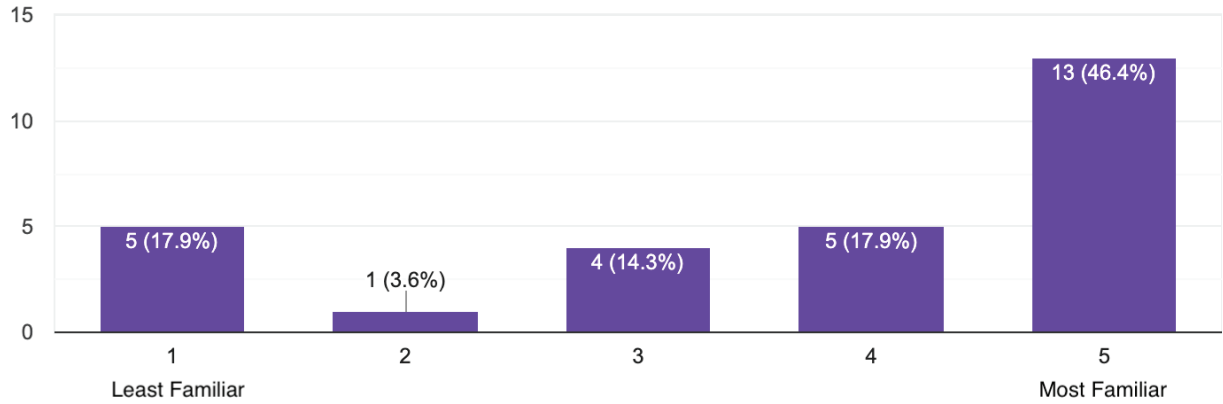


Figure 9

How familiar are you with ridehailing services such as Uber or Lyft?

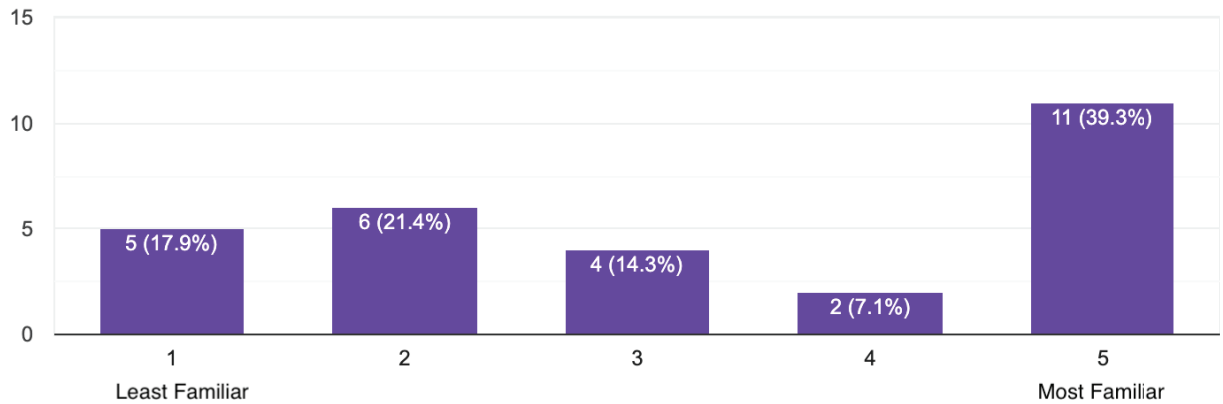


Figure 10

How often do you use ridehailing services?

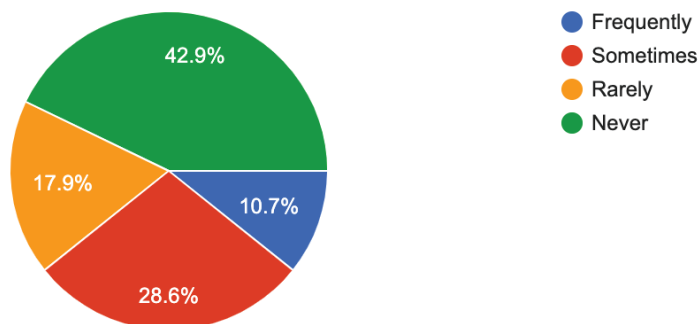


Figure 11

How familiar are you with bikesharing services such as Reddy Bikeshare?

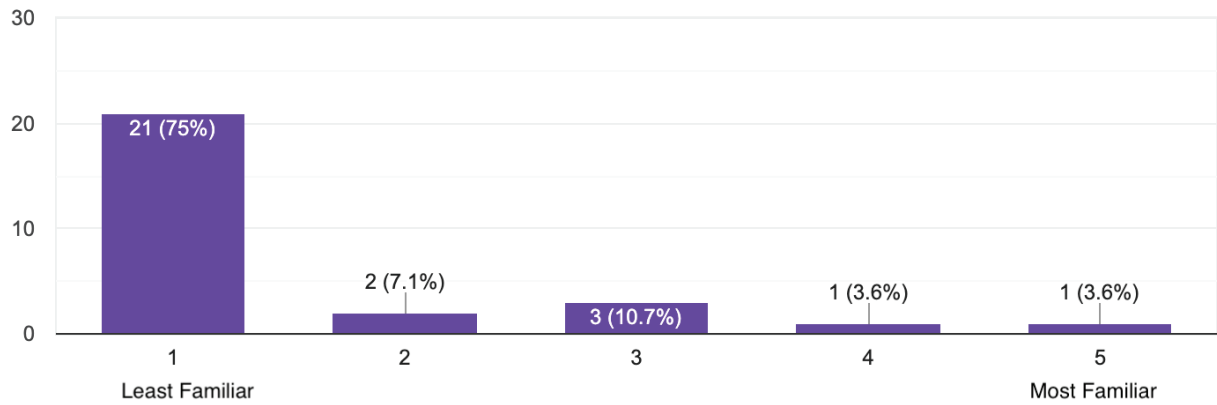


Figure 12

How often do you use bikesharing services?

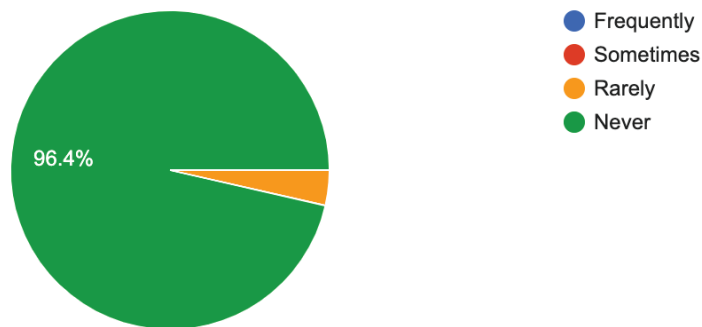
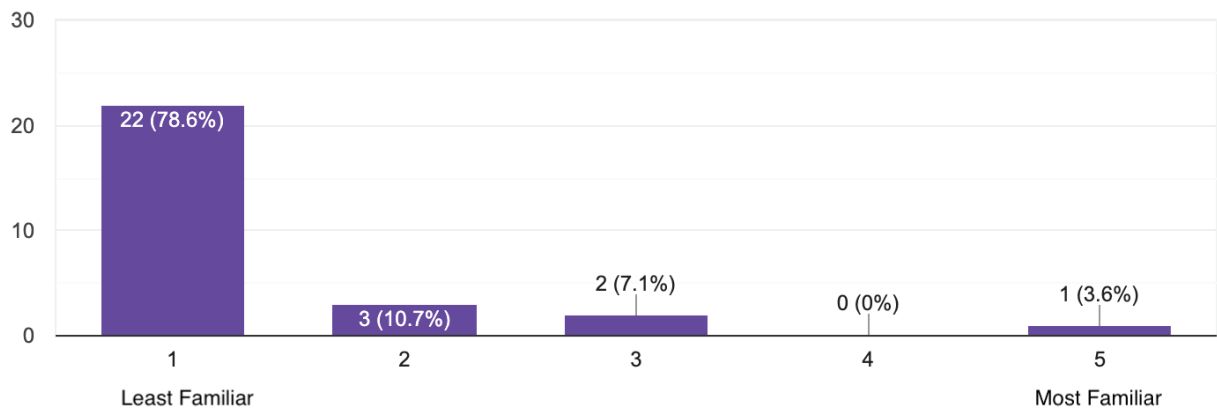
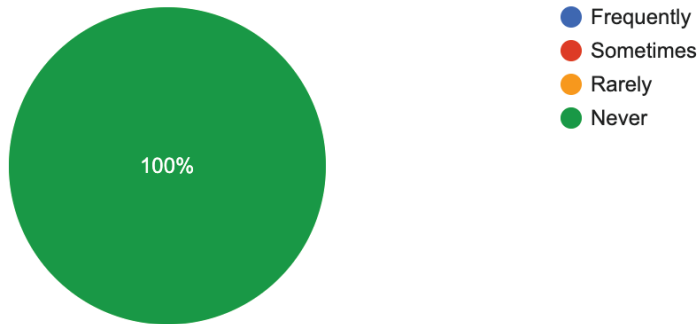


Figure 13

How familiar are you with carsharing services such as Zipcar?



How often do you use carsharing services?



Post-Survey

Figure 1

How familiar are you with ridehailing services such as Uber or Lyft?

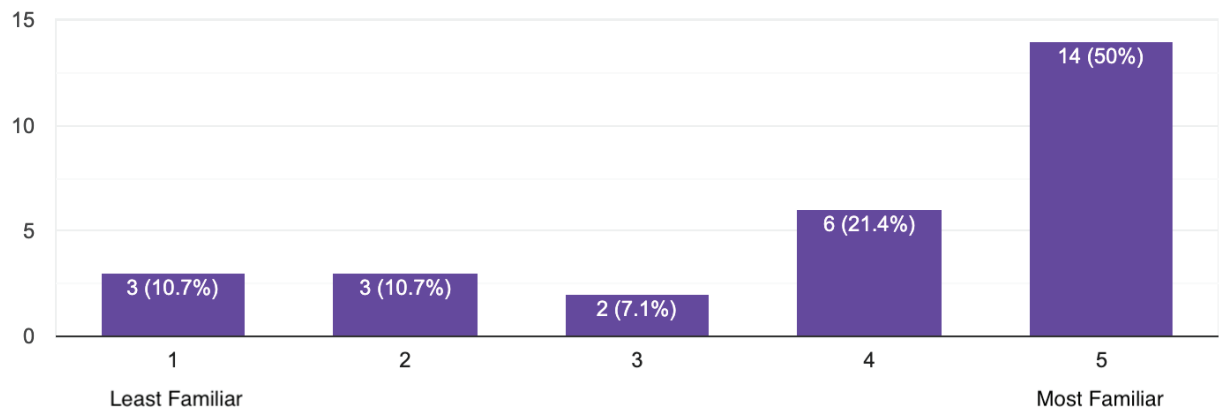
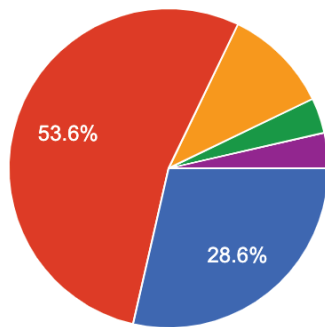


Figure 2

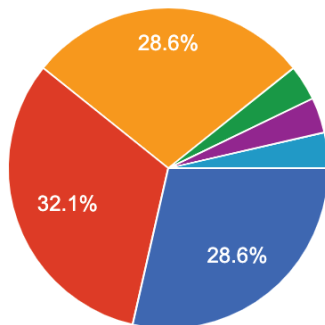
How likely are you to use ridehailing in the future?



- More Likely
- Same
- Less Likely
- I don't have a smartphone/computer
- Somewhat likely

Figure 3

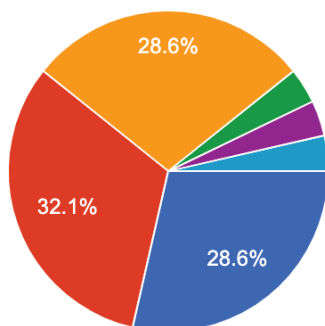
How likely are you to use bikesharing in the future?



- More Likely
- Same
- Less Likely
- I don't have a smartphone/computer
- Unable to use
- As of now I don't plan on it, however I might if it is made more adoptable.

Figure 4

How likely are you to use bikesharing in the future?



- More Likely
- Same
- Less Likely
- I don't have a smartphone/computer
- Unable to use
- As of now I don't plan on it, however I might if it is made more adoptable.

Figure 5

How familiar are you with carsharing services such as Zipcar?

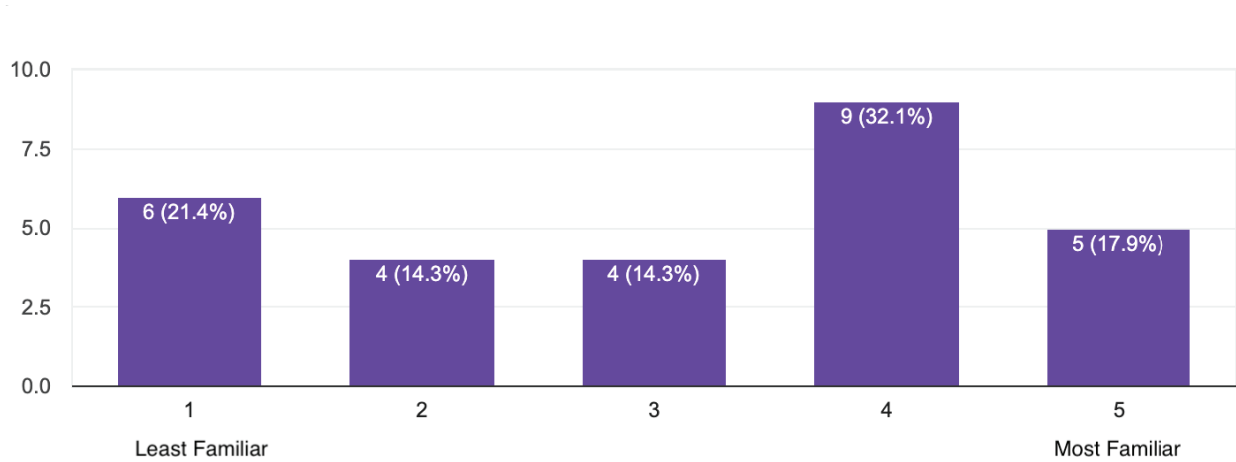


Figure 6

How likely are you to use carsharing services in the future?

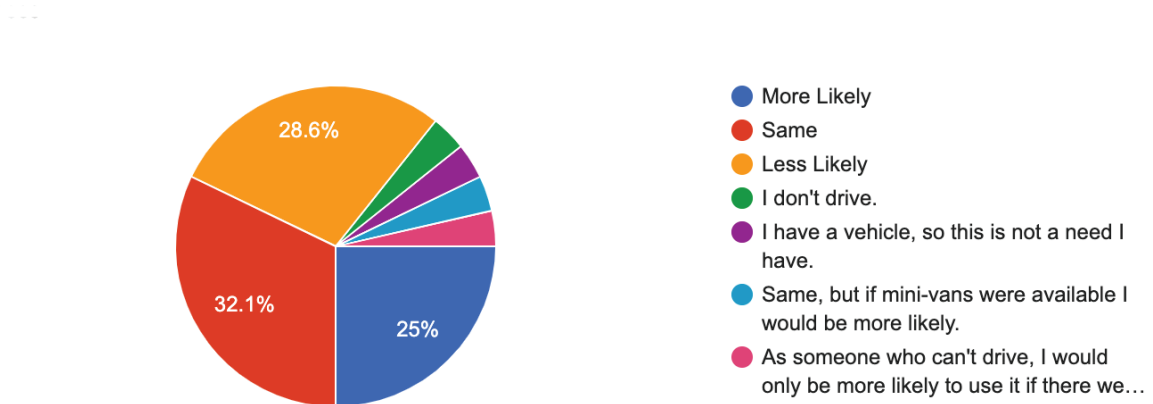


Figure 7

If e-bikes (electric assist) were available locally, would they improve your personal mobility?

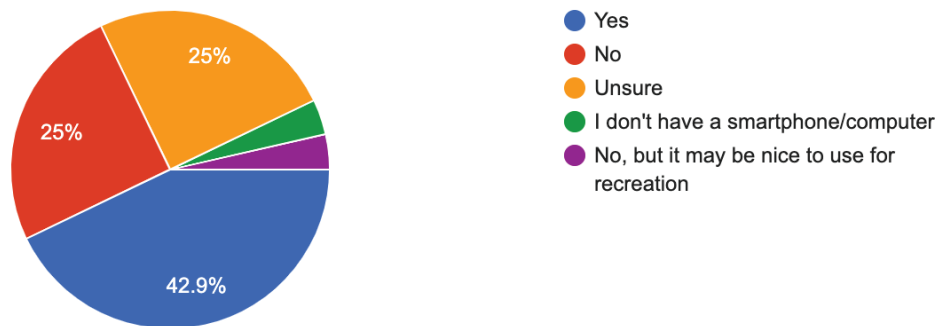


Figure 8

Which of the following shared transportation options allows you to make trips that will increase your community mobility? (Select all that apply)

