

THE FIRST FIVE YEARS OF DENVER B-CYCLE: DEMOGRAPHY OF USERS



Prepared by:

Andrew Duvall, PhD
University of Colorado Denver

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Description of Denver B-Cycle Users

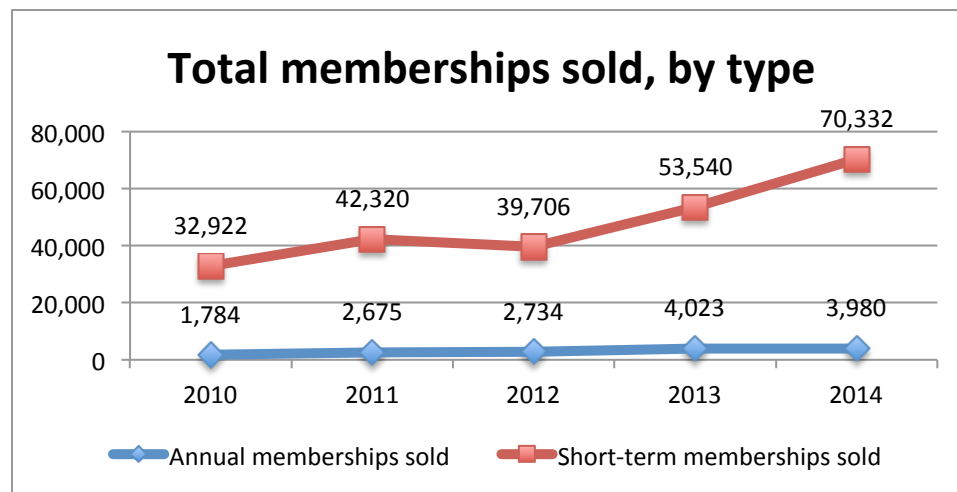
Membership types

This study is to examine the demographic characteristics of Denver B-cycle users. For this purpose, users are divided into two groups, based on purchased membership type: annual and short-term members. Denver B-cycle annual members have purchased a yearlong subscription to the system, and as such have committed to long-term use of Denver B-cycle. During registration, they provide phone, email, and physical address contact information and are sent through the mail an access card embedded with an electronic chip that allows them the ability to quickly check out a bike from any station, usually within a few seconds. When in possession of a membership card, annual members do not need to use the kiosk interface during the checkout procedure. Annual members are also enrolled to receive an emailed newsletter and regular updates sent from Denver B-cycle administrators.

Short-term members include those who purchase subscriptions for 24-hours, 7-days, or 30-days, purchased with a credit card online, or a 24-hour subscription purchased with a credit card through the kiosk of a station. The vast majority of short-term members purchase 24-hour subscriptions through the kiosk interface. In addition short-term members are required to provide a phone number for which they may opt in to receive text messages, and an optional email address during the registration process. Short-term members do not receive a membership card with an embedded electronic chip, but instead, following registration, use a credit card as an identifier via the kiosk for each check out procedure.

As the system collects more detailed contact information from annual members than short-term members, annual members are more accessible for data collection purposes. The survey results from both annual and short-term members are included in the following figures, using the best available data. However, results from short-term members should be viewed with some caution, as there were serious sampling limitations during each data collection period. Short-term use of Denver B-cycle is transitory, and with the minimal information collected during short-term registration, this affects the feasibility of contacting short-term members for survey purposes.

Figure 1



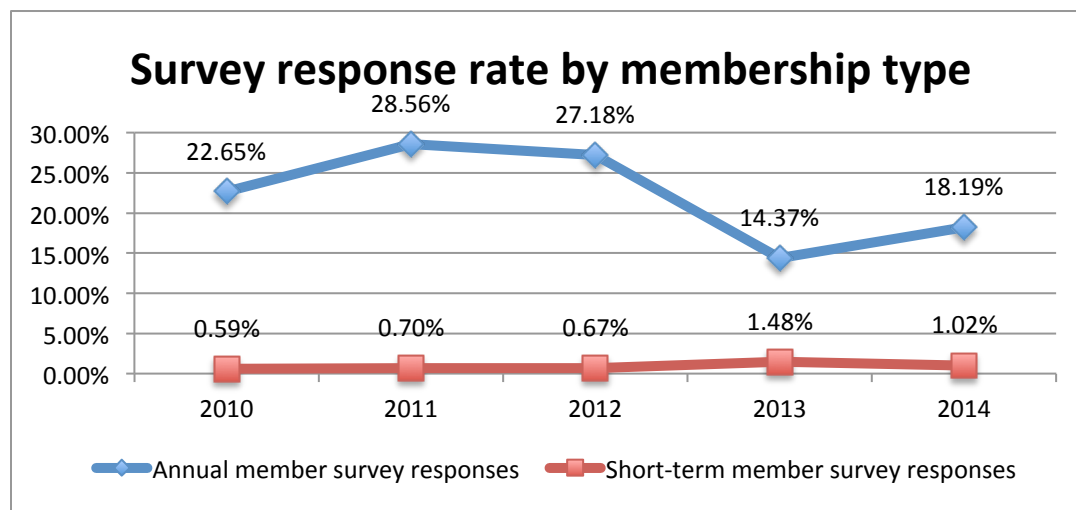
Response Rates

Data in this report are from online surveys of Denver B-cycle users, conducted in the early fall of each year, between 2010 and 2014. The surveys are non-randomized, self-selected participation from among the Denver B-cycle users population, using contact information collected during the registration process. Web links to the survey are sent through invitations in the Denver B-cycle online newsletter, and through text messages.

It should be noted that the Denver B-cycle administrative system is unable to discern whether a specific individual has purchased multiple short-term memberships over time, because of the variability of the process. Survey data revealed that many short-term users buy multiple short-term memberships, whether as a single individual buying memberships on multiple occasions, possibly using different credit cards or contact information, or as a single individual buying memberships for multiple people on one or more occasions. Therefore, the total number of short-term memberships sold is likely not equal to the total number of individuals who purchased memberships.

The response rate to the survey among annual members has fallen over time, perhaps as the more zealous early adopters of the system have shrunk in proportion to more typical users. In 2013, the system expanded by more than 50%, with the installation of new stations into several neighborhoods adjacent to the central downtown area, where Denver B-cycle had previously been concentrated. This expansion apparently led to an influx of new members, who differ in some ways from members in the initial years of operation, and the inclusion of whom has likely affected the rate of response to the annually conducted survey. Annual members maintain a higher response rate per membership sold as compared to short-term members for each year of the survey.

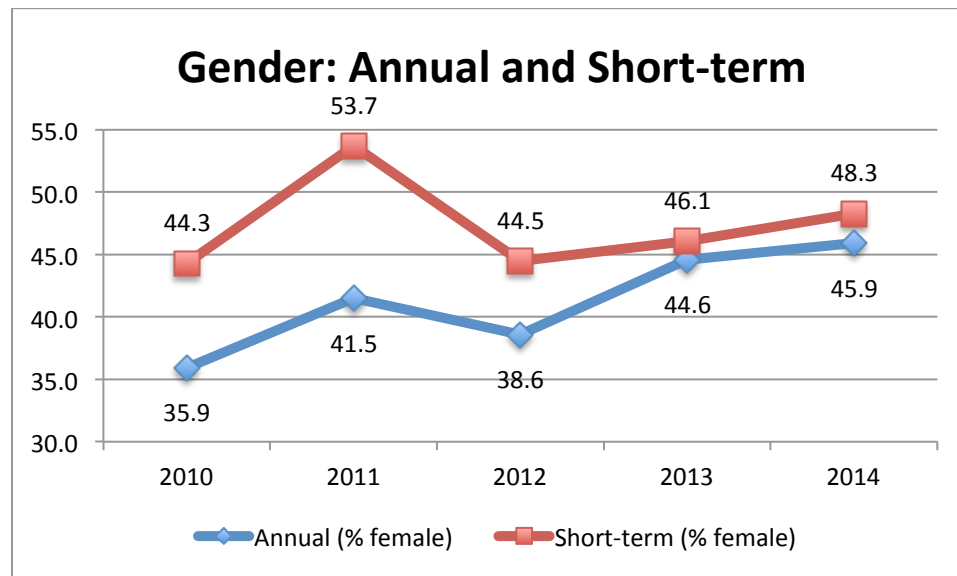
Figure 2



Characteristics of Denver B-cycle Users

Gender

Figure 3



Gender is a key item for evaluation, as the incidence of women willing to use bicycles for transportation is taken as an indicator of perceived safety and/or the appeal of bicycle-supportive infrastructure (1). The term “women as an indicator species” is sometimes colloquially applied in the evaluation of the effectiveness of bicycling supportive projects or facilities.

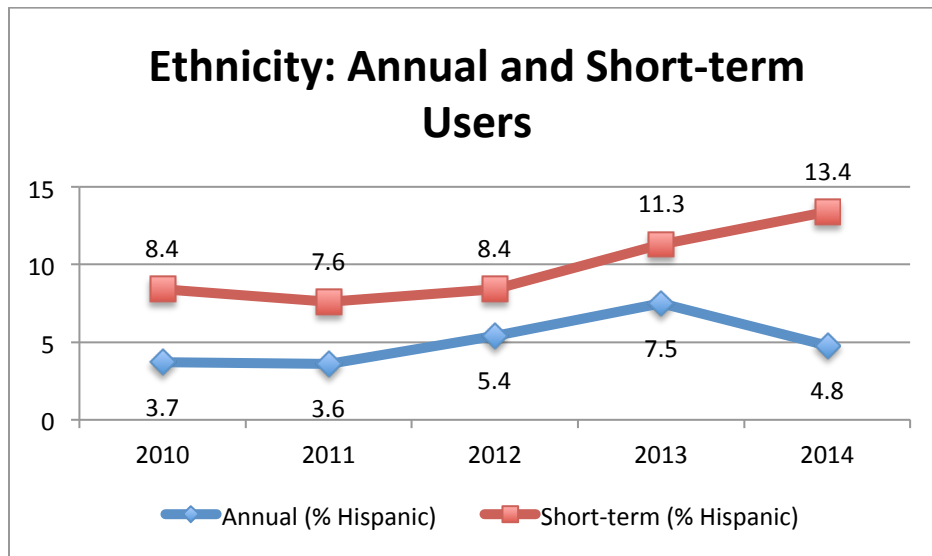
A part of the intent for public bicycle sharing is to encourage utilitarian transportation by bike. Although commuting trips are just one type of utilitarian trip possible via bike, no community-wide data exist that include a breakdown by gender of all utilitarian bike use. However, in every state in the U.S., males comprise the majority of the population who bike to work (2). In Denver, of those who bike to work, 71% are men and 29% are women (3).

Survey results of Denver B-cycle annual members also reflect the gender differential favoring inclusion of males, yet the gender split among annual users is closer than might be expected when considering bicycle-commuting data. Remembering the limitations of data from short-term users in this study, taken at face value, the gender split among short-term users is more favorable toward women than that among annual members. It is also much more favorable than the gender split expected for general bicycle commuter mode share (3). These findings may indicate that women are willing to try Denver B-cycle, but some who try shared bikes using a short-term subscription are not ready to commit to annual membership. However, the seemingly elevated numbers of women willing to try Denver B-cycle as short-term users may suggest that shared bicycles are appealing to women in a way that traditional bicycle commuting, or perhaps utilitarian bicycling in general, is not.

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Ethnicity

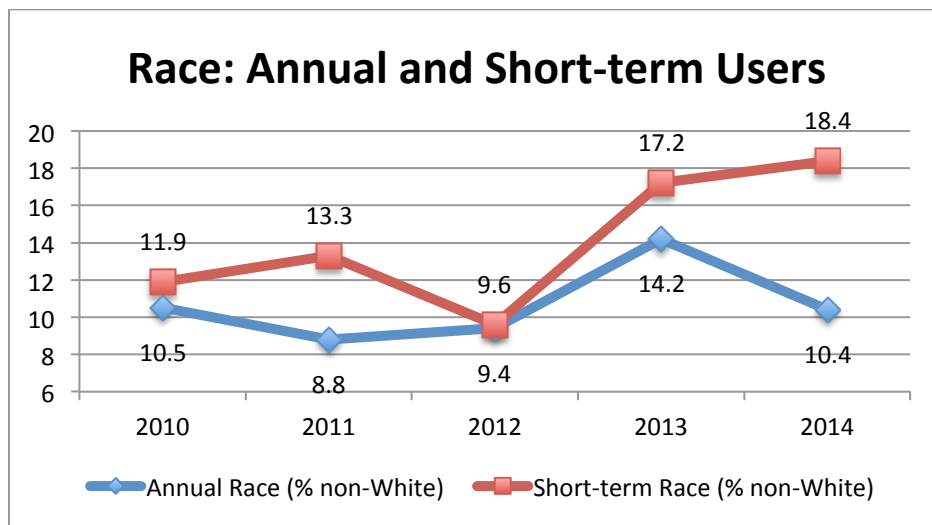
Figure 4



According to the 2010 U.S. Census, the general population of Denver includes 31.8% of the population who identify as Hispanic or Latino of any race (4). In comparison, among the Denver B-cycle annual members, a much smaller portion identifies as Hispanic or Latino. However, participation of Hispanic users appears to be trending upward over time, especially with regard to short-term membership. As was observed with participation by gender, it is evident that Hispanics are increasingly interested in trying Denver B-cycle, but many are not as yet committed to the purchase of an annual membership.

Race

Figure 5



As with gender and ethnicity, there is a disparity by race of participation among Denver B-cycle users. The general population of Denver is 31.1% non-white (4), though the portion of Denver B-cycle members who are non-white is lower. There appears to be an increase in the portion of users who are non-white, with the greatest increase within short-term memberships. Similarly to the findings regarding Hispanic

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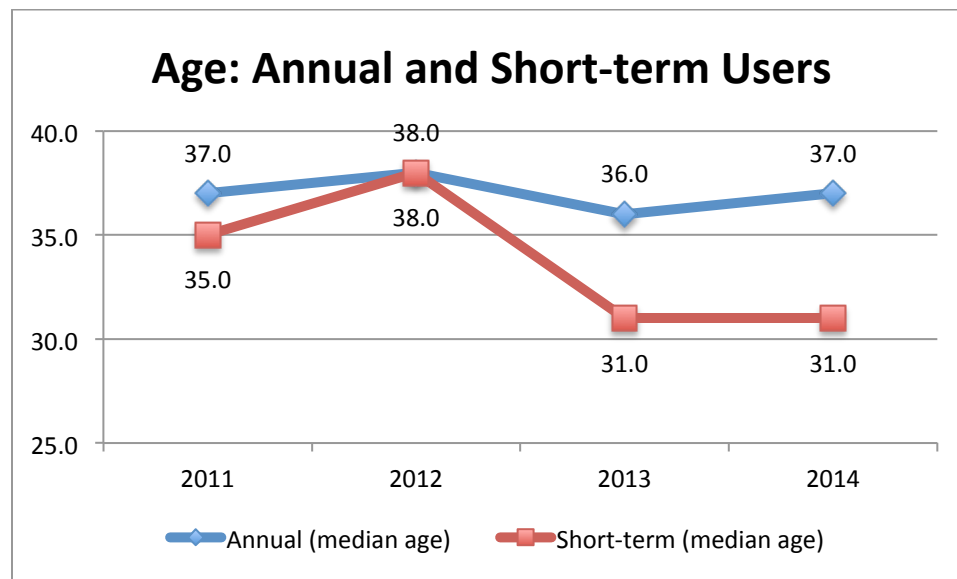
participation rates, this may indicate that racial minorities are interested in trying Denver B-cycle, but many are not willing to purchase an annual membership.

In the context of ethnicity, race and bicycling, the League of American Bicyclists recently reported that the growth of bicycling for transportation or recreation is on the rise, with notably high rates of growth within the African American and Hispanic populations (5). The same report revealed that, by many metrics, racial and ethnic minorities view bicycling favorably, and that infrastructural improvements to support better bicycle facilities are perceived as advantageous and desirable. However, for many members of ethnic or racial minority communities, bicycling for transportation in mixed traffic pose a serious concern for street safety, and constitutes a high barrier to the choice of riding a bicycle in traffic. Such apprehension is supported by evidence, because as compared to white bicyclists, African American bicyclists have a 30% greater chance, and Hispanic bicyclists have a 23% greater chance of being involved in a fatal collision (6).

Moreover, within minority populations, the most likely to use bicycles for transportation are at the lower end of the economic spectrum, with those earning less than \$35,000 annually being more than 10 times as likely to ride a bicycle (5). Minorities often have fewer transportation options as compared to the general population. African Americans and Hispanics are more likely to commute to work by walking, and are less likely to own a car, as compared to the population (6). The price of membership of Denver B-cycle may pose an additional hurdle, especially among the segments of minority populations who are most likely to ride a bicycle for transportation, yet are least able to accommodate the expense.

Age

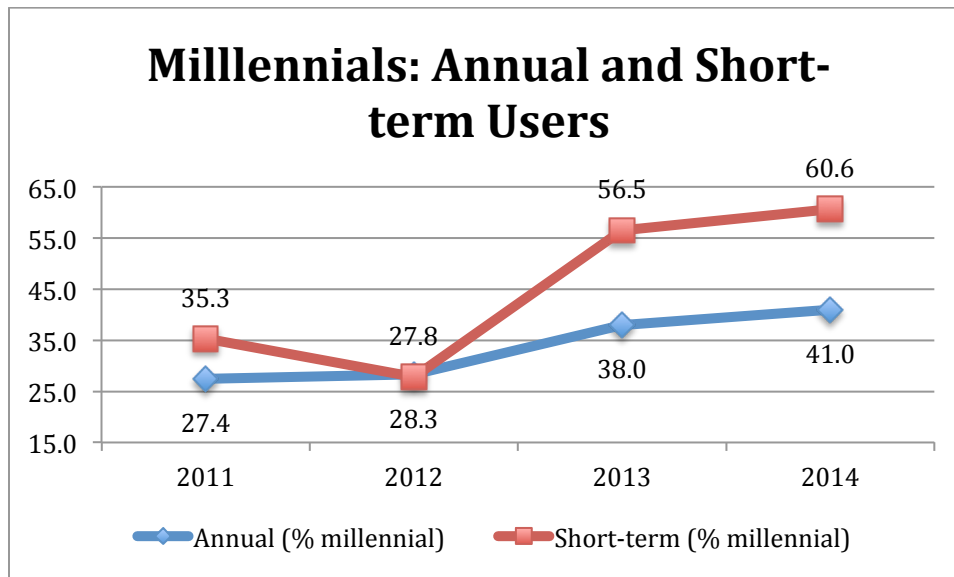
Figure 6



In the 2010 survey, the inquiry into a respondent's age asked only of age group, which is not useful for the purposes of the present analysis, so it is not included. Between 2011 and 2014, the median age of annual members has remained fairly consistent over time, between 36 and 38 years of age. However, the median age of short-term members appears to have dropped in 2013, coinciding with a major expansion of the system in which 30 new stations were added. Many of the new stations added in 2013 were located in neighborhoods adjacent to central downtown Denver, popular with younger adults.

Millennials

Figure 7



Up to the end of 2011, users of Denver B-cycle were required to be at least 18 years old. That policy changed in early 2012, when the system allowed registration to those in possession of a valid Colorado driver's license or identification card, including people of at least 16 years of age. However, because of human subjects data collection requirements for the annual surveys, only respondents of age 18 or older were allowed.

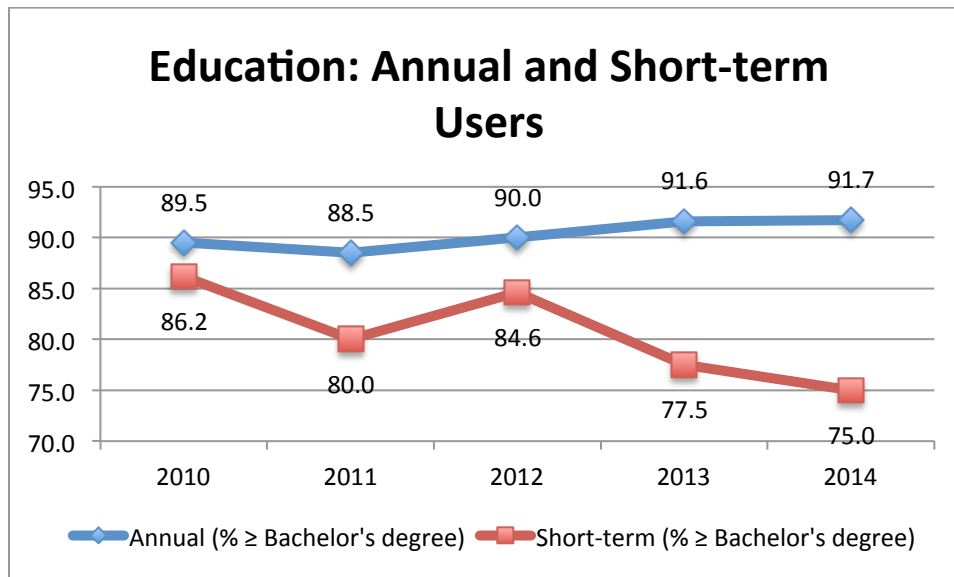
The ability to recruit new users from the younger end of the age spectrum would appear to be advantageous, as recent indicators suggest that emerging generations of young adults seem to view transportation options differently than their parents and grandparents (7). The generation often referred to as millennials, which, for the purposes of this study include those born between 1981 and 1999, has been noted for a decreased dependence on car ownership as compared to preceding generations (7, 8). Millennials are less likely to own a car, and are more interested in living within walking or bicycling distance of their work. Bike share and car share availability, as well as a broad selection of emerging web-enabled ride sharing services, greatly enhance the feasibility of living without a car in an urban setting.

The appeal of Denver B-cycle among millennials is apparently on the rise, with the portion of millennials among annual and short-term memberships increasing over time. Each year, more millennials age into the work force, and seek employment and housing. Denver B-cycle stations are present in several of the residential areas closest to downtown Denver, which are estimated to have the most appeal to people who work in the central part of the city and who pursue a limited car-use lifestyle. In many of these neighborhoods, car parking spaces are few, competitive, and expensive, housing is generally condensed and relatively upscale, and restaurant, bars, and entertainment venues are plentiful.

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Education

Figure 8

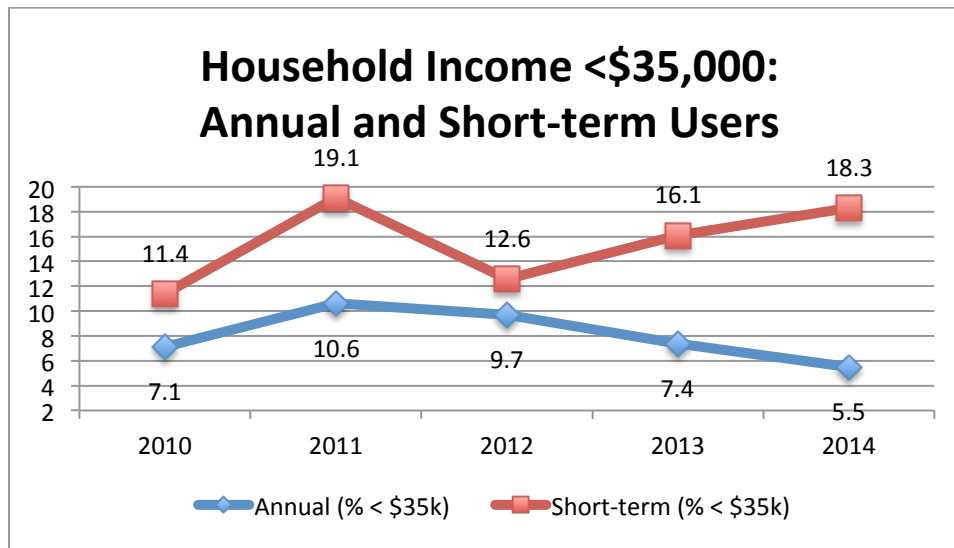


Denver has a population that is, on average, more educated than much of the rest of the country. In 2013, 44.4% of the adult population of Denver County had attained a Bachelor's degree or higher, compared to the U.S. national average of 29.6% (9). In reflection of this, Denver B-cycle users trend toward the upper end of the education spectrum, though to an even greater degree than the general population. Educational attainment of a Bachelor's degree or higher among annual members maintains a level of about 9 in 10. Though educational attainment is also higher than the general population among short-term members, it has been trending downward, suggesting that people who are interested enough in Denver B-cycle to try it for the short term include an increasing portion of those with lower educational attainment. When viewed in tandem with a decreasing median age among short-term members, this finding further emphasizes increased interest through short-term use among younger members of the population, who may still be completing post-secondary education.

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Household Income

Figure 9

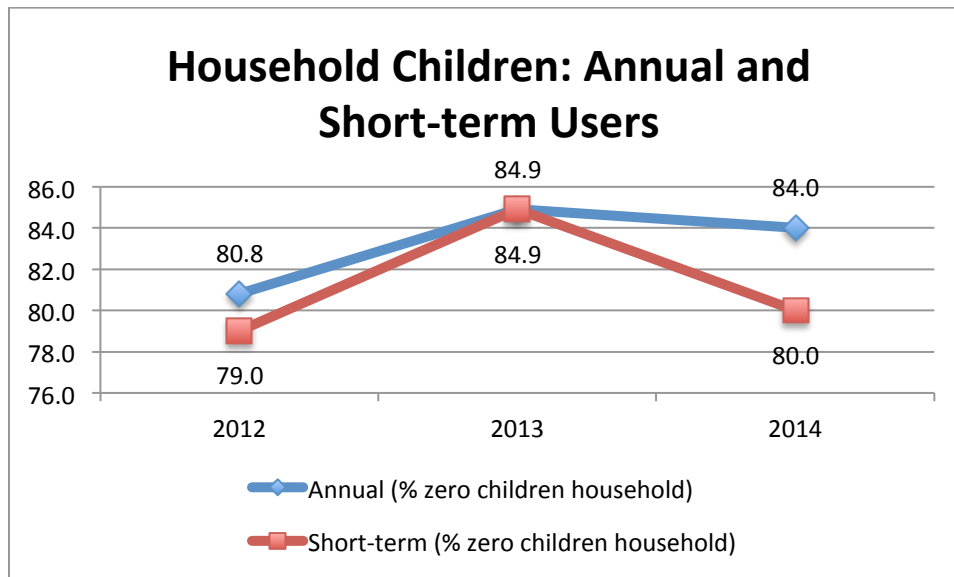


Incremental membership price increases have occurred each year, with a full annual membership price of \$80 in 2014, and a 24-hour subscription at \$8. Similarly to educational attainment, Denver B-cycle annual members trend toward the upper end of household income. Annual members with a household income of \$35,000 or less have been on the decline, while the same group is trending upward in terms of short-term memberships. This may suggest that a growing number of users are purchasing short-term memberships on an as-needed basis, rather than commit to the full price of an annual membership. When viewed in context with memberships sold by type in Figure 1, it appears that although interest in Denver B-cycle is on the increase within the lower income segment of the population, current annual membership prices may have crossed a threshold of what low-income users are willing to pay.

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Children in household

Figure 10



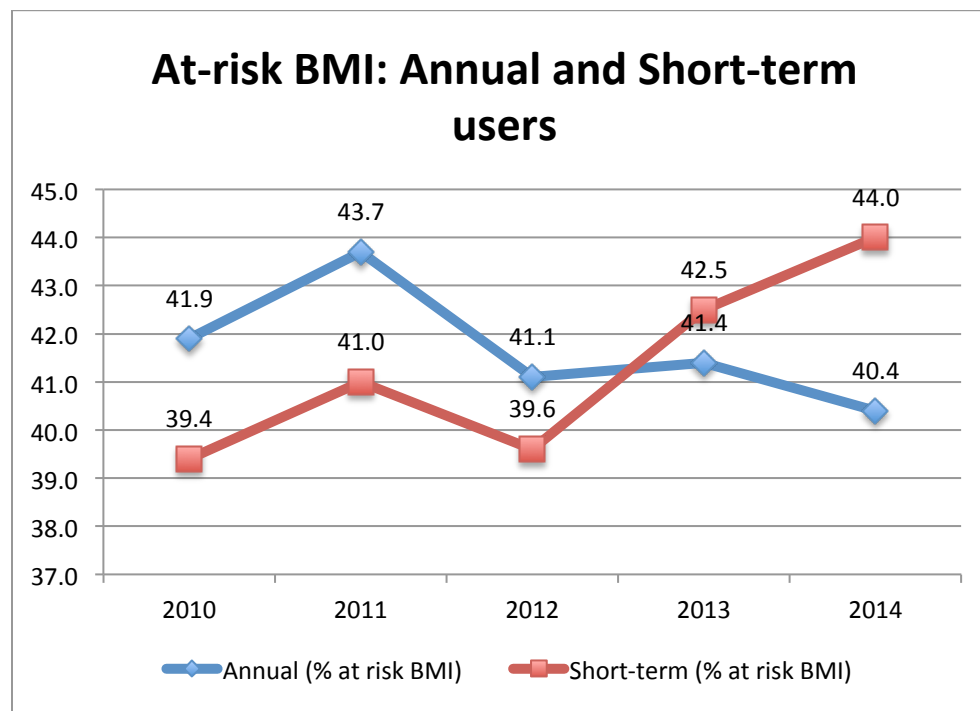
Since 2012, annual surveys have included a question regarding children in the household. This question was included to assess use among people who have children, as previous research indicated that Denver B-cycle has limited appeal to people who must transport children with them who are too young to use the system (10). Strong majorities of annual and short-term members have no children in their household

Carrying passengers on Denver B-cycle bikes is prohibited, though it is occasionally seen, as are apparently under-aged riders. Parents who would like to use Denver B-cycle to ride with their children must bring along privately owned children's bikes, a situation where planning ahead is necessary and which may constitute a barrier to use. It would appear that Denver B-cycle in its present form is most appealing to adults with no children, or adults who are in the service area without their children, such as would likely be the case with commuters.

Health Impacts

Body Mass Index

Figure 11



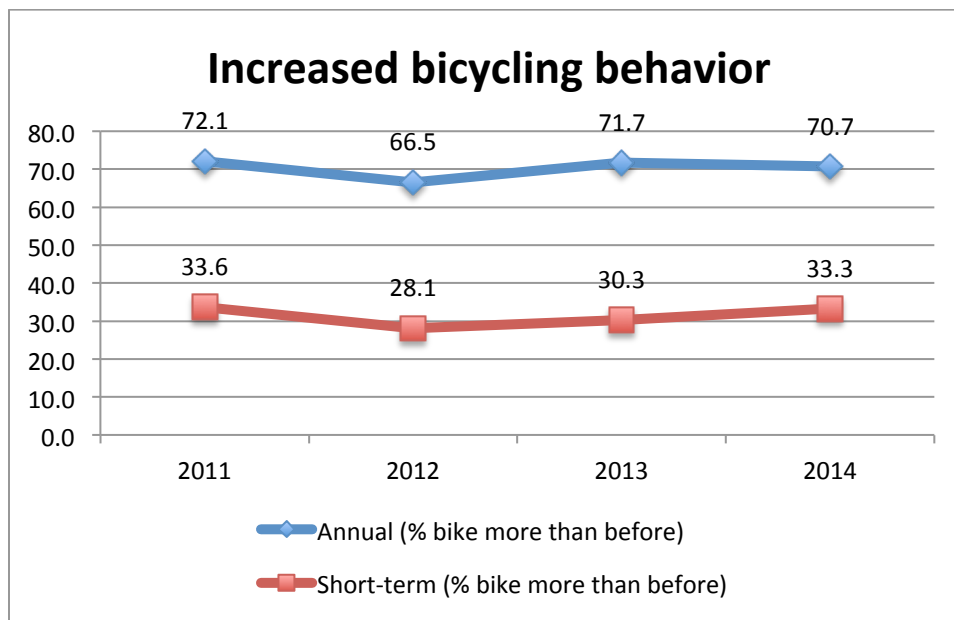
Body Mass Index (BMI) is an indicator of overall health, used to evaluate the healthy weight status of individuals (11). A BMI score above 25 but below 30 indicates overweight status, and a BMI score above 30 indicates obese status (12). For the purposes of this study, BMI scores of 25 or above are classified as “at-risk.” Obesity imposes serious elevated health risks on individuals, and is associated with increased morbidity and mortality within a population (13). Prevention and mitigation of obesity and related illness is the objective of many public health efforts, a part of which increased physical activity is a goal.

The portion of Denver B-cycle annual members who have an at-risk BMI score appears to be gradually declining over time. This may be due in part to long-term annual members who have lost weight, as around 70% of annual memberships are renewed each year. At the same time, the portion of short-term members with at-risk BMI scores has been on the increase. This finding suggests that to try Denver B-cycle for at least a limited period appeals to a growing segment of the at-risk population, who may most benefit from more physical activity.

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Bicycling Behavior

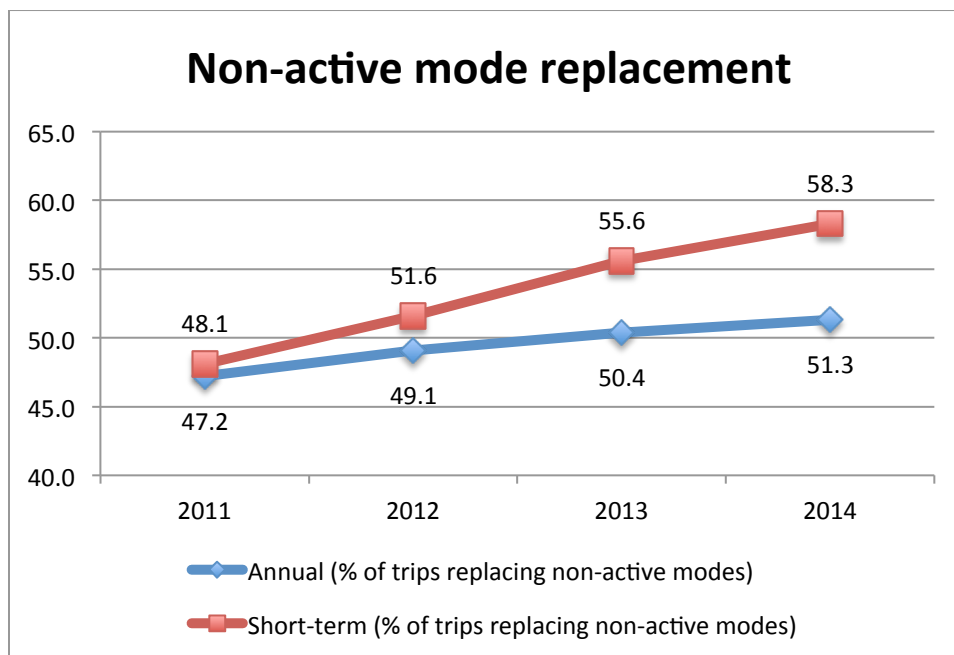
Figure 12



When asked, “Since experiencing Denver B-cycle, have your bicycling habits changed?” each year, strong majorities of annual members responded, “Yes, I now ride a bike MORE frequently than before.” Short-term members were asked the same question, and about 3 in 10 respond with the same answer. These findings suggest that although among annual members Denver B-cycle has had an especially strong impact on increasing their overall bicycling activity, that many short-term members also experience increased bicycling activity, even though they have more abbreviated connection with the system.

Replacement of Other Modes

Figure 13



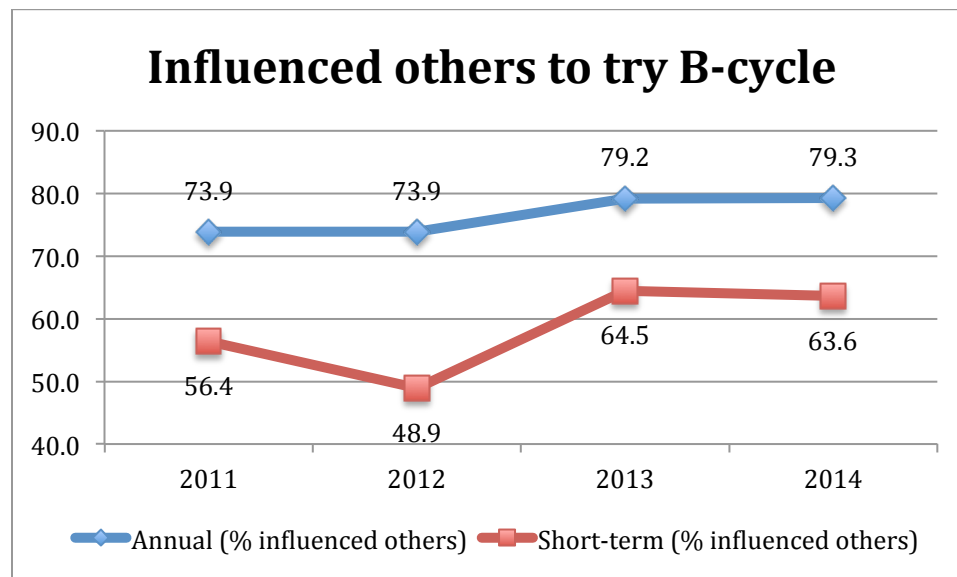
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Survey respondents were asked, “Thinking about your most recent trip on Denver B-cycle, if you had not made the trip on a B-cycle, how would you have gotten to your destination?” Responses were categorized into active and non-active modes. Active modes include walking and bicycling. Non-active modes include car, taxi, motorcycle or scooter, bus, and train.

Over time, an increasing portion of the trips made on Denver B-cycle has been replacing non-active modes with shared bike use, among both annual and short-term members. These findings support increases in bicycling activity identified in Figure 12. Shifting trips that would have otherwise been made via motorized vehicles to a non-motorized, active mode benefits individuals through increased physical activity, and is a community benefit through reduced vehicular emissions and congestion.

Influence on Others

Figure 14



Social connection between individuals is a major factor in the diffusion of use of Denver B-cycle. About 8 in 10 annual members and 6 in 10 short-term members report influencing other people to try Denver B-cycle. The social component of using shared bikes supports findings that people are more likely to engage in bicycling when they are able to ride with others, especially among demographic groups who may have apprehension about safety, or who lack experience riding in mixed traffic (5). Denver B-cycle users apparently serve each other for support by sharing experience and encouragement.

Conclusion

Demographic characteristics of Denver B-cycle users have incrementally shifted over time. Though there is much room for improvement, the representation of several demographic groups for which related literature predicts lower participation, is generally on the rise. Several indicators point to a maturing system, which recruits a subscribed membership that increasingly approximates characteristics of the general public. Efforts to become more appealing to underrepresented groups and those at the lowest end of the income scale are likely to be challenges for the foreseeable future. These challenges will test the agility of Denver B-cycle to meet them, while simultaneously adapting to meet the needs of emerging, less car-dependent generations in a changing transportation environment.

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