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Who uses subsidised micromobility? A survey of Lime Access customers

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Abstract

Shared bicycle and e-scooter schemes, which we refer to as 'shared micromobility', have been expanding in cities across the globe. Although these programs provide flexibility and increased choices for people travelling in cities, they are not without their critics. One concern is that these schemes primarily serve young, male and high-income customers. Another concern specific to shared e-scooter schemes is that they are used primarily for tourists and 'joyriding', rather than more productive trip purposes. To date, little research has directly examined the role that shared micromobility programs might play in supporting the travel needs of low-income populations. To fill this research need, this paper aims to evaluate a subsidy program for low-income riders by examining the demographics, usage patterns, benefits and barriers for low-income riders relative to general riders. We explore this aim using a survey of Lime customers in the United States, Australia and New Zealand. Lime operates shared e-bike and e-scooter programs in seventeen countries and over 200 cities around the world. They operate a program called 'Lime Access' that provides subsidised rides to qualifying customers. We find that Lime Access customers use the system in a way that better complements the goal of providing equitable, sustainable transport choices in cities. They were more likely than general riders to be locals who use shared micromobility for utilitarian purposes (commuting, shopping) as a regular part of their daily travel patterns. We discuss the implications of these findings for cities that allow share micromobility programs, suggesting that government-subsidised systems may provide more sustainable outcomes for cities.

1. Introduction

Shared bicycle schemes have been expanding in cities across the globe, more recently followed by a rapid increase in shared e-bike and e-scooter schemes. These schemes, which we refer to as 'shared micromobility', provide their users with flexibility and convenience, particularly when combined with public transport, and potentially increase the number of people advocating for safe cycling infrastructures (Fishman et al., 2013). In Australia, as of 2023 every state and territory now runs a permanent or trial program of shared micromobility.

However, these schemes are not without their critics. One concern is that shared micromobility services only meet the needs of a subset of travellers. A range of studies have found that shared micromobility users are more likely to be young, male and high-income compared to the general population (Fishman et al., 2013, Dill and McNeil, 2021), in part because they are more likely to be placed in high-income neighbourhoods that are less racially diverse (Dill and McNeil, 2021). Some shared micromobility providers have implemented schemes to subsidise travel among low-income or vulnerable populations in an attempt to increase ridership among these groups.

To date, little research has directly examined the role that shared micromobility programs can play in supporting the travel needs of low-income populations. This is particularly true for shared e-scooter programs, with a recent review finding only four studies that include shared e-scooter programs (Dill and McNeil, 2021). The preliminary research in that area suggests that e-scooter programs may be more likely to appeal to racially diverse and low-income populations than bike-share programs (Dill and McNeil, 2021). Recent reviews of shared scooter programs' equity offerings and requirements have found that despite common requirements by cities for equity programs from operators, very few studies have evaluated the efficacy of those requirements, leaving a gap in understanding of which equity programs achieved their goals (Palm et al., 2021, Brown et al., 2022).

This paper aims to evaluate a subsidy program for low-income riders by examining the demographics, usage patterns, benefits and barriers for low-income riders relative to general riders. We explore this aim using a survey of Lime customers in the United States, Australia and New Zealand. Lime operates shared e-bike and e-scooter programs in seventeen countries and over 200 cities around the world, which offers a broad and diverse perspective on low-income customers. Lime operates a program called 'Lime Access', which provides discounted rides to customers who qualify based on their income. Using a similar method as previous bikeshare studies (Buck et al., 2013), we compare the demographics and usage patterns of Lime Access customers to their general customer base provides a better understanding of the role that shared micromobility can play in supporting the travel needs of low-income communities.

2. Literature review

2.1. History of shared micromobility

The origins of what is now described as shared "micromobility" came in Amsterdam in the 1960s with the White Bikes program (Davis, 2014). In contrast to what is now a large, professionalised industry, consisting of an array of private and public operators, the initial foray into bikeshare began with white-painted bikes left on the street for anyone to use for free. As might be expected, the White Bikes were plagued by theft and vandalism (DeMaio, 2009, Fishman, 2016). It wasn't until three decades later that the initial "second-generation" bikeshare system launched in Copenhagen, which relied on coin deposit technology akin to the system employed by some supermarket chains with their shopping carts. This system was also susceptible to theft, given the low costs and anonymity.

The third generation of bikeshare systems, launched in the early 2000s, resolved the issues of the first two generations by implementing dedicated infrastructure through parking "docks", credit card payment systems, and bike tracking systems via GPS. These docked bikeshare systems proliferated into the mid 2010s as technologies improved. However, a challenge for many of these systems both then and now has been to identify and maintain consistent funding sources, as in nearly all cases, farebox recovery was well below 100% (North American Bikeshare & Scootershare Association, 2021).

In the very late 2010s, the fourth generation of shared bikes, and quickly followed by e-scooters, arrived on city streets. This generation is characterised by "dockless", free-floating operations where shared bikes and scooters are parked freely rather than being required to park at docks. Additionally, electric-assist is a common feature of the fourth generation, with all e-scooter systems and an increasing number of bikeshare systems featuring electric assist (North American Bikeshare & Scootershare Association, 2021, National Association of City Transportation Officials, 2022). Within a couple of years, these venture capital-backed systems quickly doubled the size and ridership that docked bikeshare systems had taken a decade or more to achieve. But just as each previous generation had challenges, the fourth generation also has well-publicised issues, most notably around tidy and compliant parking (Brown et al., 2021b, Brown et al., 2020, Klein et al., 2023), equity (Brown et al., 2021a), and until recently (Bellan, 2023), questions about the long-term financial sustainability of the private businesses that operate these systems (Bellan, 2022, Glasner, 2022).

2.2. Shared micromobility usage and demographics

Research by academics, industry groups, and micromobility companies alike finds consistent demographic patterns among users of shared micromobility - both docked and dockless e-scooters and e-bikes. Riders tend to be younger, male, and have higher incomes (Wang et al., 2023, Fishman et al., 2013, Dill and McNeil, 2021, Brown et al., 2021a). As a consequence, some doubt the broader relevance of shared scooters if they are primarily used by a subset of the population. This in turn raises questions about how shared scooter programs could better serve a wider, more diverse ridership.

Shared e-scooter and e-bike trips serve a variety of purposes such as commuting, linking to transit systems, and social / recreation, with shopping trips less common (Bieliński and Ważna, 2020), although the purpose varies considerably depending on the mode and system type. In contrast, some surveys of e-scooter customers find that trips are more likely to be for social / recreational trips or 'just for fun' (Bieliński and Ważna, 2020, Portland Bureau of Transportation, 2018). However, this is not universal; a survey of shared e-scooter system users in San Francisco found that most customers used scooters to get to work or school, with 'fun or recreation' the *least* common trip purpose (San Francisco Municipal Transportation Agency, 2020).

Surveys of shared micromobility riders finds that a plurality of trips replace walking, typically followed by public transit and then motor vehicles (Wang et al., 2023, North American Bikeshare & Scootershare Association, 2021, Krauss et al., 2022). Yet, this varies significantly according to the local context. In San Francisco the most common mode shift was from ride-hailing (San Francisco Municipal Transportation Agency, 2020), followed by walking and public transport. In general, more auto-centric cities and countries tend to see higher mode shift from cars, and more transit-rich cities seeing higher mode shift from public transit (Krauss et al., 2022, Wang et al., 2023).

2.3. Shared micromobility equity programs

Docked bikeshare systems have historically been located in wealthier, higher-education, better-resourced neighbourhoods (Hosford and Winters, 2018). By untethering vehicles from docking stations, dockless scooter and bike services tend to have a natural advantage in providing broader coverage compared to docked systems (Palm et al., 2021, Mooney et al., 2019, Meng and Brown, 2021).

In a recent study, Brown et al. (2021a) found that a majority of shared micromobility programs (62%) in the United States included at least one equity requirement, though some require as many as seven different equity requirements. In looking across three dimensions of equity - process, implementation, and evaluation - the authors found that implementation-related requirements were seen most frequently, such as non-smartphone access options (36% of programs) or reduced-fare programs (32% of programs). Process requirements, such as community engagement and outreach, were less common, and an equity evaluation component was even less frequently included in program requirements.

There is limited research available on the usage patterns of reduced-fare programs offered by dockless scooter operators like Lime, Bird, and Spin. Spin commissioned a study of its equity offerings, which provided several recommendations, reported on a website with limited information about the study content and findings. The report does not provide insights into the underlying usage patterns or demographics of the company's reduced-fare program[1].

3. Methodology

The meet the research aim, we employed an online questionnaire survey of Lime users in Australia (Melbourne, Sydney and Gold Coast), New Zealand (Christchurch, Auckland, Tauranga, The Hutt Valley and Hamilton) and the United States (Seattle, San Francisco, San Diego, Portland and Spokane). In some of these locations Lime operates shared e-bikes, shared e-scooters, or both, so for the purpose of this study the specific mode used was not compared directly.

The survey was designed in collaboration between Monash University and Lime; Lime sent an invitation to participate through their app. Because of the focus on Lime Access members, all members of this program in the targeted cities were invited; 'non-Access' members were randomly selected for invitation.

Participants who opted in filled out a short questionnaire survey on the Qualtrics platform and were put into a prize draw for a gift voucher. To increase participation of Lime Access members from Australia and New Zealand, they were all provided with a $5 voucher in addition to the prize draw. The survey and recruitment process were approved by the Monash University Human Research Ethics Committee (MUHREC project ID 33234).

The survey was first distributed to Australia and New Zealand in June 2022. After reviewing these results and adjusting a few questions the survey was distributed to selected cities in the US in September/October 2022.

In total, 1,177 responses were recorded. Through the process of data cleaning, 95 incomplete responses were removed and a further 11 responses were deleted because an individual filled out the survey twice. This resulted in a final sample size of 1,037. Of those, 98 used the recruitment link for Lime Access members. In addition, the questionnaire itself asked if

[1] See https://www.spinmobilityequity.com/

someone was a member of Lime Access and anyone who said 'yes' was coded as an Access member, bringing the total to 166.

The questionnaire survey included questions on the following topics:

- How often they use Lime
- Information about their most recent trip
- Reasons why they use Lime
- Challenges/obstacles they experience using Lime
- Familiarity with the Lime Access program
- Demographics

The survey results will be presented in descriptive form.

4. Results

4.1. Demographic differences

Table 1 presents the demographics of the total survey sample as well as a comparison between the Access and non-Access customers. Access customers are over-represented in the American sample compared to the Australian and New Zealand samples.

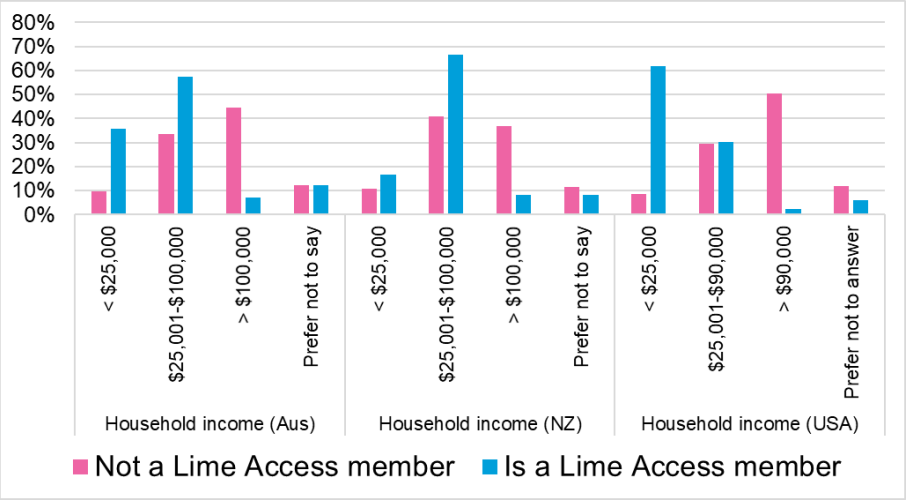
Table 1: Demographics of sample

	Not Lime Access N	%	Lime Access N	%	Survey total N	%
World region						
Australia	245	28.1	14	8.4	259	25.0
New Zealand	164	18.8	12	7.2	176	17.0
USA	462	53.0	140	84.3	602	58.1
Gender						
Male	506	60.0	103	63.6	609	60.6
Female	308	36.5	48	29.6	356	35.4
Other, non-binary, prefer not to say	29	3.4	11	6.8	40	4.0
Occupation						
Employed full-time	615	71.9	39	24.1	654	64.3
Employed part-time	92	10.8	41	25.3	133	13.1
Unemployed	30	3.5	26	16.0	56	5.5
Student	58	6.8	32	19.8	90	8.8
Home duties	13	1.5	5	3.1	18	1.8
Retired	24	2.8	9	5.6	33	3.2
Other	23	2.7	10	6.2	33	3.2
Age						
18 - 24	115	13.4	30	18.1	145	14.1
25 - 34	275	31.9	45	27.1	320	31.2
35 - 44	238	27.6	45	27.1	283	27.6
45 - 54	137	15.9	24	14.5	161	15.7
55 - 64	73	8.5	13	7.8	86	8.4
65 or older	16	1.8	6	3.6	22	2.2

Lime customers are more likely to be male (61% of the survey sample) which is to be expected as in these countries men are more likely to ride bicycles or e-scooters than women. Most Lime

customers are employed (77%) but this drops to only 49% of Lime Access customers, who are more likely than non-Access customers to be students (20%) or unemployed (16%). Most Lime customers are between 25 and 44 years old with a similar age spread among Lime Access customers. As expected, Lime Access customers are much more likely to be in the lower income brackets than non-Access customers (see Figure 1).

Figure 1: Income distribution of sample



4.2. Usage pattern differences

A range of questions asked customers about their use of Lime so that we could determine whether Access customers use shared micromobility differently to non-Access customers. In this section we also share the results for the 26 respondents from Australia / New Zealand, although we advise caution as the sample size is very low.

Table 2 compares the usage patterns of the Lime program between Access and non-Access members. Lime Access members are much more likely to be long-term and frequent users of the system. Two thirds (68%) of them had been a member for over 6 months (compared to half of the non-Access customers) and over a third use the system at least once a day (compared to only 7% of non-Access customers). Lime Access customers are also more likely to be using Lime in neighbourhoods where they live (79%); in contrast, although half of non-Access customers live in the neighbourhood where they most recently used lime, another 24% used Lime as a tourist from outside the city/region. These patterns were very consistent between the total Lime Access sample and the 26 respondents from Australia or New Zealand.

If Lime had not been available, the majority of customers would have walked instead. However, among Lime Access customers, over a third of trips would have been made by public transport (34%), only slightly lower than walking (39%). Among the Aus/NZ sample, the proportion walking was higher (50%) and using public transport was lower (26%), although this is from a very small sample size of 26. In contrast, non-Access customers were much more likely to replace walking (49%) with taxi/ridehailing the second most common substitution (17%).

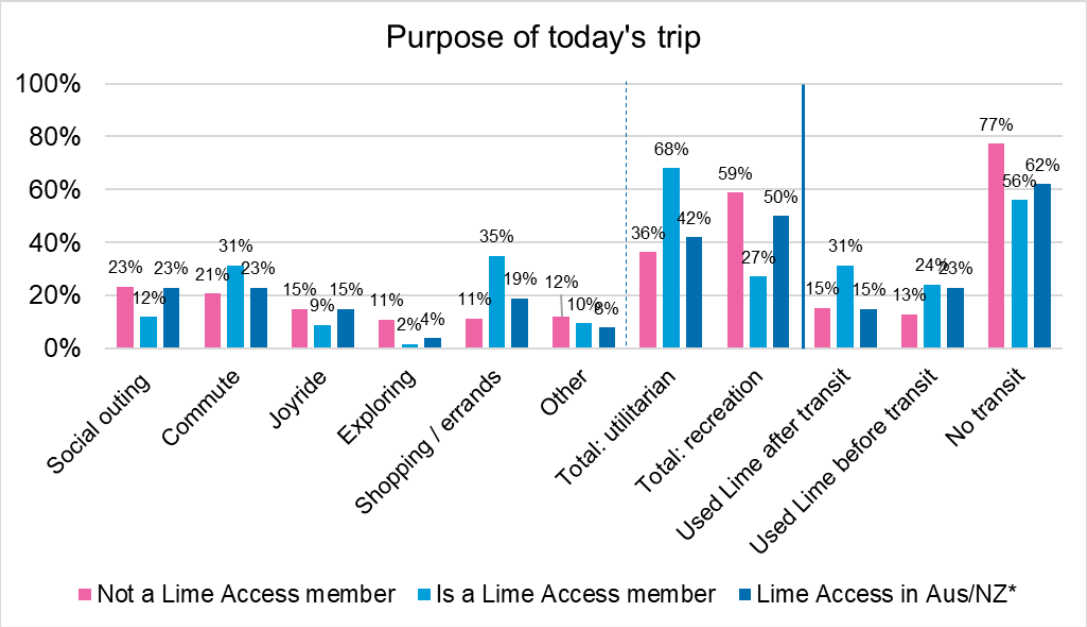
Table 2: Lime customer usage patterns

	Not Lime Access	Lime Access	Lime Access, Aus/NZ*
How long have you been a member of Lime?			
Less than a week	9%	1%	4%
More than one week but less than one month	19%	6%	0%
Over a month but less than 6 months	23%	25%	19%
Over 6 months	50%	68%	77%
How often do you make trips using a shared bicycle or scooter?			
Once a day or more	7%	35%	12%
More than once a week	16%	37%	39%
Once every week or two	27%	21%	31%
Less than once a month	49%	7%	19%
What is your relationship to the neighbourhood where you took your most recent ride?			
I live here	49%	79%	77%
I work here	24%	28%	27%
I attend school/uni here	4%	12%	12%
Visiting (live in the same city/region)	18%	13%	12%
Tourist (live outside this city/region)	24%	5%	8%
How would you have made this trip if a shared scooter/bike had not been available?			
Walk	46%	39%	50%
Public transport	14%	34%	26%
Taxi or ridehailing	17%	4%	4%
Personal car or truck	10%	10%	12%
I would not have made this trip	6%	4%	4%
Other	8%	8%	4%

**Note that due to small sample size (N = 26) these data should be interpreted with caution*

Survey participants were asked to report on the purpose of their most recent trip using Lime and these reasons are shown in Figure 2. For non-Access members the most common trip purposes were social outings and part of a commute trip; Access members were much more likely to use Lime for shopping/errands and commuting. Overall, Access members were far more likely to use Lime for utilitarian trips (68%) whereas non-Access members were more likely to use Lime for recreation (58%). Lime was sometimes used as a first mile / last mile mode linked to transit, especially among Access customers (44% of trips linked with transit); this was less common for non-Access customers (23% linked with transit). Access customers in Aus/NZ behaved more similarly to non-Access customers, with more recreational trips and fewer utilitarian trips, especially for shopping/errands and commuting. It is unclear if this is due to the small sample size, or a difference in the market in Australia and New Zealand.

Figure 2: Purpose of riding Lime during latest trip



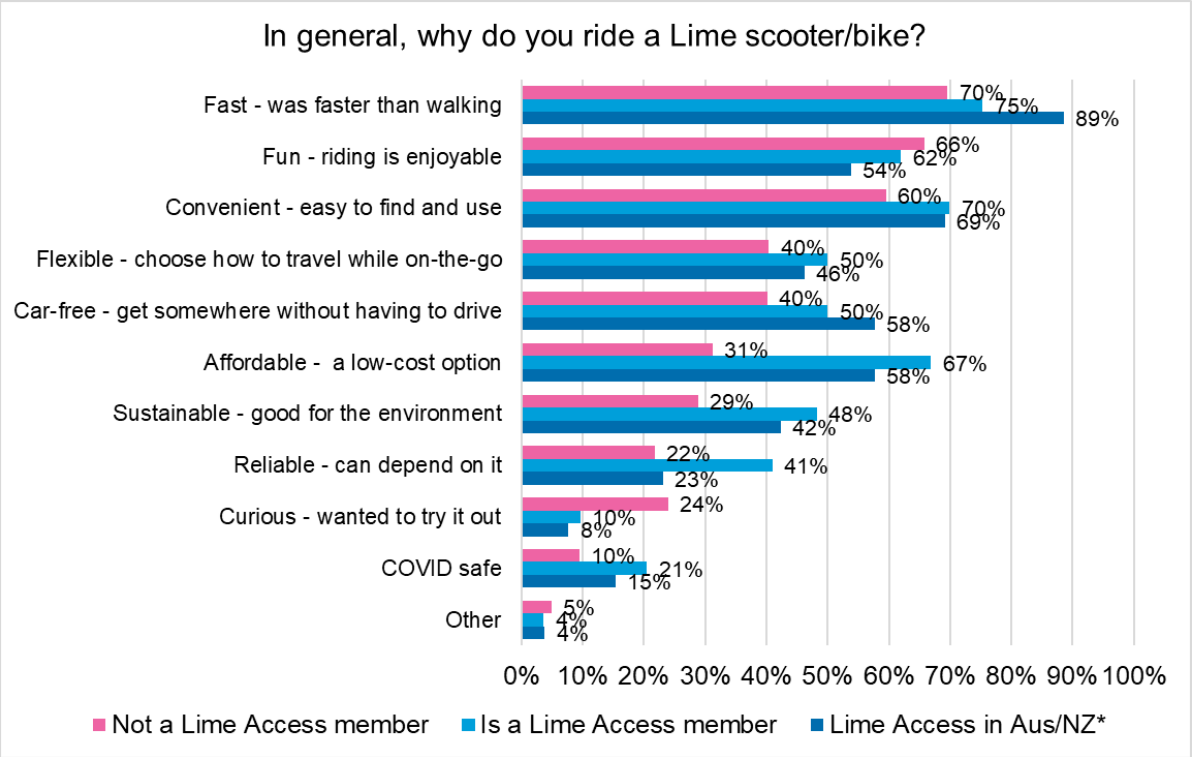
**Note that due to small sample size (N = 26) these data should be interpreted with caution*

4.3. Perception differences

We asked survey respondents why they use Lime and what problems they face when using the system. Participants could choose as many benefits and challenges as they wished.

On average, Lime Access customers reported significantly more benefits (average 5.0 benefits) than non-Access customers (4.0 benefits). Figure 3 shows that most customers use the system because it's fast, fun and convenient. Access members were far more likely than non-Access members to say that Lime was affordable (67%), good for the environment (48%) and reliable (41%). The only benefits that non-Access members nominated more than Access members were that Lime was fun (66%) and that they were curious to try it out (24%). The reasons given by Access customers in Aus/NZ are quite similar, with a higher proportion nominating 'fast' as a reason (89%) and a lower proportion nominating 'reliable' (23%).

Figure 3: Reasons for using Lime



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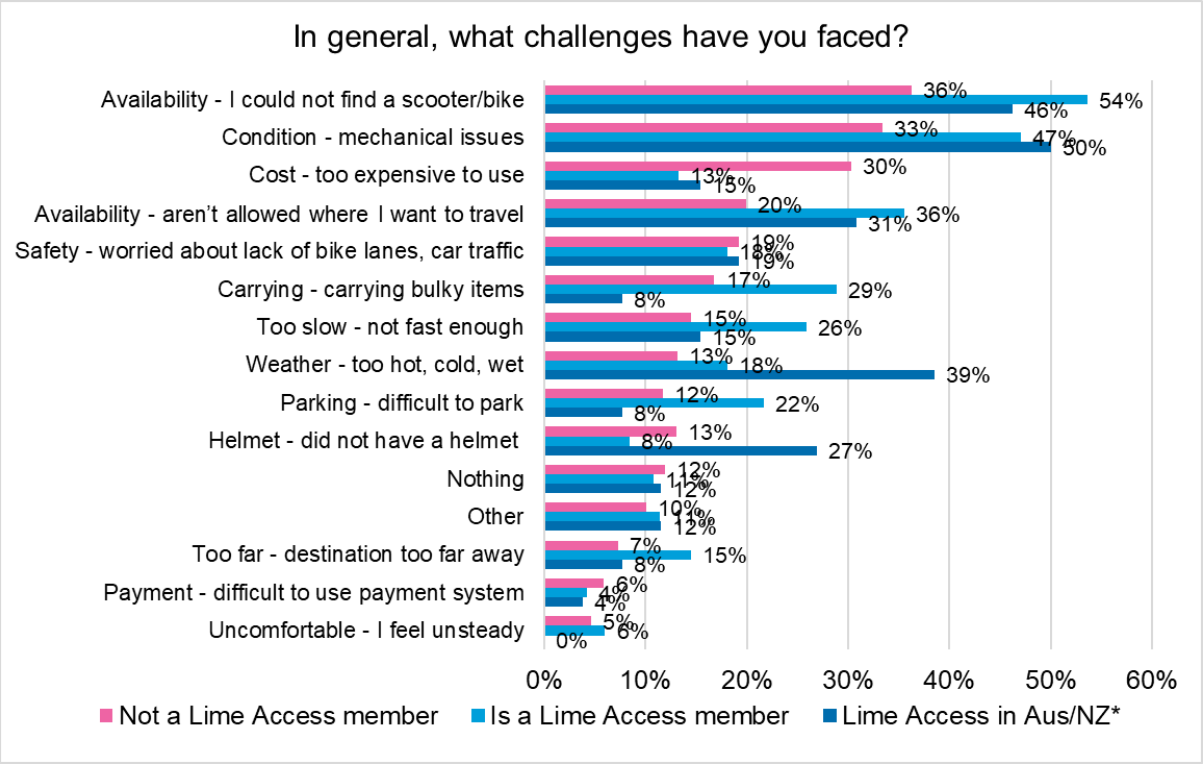
Lime Access customers were also more likely to report challenges (average 3.2 challenges) than non-Access customers (2.5). Both groups cited availability and mechanical issues as their most common challenges. However, for Access customers availability was a much more significant issue, both in not being able to get a scooter/bike (54%) and needing to use it where it wasn't allowed (36%). Carrying bulky items was also an issue for nearly a third of Access customers (29%). In contrast, non-Access customers were more likely to say that cost was an issue (30%). There were a few notable difference among Aus/NZ Access members. They were less likely to cite carrying bulky items or parking as an issue, but they were more likely to cite poor weather and not having access to a helmet.

Note that the challenges to use are only reported by people who have already enrolled in Lime. It is likely that some challenges (such as cost and safety concerns) would be much greater among people who do not currently use Lime.

Figure 4: Challenges with using Lime



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5. Discussion

This study paints a picture of the very different use of shared micromobility among people who are provided subsidised rides (via Lime Access) compared to 'standard' customers, drawing on a survey across three different countries (Australia, New Zealand and the United States). Overall, Lime Access customers use the system in a way that better complements the goal of providing equitable, sustainable transport choices in cities. They were more likely than general customers to be locals who use shared micromobility for utilitarian purposes (commuting, shopping) as a regular part of their daily travel patterns. For these customers, micromobility is more likely to substitute *and* complement public transport, with almost half of riders using transit as part of their trip chain, and a third considering using transit if Lime was not available. These customers saw more benefits to using Lime than non-Access members, and 41% noted it was a reliable travel mode for them. Perhaps because of this reliance on Lime, there was a greater need for more availability of bikes/scooters and expanding the system into areas where currently it is not allowed.

In contrast, non-Access customers were more likely to be new or occasional riders. Although most non-Access customers lived or worked where they used Lime, they were more likely than Access riders to use Lime for social and recreational purposes. A significant minority of non-Access customers (24%) were tourists to the city where they used the system. The less-frequent use of Lime among this group was reflected in fewer benefits and problems, but it is worth noting that this group was more likely to list cost as a challenge (30% said it was too expensive).

Although the sample size of respondents from Australia and New Zealand was very low (26), it is worth noting that their overall usage patterns are fairly similar to the total sample. However, their trip purpose appears to be more similar to non-Access members, with a high proportion of trips used for recreation and less shopping / commute trips. They were also more likely to point out problems with helmet access and local weather and fewer problems with

parking. This reflects the need to understand the role of shared micromobility within its embedded national and local contexts.

5.1. Expanding subsidised programs

The findings from this survey show how subsidising shared micromobility programs, at least for low-income customers, leads to increased usage, which may in turn help shared scooter programs better achieve equity and sustainability goals. Increasingly, cities are viewing equity programs as fundamental components of a 'successful' program, including tying fleet increases to equity program usage (e.g. Washington, DC, Denver, etc.). Future research could model the impact of these schemes on usage and equity using a stated choice experiment to test various levels of subsidy.

As shared scooter companies look to expand the usage of reduced-fare programs by more individuals, the most prevalent obstacle is likely to be a lack of awareness that the program exists. One opportunity for shared micromobility operators is to partner with services that directly serve or cater to individuals relying on income assistance programs. Shared micromobility companies could partner with or advertise through these assistance programs, as a more targeted marketing tool to communicate directly with eligible individuals. Cities too can support the expansion of reduced fare programs through outreach as well as subsidies.

Yet, the cost of running a reduced fare program without a public subsidy remains a challenge for commercial enterprises that provide these systems. As these programs continue to grow, they have the potential to erode the earnings of the shared scooter companies. A broader conversation about the role of local governments in providing financial support for these reduced fare programs would be productive. Alternatively, some cities have relied on creative regulations and accounting. For example, the city of Denver, Colorado does not charge shared scooter operators any program fees, but in exchange expects robust equity outcomes as well as other commitments, like the creation of parking corrals.

Shared e-scooter programs are likely to become a permanent feature of at least some Australian cities into the future. As of 2023, every Australian state or territory runs a program of shared micromobility. Studies like this one demonstrate that these programs are not just about tourists going on joyrides; with the right regulations and partnerships in place, these modes of travel can benefit vulnerable groups in our society.

7. References

Bellan, R. 2022. *Bird may not have enough funds to continue shared micromobility business* [Online]. TechCrunch. Available: https://techcrunch.com/2022/11/14/bird-may-not-have-enough-funds-to-continue-shared-micromobility-business/ [Accessed 24 April 2023 2023].

Bellan, R. 2023. *Lime reports first profitable year, tests the waters for IPO* [Online]. TechCrunch. Available: https://techcrunch.com/2023/02/21/lime-reports-first-profitable-year-tests-the-waters-for-ipo/ [Accessed 24 April 2023 2023].

Bieliński, T. & Ważna, A. 2020. Electric scooter sharing and bike sharing user behaviour and characteristics. *Sustainability,* 12**,** 9640.

Brown, A., Howell, A. & Creger, H. 2021a. Mobility for the People: Evaluating Equity Requirements in Shared Micromobility Programs. Portland, Oregon: Transportation Research and Education Center (TREC).

Brown, A., Howell, A. & Creger, H. 2022. Mobility for the People: Evaluating Equity Requirements in Shared Mobility Programs. National Institute for Transportation and Communities (NITC).

Brown, A., Klein, N. J. & Thigpen, C. 2021b. Can you park your scooter there? Why scooter riders mispark and what to do about it. *Findings*.

Brown, A., Klein, N. J., Thigpen, C. & Williams, N. 2020. Impeding access: The frequency and characteristics of improper scooter, bike, and car parking. *Transportation Research Interdisciplinary Perspectives,* 4**,** 100099.

Buck, D., Buehler, R., Happ, P., Rawls, B., Chung, P. & Borecki, N. 2013. Are bikeshare users different from regular cyclists? A first look at short-term users, annual members, and area cyclists in the Washington, DC, region. *Transportation Research Record,* 2387**,** 112-119.

Davis, L. S. 2014. Rolling along the last mile: Bike-sharing programs blossom nationwide. *Planning,* 80**,** 10-16.

Demaio, P. 2009. Bike-sharing: History, impacts, models of provision, and future. *Journal of Public Transportation,* 12**,** 41-56.

Dill, J. & Mcneil, N. 2021. Are shared vehicles shared by all? A review of equity and vehicle sharing. *Journal of Planning Literature,* 36**,** 5-30.

Fishman, E. 2016. Bikeshare: A review of recent literature. *Transport Reviews,* 36**,** 92-113.

Fishman, E., Washington, S. & Haworth, N. 2013. Bike share: a synthesis of the literature. *Transport Reviews,* 33**,** 148-165.

Glasner, J. 2022. *VCs Squandered Billions On Scooter Startups. Markets Think They're Worth A Pittance* [Online]. Crunchbase. Available: https://news.crunchbase.com/transportation/scooter-startups-vc-public-market-lime-brds/ [Accessed 24 April 2023 2023].

Hosford, K. & Winters, M. 2018. Who are public bicycle share programs serving? An evaluation of the equity of spatial access to bicycle share service areas in Canadian cities. *Transportation Research Record,* 2672**,** 42-50.

Klein, N., Brown, A. & Thigpen, C. 2023. Clutter and compliance: Scooter parking interventions and perceptions. *Active Travel Studies,* 3.

Krauss, K., Doll, C. & Thigpen, C. 2022. The Net Sustainability Impact of Shared Micromobility in Six Global Cities. *submitted to Case Studies on Transport Policy*.

Meng, S. A. & Brown, A. 2021. Docked vs. dockless equity: Comparing three micromobility service geographies. *Journal of Transport Geography,* 96**,** 103185.

Mooney, S. J., Hosford, K., Howe, B., Yan, A., Winters, M., Bassok, A. & Hirsch, J. A. 2019. Freedom from the station: Spatial equity in access to dockless bike share. *Journal of Transport Geography,* 74**,** 91-96.

National Association of City Transportation Officials 2022. Shared Micromobility in the U.S. 2020-2021.

North American Bikeshare & Scootershare Association 2021. Shared Micromobility State of the Industry Report for North America.

Palm, M., Farber, S., Shalaby, A. & Young, M. 2021. Equity analysis and new mobility technologies: toward meaningful interventions. *Journal of Planning Literature,* 36**,** 31-45.

Portland Bureau of Transportation 2018. 2018 e-scooter pilot user survey results. Portland, Oregon.

San Francisco Municipal Transportation Agency 2020. Powered Scooter Share Mid-Pilot Evaluation.

Wang, K., Qian, X., Fitch, D. T., Lee, Y., Malik, J. & Circella, G. 2023. What travel modes do shared e-scooters displace? A review of recent research findings. *Transport Reviews,* 43**,** 5-31.