Facilitators and barriers to bikeshare use among users and non-users in a socioeconomically diverse urban population

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ABSTRACT

Public bike sharing programs are becoming increasingly popular worldwide. While there is a growing body of literature exploring participation and facilitators among bike share users, little is known about the views of people who have not enrolled in bikeshare programs and how they differ from current users. This knowledge is critical to expand bikeshare ridership, particularly among low-income populations who typically have lower participation levels.

We developed a cross-sectional survey to assess perceived barriers and facilitators to bikeshare use among users and non-users of the Bluebikes bikeshare program in Boston, Massachusetts. Survey respondents were recruited from lower-income Boston neighborhoods via flyers, social media, Craigslist, and in-person between June 12–July 31, 2019. A total of 512 people completed the survey (277 bikeshare users and 235 non-users).

Bikeshare users in our sample differed significantly from non-users with respect to age, sex, and race. Barriers and facilitators of bikeshare use were largely similar between users and non-users, as well as among users stratified by household income. The most frequently cited barriers included: safety concerns, lack of a helmet, proximity to stations, trouble with renting/returning a bike, and weather. The main facilitators included: convenience, proximity to stations, environmental benefits, economic benefits, fun, and health benefits. Salience of many of the most frequent barriers and facilitators increased with frequency of ridership.

Barriers identified by users and non-users of bikeshare programs suggest key areas of program improvements and/or areas of focus for future recruitment efforts. Likewise, potential facilitators noted by non-users may represent key marketing opportunities for bikeshare programs that are seeking to expand in socioeconomically diverse urban settings.

1. Introduction

Public bike sharing programs are gaining popularity around the United States (U.S.) and globally. In 2018, bikeshare riders across the U.S. took over 36.5 million trips using station-based bike sharing programs (National Association of City Transportation Officials, 2019), up from 320,000 in 2010 (National Association of City Transportation Officials, 2016). There are many potential benefits of bikeshare including: increased physical activity and associated health benefits, reduction of carbon footprint, and cost savings when compared to car ownership or alternative modes of transportation (Litman, 2015; Bauman et al., 2017).

There is a growing body of literature exploring participation and facilitators to use of bikeshare programs in urban areas. These studies have identified a number of barriers including: safety concerns, lack of infrastructure, uncertainty about how to use bike sharing systems, mandatory helmet legislation, and challenges with enrollment (e.g. problems during the sign-up process) (Nickkar et al., 2018; McNeil et al., 2017; Fishman et al., 2014; Fishman, 2016). A small number of peer-reviewed studies have examined sociodemographic predictors of bikeshare use (Fishman, 2016; Ogilvie and Goodman, 2012) or compared characteristics of bikeshare users to “regular cyclists” (Buck et al., 2013). These studies report that the majority of bikeshare users are male, employed, and have higher incomes, suggesting that current participation in bikeshare programs may not reflect the diversity of urban populations.
An important gap in the literature is understanding the perspective of people who do not currently use bikeshare programs, but who might in the future (Fishman, 2016; Hosford et al., 2018). One reason for the lack of research in this area is that potential study participants are less interested in joining a research study if they are not current or former bikeshare users (Fishman et al., 2014). Engaging people in research who have never used bikeshare programs is critical for understanding how to expand bikeshare ridership.

The bikeshare program in Greater Boston – Bluebikes – is one of the five largest in the country (National Association of City Transportation Officials, 2018). In the past two years of operation, Bluebikes has expanded from 1,800 bikes at 194 stations in Boston, Cambridge, Somerville, and Brookline, to over 3,000 bikes and 300 stations, including several lower-income neighborhoods that have not previously been reached by the program (Bluebikes, 2019). In early 2018 as part of the program’s expansion, Bluebikes launched an innovative initiative called “SNAP Card to Ride,” offering substantially discounted memberships (i.e. a 50% discount for an annual membership, or $5 per month) to low-income individuals who participate in the Supplemental Nutrition Assistance Program (SNAP, formerly food stamps) (City of Boston, 2018; Bluebikes, 2018). These efforts have the potential to address concerns that have been raised in the literature regarding equity in access to bikeshare programs for low-income and racial/ethnic minority populations (Nickkar et al., 2018; Fishman, 2016; Ogilvie and Goodman, 2012).

The recent expansion of bikes and stations throughout Greater Boston, particularly the emphasis on access in lower-income neighborhoods, provides an important opportunity to explore facilitators and barriers to bikeshare use among both bikeshare users and non-users in lower-income Boston neighborhoods. As previous work has shown that geographic proximity may not be sufficient to increase bikeshare use (Bernatchez et al., 2015); a more thorough understanding of barriers and facilitators of bikeshare use will be critical for promoting bikeshare use and expanding ridership in previously underserved areas.

2. Methods

We developed a cross-sectional survey to assess barriers and facilitators to bikeshare use, characteristics of bikeshare trips, and overall transportation use among users and non-users of the Bluebikes program. Bikeshare users were asked about their experience while non-users were asked about their perceptions (e.g. users: “I had trouble renting or returning a bike;” non-users: “I would have trouble renting or returning a bike”). Subject matter experts (e.g., community partners familiar with the administration of the Bluebikes program) provided input during survey development and also pilot tested the survey. All feedback was incorporated into the final version of the tool. Survey questions and response categories are included in Appendix A, and additional methodological details are provided in Appendix B.

We recruited participants from lower-income Boston neighborhoods. We defined a priority lower-income neighborhood as one with a median household income less than the median for the City of Boston overall (i.e. $62,021 based on 2013–2017 ACS 5-year estimates) (Boston Planning & Development Agency, 2019; United States Census Bureau, 2019). Participants were eligible if they were aged 18 years or older, able to complete the survey in English or Spanish, and lived in one of the priority neighborhoods (confirmed by ZIP code). We generated and distributed unique survey links to bikeshare users and non-users via flyers, Facebook, Craigslist, and in-person at high-traffic intersections and public transportation stations in priority ZIP codes from June 12 to July 31, 2019.

2.1. Statistical analyses

Survey responses were summarized using descriptive statistics (mean, standard deviation). We used t-tests (for continuous variables) and chi-square tests (for categorical variables) to compare characteristics between bikeshare users and non-users. The p-values were calculated using a two-sided test (a 0.05 level of significance). The statistical analyses were performed using IBM SPSS 25.0.

Table 1: Demographic characteristics of survey respondents; Boston, MA (2019).

| Characteristic          | User (N = 277) | Non-user (N = 235) | p² |
|-------------------------|---------------|-------------------|----|
| Age (y)                 | 27.7 ± 8.0    | 31.5 ± 11.6       | < 0.001 |
| Sex                     |               |                   | 0.007 |
| Male                    | 121 (43.7)    | 77 (32.8)         |    |
| Female                  | 154 (55.6)    | 150 (63.8)        |    |
| Other                   | 2 (0.7)       | 8 (3.4)           |    |
| Race                    |               |                   |    |
| White                   | 154 (56.4)    | 136 (59.7)        | 0.465 |
| Black or African American| 44 (16.1)    | 52 (22.8)         | 0.058 |
| American Indian or Alaskan Native | 2 (0.7) | 3 (1.3) | 0.513 |
| Asian                   | 66 (24.2)     | 37 (16.2)         | 0.028 |
| Native Hawaiian or Pacific Islander | 1 (0.4) | 0 (0.0) | 0.360 |
| Other                   | 17 (6.2)      | 12 (5.3)          | 0.645 |
| Hispanic or Latina      | 43 (15.7)     | 27 (11.5)         | 0.176 |
| Education               |               |                   | 0.783 |
| Less than high school or GED | 3 (1.1) | 4 (1.7) |    |
| High school diploma or GED | 24 (8.7) | 26 (11.1) |    |
| Some college            | 32 (11.6)     | 31 (13.2)         |    |
| Associates’ degree, vocational school, or certificate program | 15 (5.4) | 12 (5.1) |    |
| Bachelor’s degree or higher | 203 (73.3) | 162 (68.9) |    |
| Currently a student     | 107 (38.8)    | 71 (30.2)         | 0.043 |
| Employment status       |               |                   | 0.018 |
| Working full time        | 178 (64.3)    | 137 (58.6)        |    |
| Working part time        | 41 (14.8)     | 47 (20.1)         |    |
| Not employed, looking for work | 24 (8.7) | 24 (10.3) |    |
| Not employed, not looking for work | 30 (10.8) | 13 (5.6) |    |
| Retired                  | 1 (0.4)       | 3 (1.3)           |    |
| Disabled                 | 3 (1.1)       | 10 (4.3)          |    |
| Household income (annual) |           |                   | 0.653 |
| Lower-income (< $50,000) | 161 (58.8) | 130 (56.8) |    |
| Higher-income (> $50,000) | 113 (41.2) | 99 (43.2) |    |
| Membership               |               |                   |    |
| Annual                   | 82 (29.6)     | –                 |    |
| Monthly                  | 37 (13.4)     | –                 |    |
| Daily                    | 29 (10.5)     | –                 |    |
| Single                   | 129 (46.6)    | –                 |    |
| Mode of transportation   |               |                   |    |
| Bus                      | 173 (62.5)    | 143 (61.1)        | 0.755 |
| MBTA (train)             | 211 (76.2)    | 201 (85.9)        | 0.006 |
| Car                      | 131 (47.3)    | 133 (56.8)        | 0.031 |
| Rideshare (e.g., Lyft, Uber, taxi) | 189 (68.2) | 126 (53.9) | 0.001 |
| Carshare (e.g., Zipcar)  | 19 (6.9)      | 14 (6.0)          | 0.688 |
| Walking                  | 232 (83.8)    | 193 (82.5)        | 0.701 |
| Personal bike            | 75 (27.1)     | 82 (35.0)         | 0.052 |
| Bikeshare (e.g., Bluebikes, Limebikes) | 248 (89.5) | 0 (0.0) | < 0.001 |
| Other                    | 14 (5.1)      | 7 (3.0)           | 0.242 |

* Table values are mean ± SD for continuous variables and n (column %) for categorical variables. Some percentages may not sum to 100% due to missing values.

b P-value is for t-test (continuous variables) or chi-square test (categorical variables). Significance is at the p < 0.05 level.

c Percentages may sum up to over 100% due to participants’ being able to report multiple races.

d See Survey in Appendix B for complete income response categories.

e Membership type was self-reported in response to the question “During the past month, what type of membership or pass have you mostly used with Bluebikes?”

f Available plans (Bluebikes, 2019) include: annual (i.e. $99 for unlimited 45-minute rides for 1 year), monthly (i.e. $20 for unlimited 45-minute rides for 30 days), daily (i.e. $10 for unlimited access to 2-hour rides in a 24-hour period) or single trip ($2.50 for a one-way ride).
and chi-square tests (for categorical variables) to examine significant differences in response by user status, income, and frequency of bike-share use among users. We used a threshold of $50,000 to define higher vs. lower income households among the survey respondents. Finally, we summarized open-ended responses and grouped them by theme. All quantitative analyses were completed using Stata/SE 14.2. All participants provided informed consent and received $10 gift cards as compensation. This study was reviewed and approved by the Harvard T.H. Chan School of Public Health Institutional Review Board.

3. Results

A total of 277 bikeshare users and 235 non-users completed the survey, including 2 responses completed using the Spanish-language survey. Demographic characteristics of survey respondents are summarized in Table 1. Compared to non-users, Bikeshare users in our sample were significantly younger (p < 0.001), and more likely to be male (p = 0.007) and Asian (p = 0.028). Bikeshare users also significantly differed from non-users by employment status: a higher proportion of users worked full time (p = 0.018) and were current students (p = 0.043). While all respondents reported a range of transportation modes in the past calendar month, users were significantly more likely than non-users to report use of rideshare (e.g. Lyft, Uber, taxi) (p = 0.001) and significantly less likely to report use of the MBTA (train) (p = 0.006) and a personal car (p = 0.031).

Among non-users, most (n = 199, or 85%) had heard of Bluebikes, but only 17.6% had heard of the discounted membership for low-income individuals prior to taking the survey. About half (51.3%) of non-users reported that they would be more interested in using Bluebikes if they qualified for the discounted membership. Among users, most did not use the discounted membership (n = 240, 87%), but knowledge of the low-income membership was almost twice as high as the non-users (30.4%) – a difference that was statistically significant (p = 0.002).

Fig. 1 provides the top five barriers to and facilitators of bikeshare use reported by users and non-users. Four of the five barriers were similar between the two groups (no helmet, traffic safety concerns, bad weather, inconvenient stations), though the rank ordering differed. Users additionally noted trouble renting or returning a bike, while non-users cited that routes are too far or too difficult. Similar to the results for barriers, four of the five facilitators were the same for users and non-users (convenience, easy access to bikes, health benefits, a fun/new experience), though again the rank ordering differed. Users also cited economic benefits while non-users cited the environmental benefits of bikeshare as potential facilitators of use. Complete response data for all barriers and facilitators are available in Appendix Table C.1 and Table C.2.

We also report barriers and facilitators by frequency of bike use among users (Appendix Table C.5) and found that salience of many factors appears highest among the most frequent users. Specifically, 4 of the top 5 facilitators varied significantly by use frequency (convenience, access, health and economics) whereby the less frequent riders were generally less likely to report each facilitator. Of the top 5 barriers, 3 varied significantly by use frequency (helmet, trouble renting and weather), with the less frequent riders generally less likely to report trouble renting or weather and more likely to report helmets as a barrier.

4. Discussion

This study is one of the first to identify barriers and facilitators to bikeshare use among non-users (Hosford et al., 2018). Another key contribution of this paper is the focus on lower-income individuals living in an urban area where there is a deliberate expansion of bike-share bikes and docks. Consistent with previous literature (Fishman et al., 2014; Ogilvie and Goodman, 2012; Hosford et al., 2018); bikeshare users in our sample differed significantly from non-users with regard to age, sex and race, as well as employment and student status. These sociodemographic differences between bikeshare users and non-users highlight a continuing need for a focus on equity when promoting and expanding bikeshare programs in the future.

For both users and non-users, the most frequently cited barriers included: safety concerns, lack of a helmet, proximity to stations, trouble with renting/returning a bike, and weather, all of which are consistent with previous literature (Nickkar et al., 2018; McNeil et al., 2017; Fishman et al., 2014; Fishman, 2016; Hosford et al., 2018). The main facilitators were also consistent with existing literature as well as between the two groups of users, and included: convenience, proximity to docking stations, environmental benefits, economic benefits, fun, and health benefits (Nickkar et al., 2018; McNeil et al., 2017; Fishman et al., 2014; Fishman, 2016; Hosford et al., 2018).

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The similarity in barriers and facilitators across users and non-users is notable, and may suggest that addressing these barriers could increase participation and satisfaction among both groups. Future research should include community-engaged qualitative work to further explore not-yet identified barriers that may contribute to underlying differences in use.

Results suggest that for many of the most frequent barriers (e.g. trouble renting, weather) and facilitators (e.g. convenience, access, fun, economics), salience increases with frequency of ridership. The exception is helmets, which were mentioned less frequently as a barrier for the most frequent riders, suggesting that these riders may either have their own helmets or else that they do not perceive it to be a problem to ride without one. These findings suggest that further research should examine changes in perceptions and beliefs about bikeshare programs over time and by frequency of use, as these findings could be informative with respect to identifying beliefs that are most important to address among early or infrequent users, and therefore potentially the best targets for intervention.

It is important to note that, in many areas, there has been a shift from traditional docked bike systems where bikes must be returned to a specific location (e.g. Bluebikes) to dockless bike systems (e.g. Lime bikes) where bikes can be left anywhere within the program’s boundaries (Baltimore City Department of Transportation, 2018). User concerns about proximity to docking stations might be addressed through dockless bikeshare systems as prior research indicates that convenience (i.e. geographic proximity to a docking station) is important for participation (Fishman et al., 2014). That said, dockless bikeshare systems might exacerbate existing reservations about unequal access to bike-share programs if bikes are limited and not distributed equitably.

There are several initiatives in Boston that could address barriers identified by this study. Bluebikes is one of the first bikeshare programs in the country to allow participants to demonstrate income eligibility for discounted memberships by showing their EBT card, reducing the burden of additional paperwork (Bluebikes, 2018). However, few respondents had heard of the low-income membership option for Bluebikes, pointing to the need for greater marketing and community engagement moving forward. Some users noted difficulty renting or returning a bike due to full or empty stations. The Bluebikes Bike Angel program addresses this problem by allowing users to earn “Bike Angel Points” and rewards by cycling from full to empty stations. Rewards include membership extensions and gift cards, both of which could make riding even more affordable (Bluebikes, 2019). It is possible that residents may not be familiar with these existing initiatives aimed to help address barriers to bikeshare use given the frequency these issues were noted in the survey.

Marketing and/or community education along with systemwide improvements that emphasize barriers identified in our study have the potential to increase bikeshare ridership. However, previous research has shown that access and education may not be sufficient to increase bikeshare use in lower-income areas. When bikeshare was expanded to low income areas of London, U.K., residents increasingly used bikeshare over time, but only if the system remained affordable (Goodman and Cheshire, 2014). Similarly, inequalities in awareness of the local bike-share program persisted in Montreal despite residents’ proximity to docking stations, whereby those with lower education were less likely to be aware of the program (Bernatchez et al., 2015). To meaningfully address equity concerns, the expansion of bikeshare systems in lower-income or lower-resource communities will need to better promote awareness of discounted memberships and address key barriers raised by this study such as transportation safety for cyclists (e.g., protected bike lanes) (Braun et al., 2018).

4.1. Limitations

This study had several limitations. The survey relied on a convenience sample recruited in-person and on social media, resulting in a sample that included more women, more white individuals, and more individuals with a university degree than what might have been expected in our priority neighborhoods, thereby limiting the generalizability of our findings. The use of self-report could introduce bias. Sociodemographic differences between bikeshare users and non-users are likely conservative given our focus on lower-income neighborhoods prioritized for expansion by Bluebikes. Bikeshare users were asked about their experiences, while non-users were asked about their perceptions. The question stems and response categories were as similar as possible to facilitate comparison between the groups, but final results represent slightly different constructs for users and non-users. Data collection took place during the summer; weather may have ranked differently if surveys were conducted in other seasons. Despite these limitations, the findings regarding non-users in particular may be informative to other large urban areas interested in expanding bikeshare ridership, particularly in lower-income communities.

5. Conclusion

Barriers to bikeshare use identified by both users and non-users suggest key areas of program improvements and/or areas of focus for future recruitment efforts. Likewise, potential facilitators noted by non-users may represent marketing opportunities for bikeshare programs that are seeking to expand in socioeconomically diverse urban settings.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2020.101185.

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