



CHARACTERISTICS OF DENVER B-CYCLE USERS 2012



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DEPARTMENT OF HEALTH AND BEHAVIORAL SCIENCES

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Additional information

The conclusions contained within this document do not necessarily reflect the opinions of those listed above. Any mistakes are the author's responsibility. For more information, contact:

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Executive Summary

Surveys of Denver B-cycle users established baseline data of their demographic makeup. The demography of annual members was found to largely adhere to expectations established in related literature regarding people who commute by bicycle (1-3). Accordingly, annual members tend to be male, in their 30s or 40s, non-Hispanic, Caucasian, well educated, and trend toward the upper end of the household income scale.

Participation among women is closer to men than might be expected, at 38.6% of annual members. In related bicycle use literature, the gender split is estimated at 76% to 24% in favor of male participation (1). 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 that may extend to population subgroups currently underrepresented within the Denver B-cycle population of users (3, 4).

Denver B-cycle appears to be affecting social norms of bicycling in the community, as a rise in bicycle activity coincides with Denver B-cycle operation. Annual members report using shared bikes for commuting and work-related trips, shopping and errand trips, and for social and entertainment activities. They also report leaving cars at home, substituting combined transit and B-cycle use. The social norm of car dependence is a risk factor associated with obesity, so replacing car trips with active modes can reduce risks (5, 6). Denver B-cycle appears to be fostering changes to social norms, as social interaction and encountering stations in the built environment were found to be chief among reasons why people first use the system.

Based on survey responses, an estimated combined 52.4% of trips on shared bikes replaced non-active motorized modes or trips that would not have been made. When applied to system generated usage data, on average Denver B-cycle annual members benefited from an estimated average 31.9 minutes of additional active transportation behavior per week of activity than they would have otherwise experienced. In addition, more than 90% of annual members reported walking between 1 and 10 minutes to access stations.

Denver B-cycle annual members were positive about their health, as more than 96% reported good, very good or excellent health status. However, the median BMI of annual members was 24.27, as calculated from self-reported height and weight, which is near overweight classification (7). This means that nearly half of annual members were overweight or obese, similar to the general population (8). Denver B-cycle participation is not relegated only to the most physically fit members of the community. Annual members reported health effects, which they attributed to their use of the system, including improved fitness, reduced stress, better mood, and weight loss.

Key Findings

Finding:	Detail:
Participation is higher among women than literature would suggest	Female users: 38.6% of annual members, 44.5% of short-term users
Annual members are primarily from small households	79% from one or two member households; 82% have no children in household
B-cycle use increases net active transportation	52.4% of Denver B-cycle trips replace non-active or less active modes
On average, annual members regularly engaged the system	Annual member averages: 47.3 checkouts; 11.0 weeks of activity; trip duration 14.2 minutes; 60.8 minutes weekly
Changes to social norm of car dependence	51.7% report leaving a car at home due to joint B-cycle/transit use
Quality of life attributed to B-cycle use	52.3% report better mood; 35.5% report reduced stress; 31.5% report increased fitness; 13.6% report weight loss
Transportation cost savings	75.7% report fuel cost savings; 71.5% report car parking savings; 13.8% report transit fare savings

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Project overview

Purpose

The purpose of this project was to gather data to establish a benchmark of users of the Denver B-cycle public bicycle sharing system. As the rate of bicycle transportation use is, in general, low among populations within the United States, and public bicycle sharing is a new concept within the landscape of urban transportation, little is known about the characteristics of people who self-select to participate. The years 2011 and 2012 are the second and third years of operation of Denver B-cycle. As time goes on, the system is becoming more familiar to residents and visitors to the area.

Understanding the makeup of users during these initial years of operation is of value for future assessment of changes in participation, specifically to detect advancements toward increased inclusivity and diversity among population subgroups. Other goals include understanding effects of the use of Denver B-cycle on the health of users, including replacement of car trips, changes to active transportation, and other perceived health, economic and environmental benefits.

Methods

Results presented in this document are from data collected through surveys of users of Denver B-cycle. Links to online surveys were sent to contacts in the Denver Bike Sharing newsletter database, which is primarily comprised of annual members, but also includes some short-term users and others who are interested in Denver B-cycle. The surveys were administered at the beginning of October in both 2011 and 2012. This timeframe was chosen to capture the greatest number of participants, as the peak annual use of the system tends to occur in September.

In 2011, Denver B-cycle had 2,675 annual members, of whom 764 responded to the survey, resulting in a 28.6% response rate among annual members. During 2012, there were 2,750 annual members, of which 743 responded for a response rate of 27.0%.

In addition to annual members, some short-term users completed the survey. During 2011, 297 short-term users participated, as did 267 during 2012. As the total number of short term users were 42,320 and 41,000 for 2011 and 2012 respectively, sample rates were too low to have high confidence in a representative sample. The chief reason for low sampling among short-term users is that very little contact information is collected from short-term users during the registration process, so in many cases it is not possible to contact them for survey purposes.

Data analyses were completed using Stata/IC 11.2 statistical software.

Description of Denver B-Cycle Users

The primary objective of this section is to establish a baseline to examine patterns regarding the use of Denver B-cycle. Investigation efforts focus on annual members, as the parameters of the system allow for access to annual members much more readily than for short-term users. Annual members are also more committed to an investment toward long-term use of Denver B-cycle, and are best positioned to experience effects attributable to the use of shared bikes.

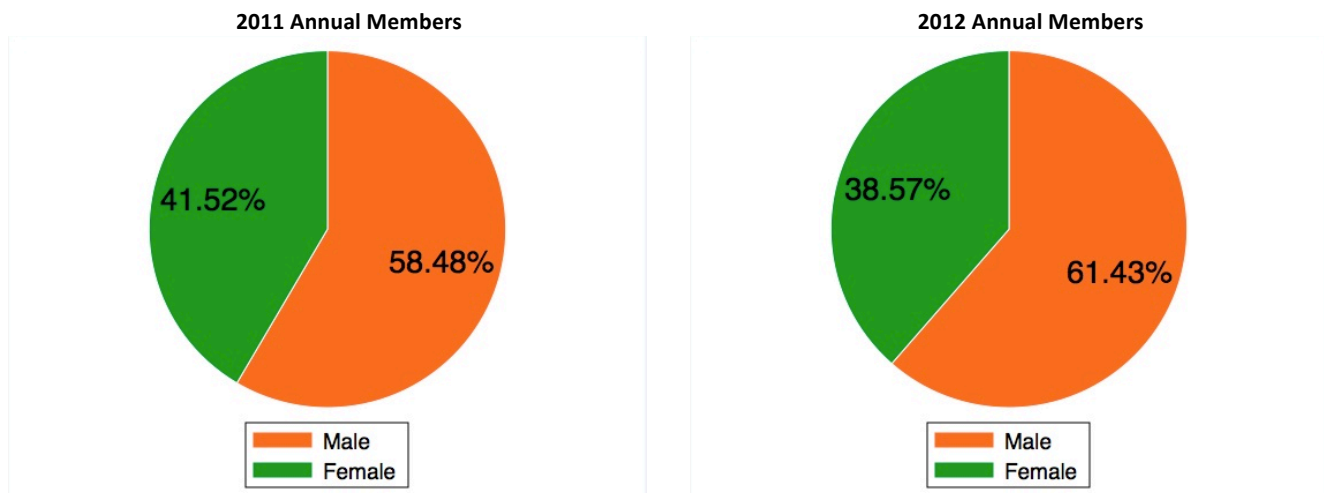
Results of short-term user data are included in some of the following, but should be viewed with caution. Short-term use of Denver B-cycle is transitory. Only minimal information is collected during short-term registration, minimizing the ability to contact users for data collection purposes. As such, there are limitations in knowing how representative results derived from short-term user data may be of short-term users in general.

This evaluation process groups impacts under three major subsections: *characteristics*, *social outcomes*, and *health effects*. The following results are taken from surveys of users of Denver B-cycle. Associated questions from which the results are derived are presented in *italics* preceding figures or tables. When applicable, results from annual members for both 2011 and 2012, and of short-term users are shown.

Characteristics of Denver B-cycle Users

Gender

What is your gender?

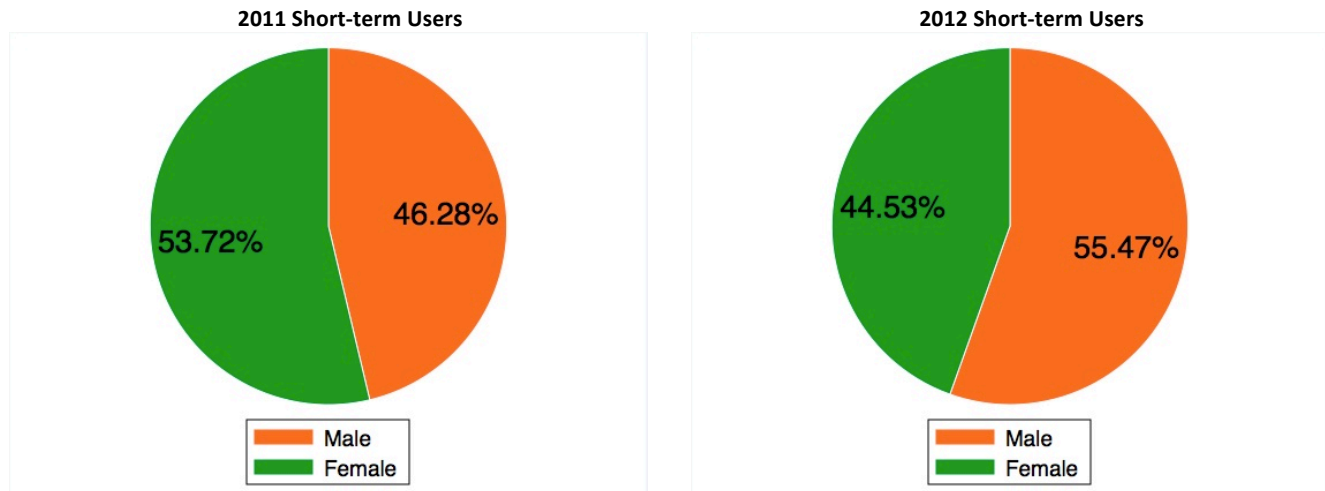


Gender is a key item for evaluation, as the incidence of women willing to use bicycles for transportation is taken as an indicator of the perceived safety and/or the appeal of bicycle-supportive infrastructure (2). In this case, participation among women is closer to men than might be expected, at 38.6% of annual members. In related bicycle use literature, the gender split is estimated at 76% to 24% in favor of male participation (1). 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 that may extend to population subgroups currently underrepresented within the Denver B-cycle population of users (3, 4).

The use of a bicycle for commuting is representative of a utilitarian transportation purpose. 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., including Colorado, males comprise the majority of the population who bike to work (1). In Denver, of those who bike to work, 71% are men and 29% are women (9).

Annual members of Denver B-cycle reflect the gender differential favoring inclusion of males. Yet, the gender split among annual users is about ten percentage points closer that might be expected when considering bicycle-commuting data. A look at the gender split among short-term users of Denver B-cycle is also revealing, as shown in the following figures.

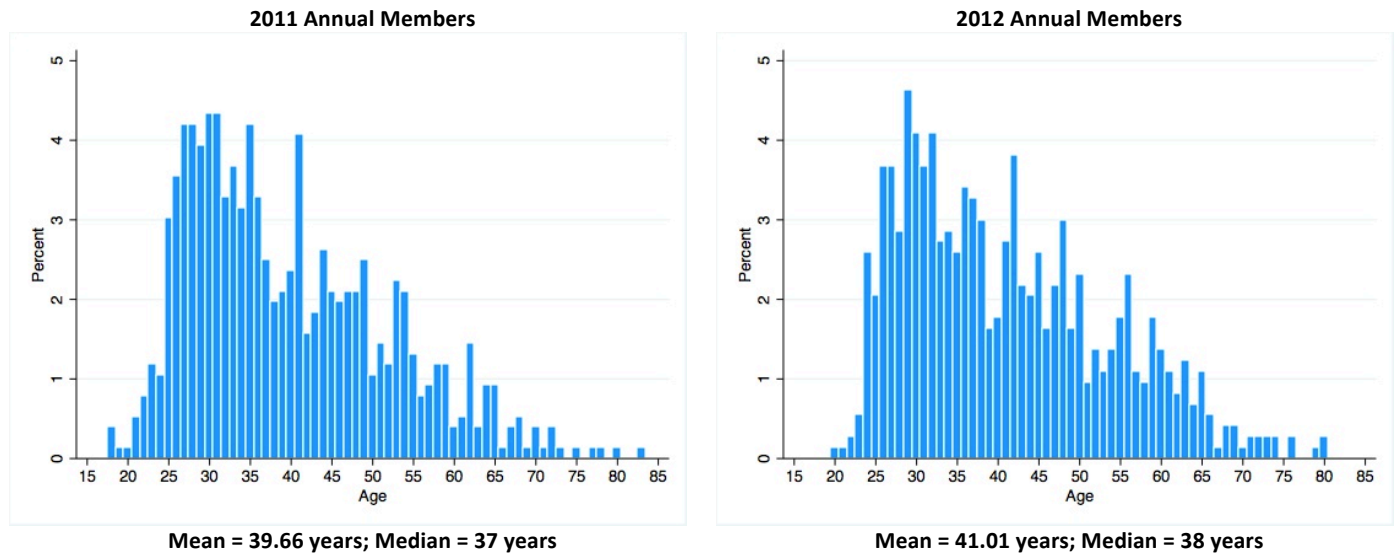
What is your gender?



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 general bicycle commuter mode share gender split (9). In 2011, women apparently exceeded men in short-term subscriptions to the system. These results 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.

Age

What is your age?



In 2011, users of Denver B-cycle were required to be at least 18 years old. That policy changed for 2012, when the system allowed participation of those in possession of a valid Colorado driver's license or identification card, to include those of at least 16 years of age. However, no survey respondent in 2012 was younger than 20. Between 2011 and 2012, the mean and median ages of annual members rose slightly, with the majority of users falling between their mid 20s and mid 60s in age. For comparison, nationally a slim majority of the population (54%) who are bicyclists are between the ages of 16 and 65 (1).

The age distribution of Denver B-cycle annual members aligns with that of working-aged people present in much of the Denver B-cycle service area. As will be shown later in this report, the trip types and purposes are also supportive of the needs and behaviors of this age group.

Ethnicity

What is your ethnicity?



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 (10). In comparison, among 2012 Denver B-cycle annual members, only 5.42% identify as Hispanic or Latino. Though there is much difference between the Hispanic or Latino ethnic makeup of the general population and of Denver B-cycle annual members, the figure for 2012 shows a net increase of nearly two percent over the same figure for 2011.

Race

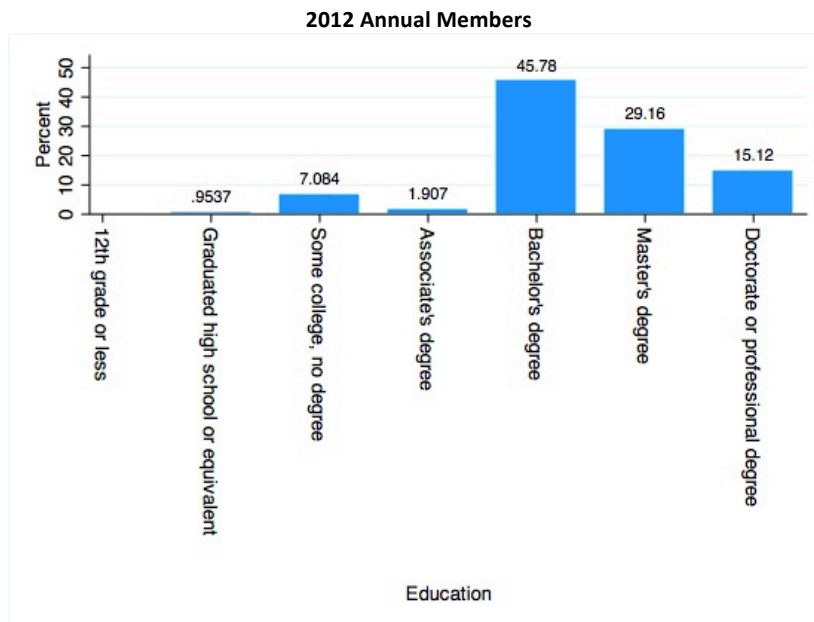
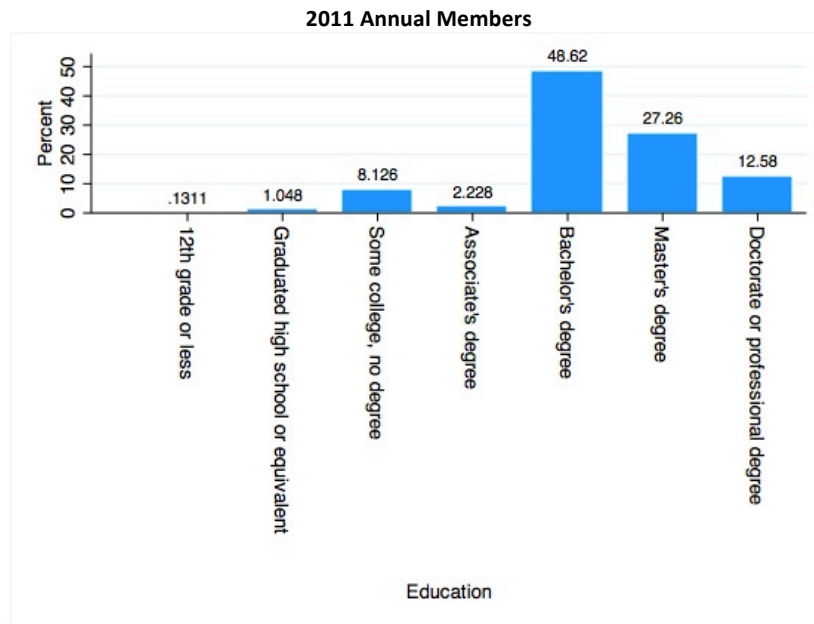
What is your race?

	2011 Annual Members	2012 Annual Members
Native American/Alaska Native	0.40%	0.27%
Asian	1.71%	2.05%
Black/African American	0.66%	0.68%
Native Hawaiian or Other Pacific Islander	0.26%	0.41%
White/Caucasian	91.17%	90.57%
Other/Multi Racial	3.16%	3.01%
Decline to Respond	2.64%	3.01%

The general population of Denver is 68.9% White/Caucasian (10). Yet, among the group of 2012 Denver B-cycle annual members, a strong majority are White/Caucasian. This is in contrast to national findings that some racial or ethnic minority groups, specifically African Americans, are comparatively more likely to walk or bike to work (1).

Education

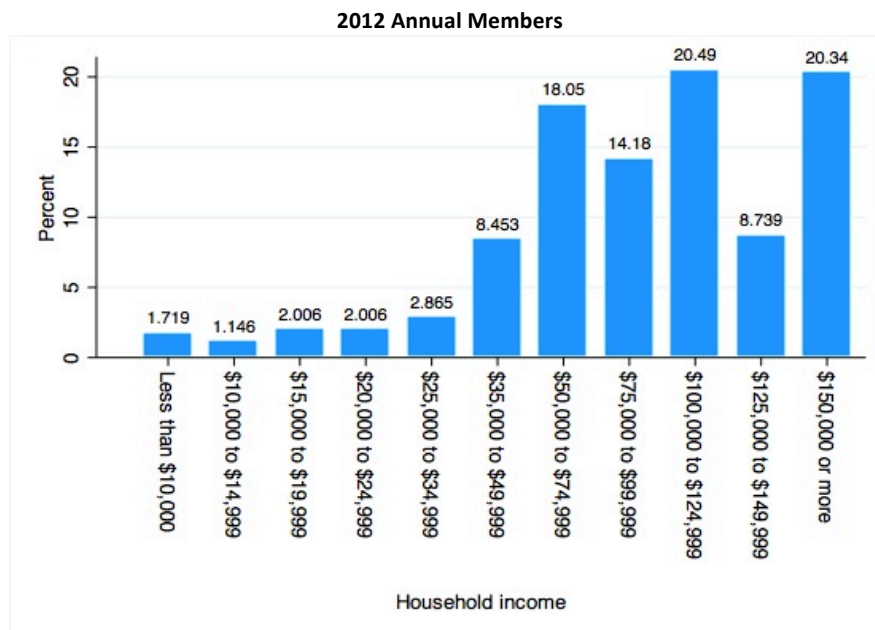
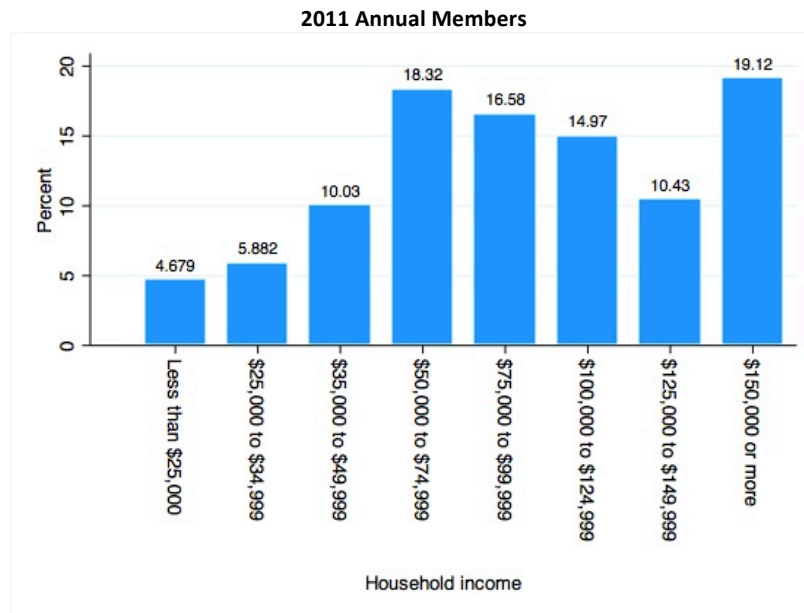
What is the highest education you have completed?



Denver County has a population that is, on average, more educated than much of the rest of the country, with 41.3% of the population having attained a Bachelor's degree or higher (11). In reflection of this, Denver B-cycle annual members trend heavily toward the upper end of the education spectrum, with more than 90% in attainment of a Bachelor's degree or higher.

Household Income

Is your annual household income from all sources—



Similarly to educational attainment, Denver B-cycle annual members trend toward the upper end of household income. Data collection methods were changed in 2012 to include more categories for household income of less than \$25,000, so as to better understand those at the lower end of the income scale. Between 2011 and 2012, an increase in annual members with a household income of less than \$25,000 was detected. In 2011, 4.68% of annual members reported household income of \$25,000 or less, while in 2012, the same figure was 6.88%, a net increase of more than 2%.

Employment status

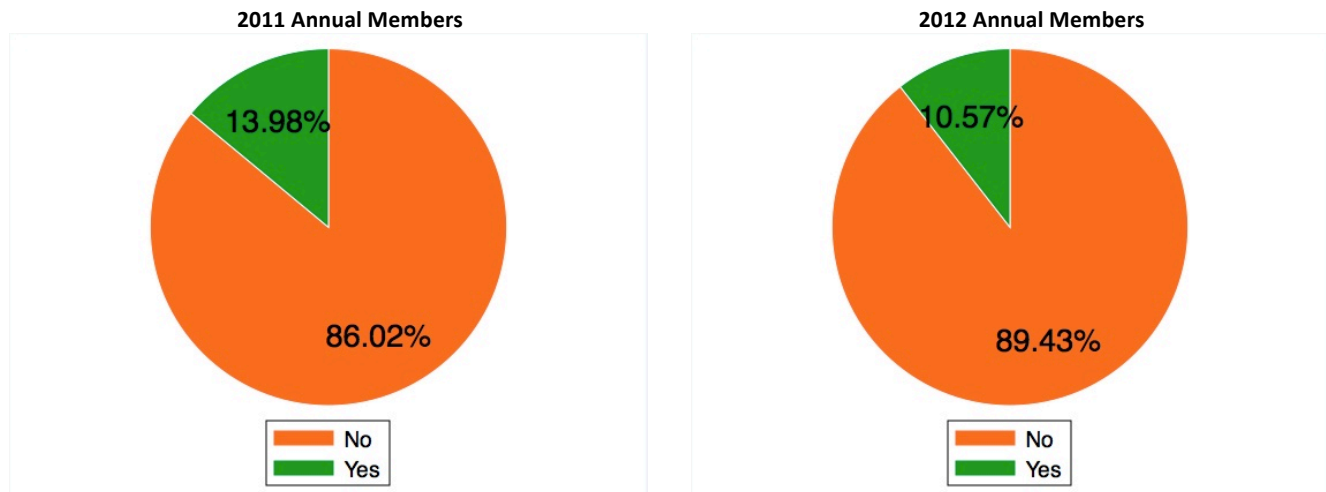
Which best describes your employment situation?

	2011 Annual Members	2012 Annual Members
I am employed full time	82.9%	83.6%
I am employed part-time	8.8%	8.9%
I am not employed	3.9%	2.9%
I am retired	3.0%	4.4%
I prefer not to answer	1.3%	0.3%

A strong majority of 92.5% of 2012 Denver B-cycle annual members are employed full or part-time. Unemployment among annual members is lower than the state and national averages at 2.9%. The number of retired annual members grew slightly between 2011 and 2012, to 4.4%.

Student status

Are you a student?



Most Denver B-cycle annual members are not students. The percentage of annual members who are students declined somewhat between 2011 and 2012. Low participation among college and age-eligible high school students may reflect the minimal presence of Denver B-cycle stations at education facility locations in the city.

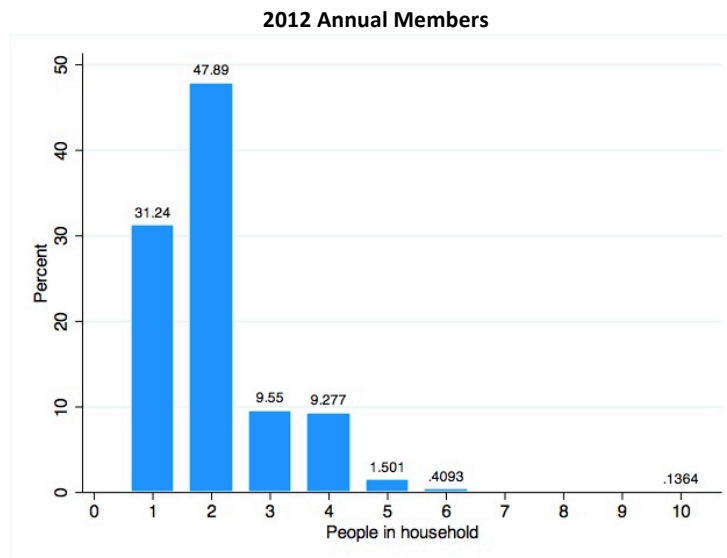
On higher education campuses, Denver B-cycle has a limited number of stations. The small group of stations on or near the Denver University campus in south Denver is not closely connected with the greater Denver B-cycle network, and may not have sufficient coverage of desired destinations both on and off campus in the area to adequately function as a network of its own. On Auraria Campus in central downtown Denver, policies not permitting bicycle riding on much of the campus contributed to a near lack of stations on or near the campus during

the initial years of the system. Though, in Fall 2012, some of Auraria’s bicycle exclusionary policies were relaxed, resulting in an on-campus bike route, and an on-campus Denver B-cycle station, was deployed in early 2013.

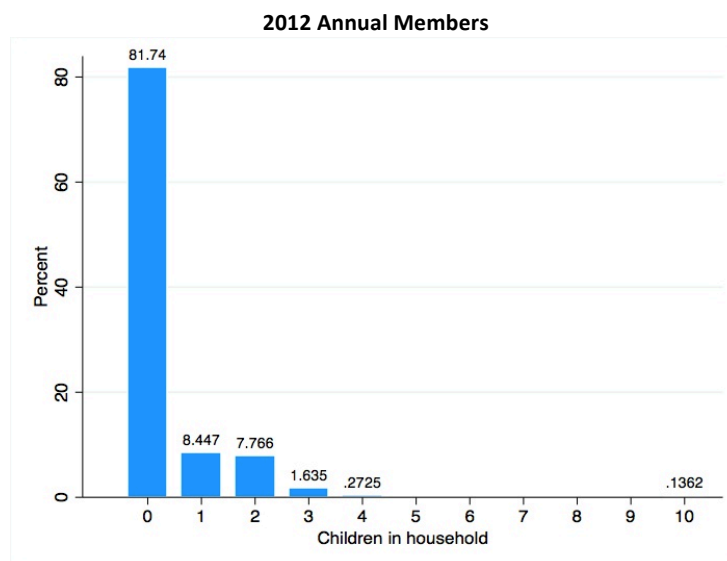
As of 2012, no discernable efforts had been made to actively recruit high school students to become annual members. However, in 2013, Denver B-cycle stations will be at or near at least three Denver high schools. Coupled with a modification to the membership policy to allow annual members as young as 15 years old, there is potential for increased appeal in the use of Denver B-cycle among high school students.

People in household

Counting yourself, how many people live in your household?



How many children under age 18 are in your household?

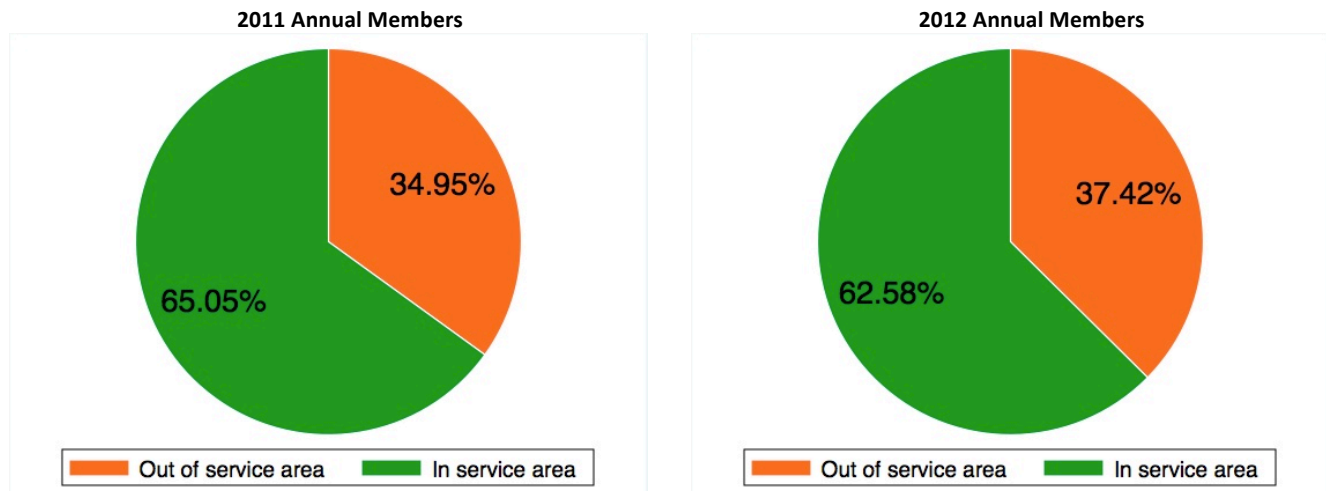


More than 79% of Denver B-cycle annual members live in households of two or fewer people, and nearly 82% have no children within the household. These figures could reflect the limited appeal for participation among those parents who have children too young to use Denver B-cycle. Though carrying passengers on the shared bikes is prohibited, 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.

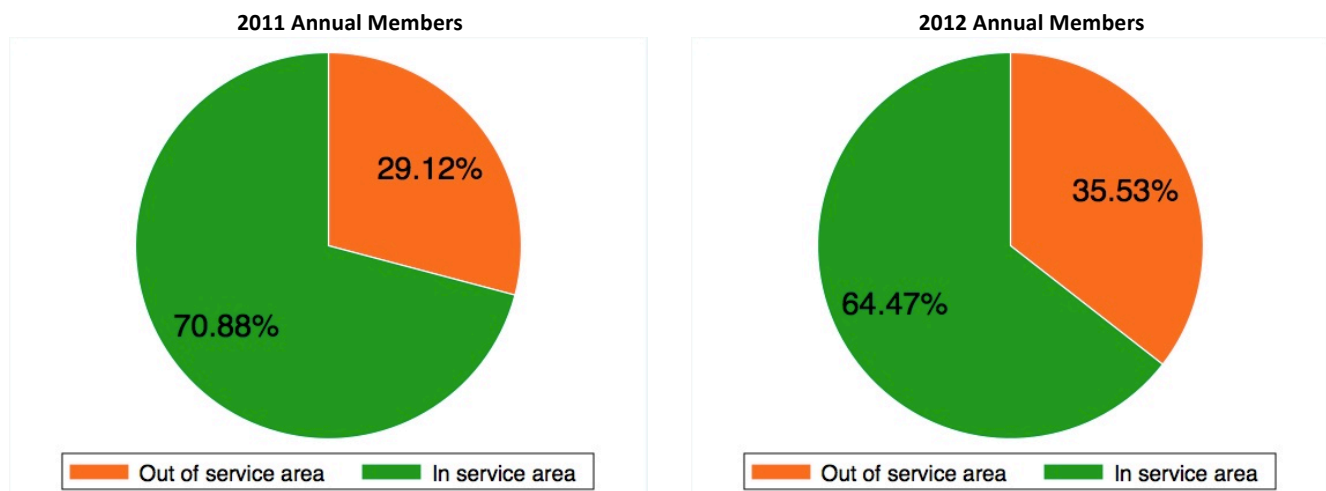
Location of Residence and Employment or School

What is the ZIP Code where you live?

(Note: ZIP Codes designated as being in service area encapsulate at least one Denver B-cycle station. In service area ZIP Codes include the following: 80202, 80264, 80265, 80290, 80293, 80294, 80203, 80204, 80205, 80211, 80218, 80209, 80206 and 80210.)

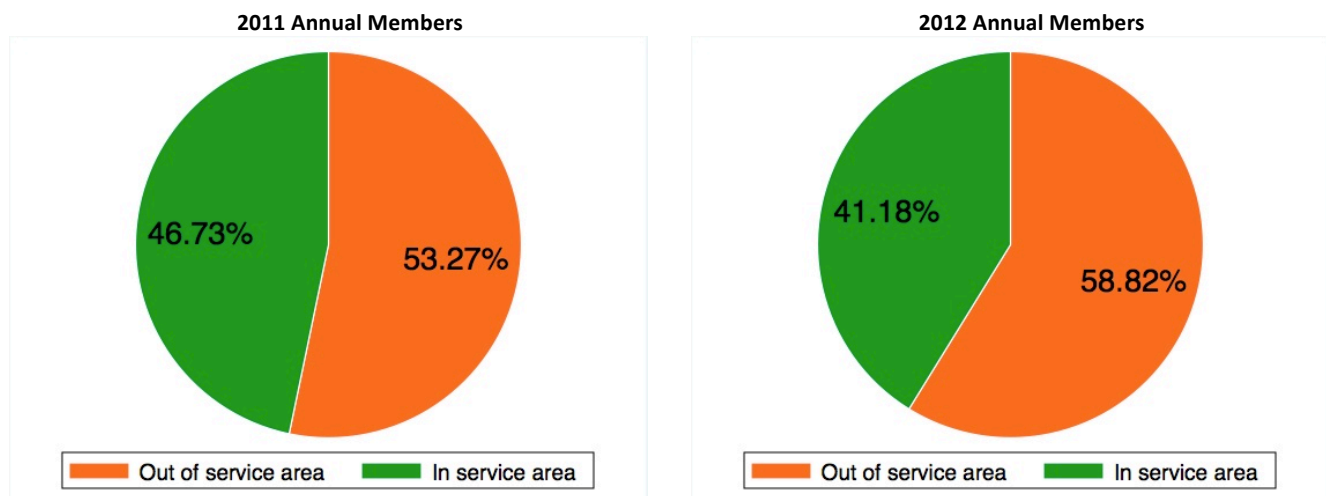


What is the ZIP Code where you work or attend school?



As a means of transportation, public bicycle sharing is only useful to those who spend at least some time in proximity to a bike sharing station. Prior research revealed that living or working within the a service area of public bicycle sharing significantly affects participation (12). Therefore, it is unsurprising that a large majority of Denver B-cycle annual members either live or work within the Denver B-cycle service area. However, between 2011 and 2012, the percentages of annual members who either live or work outside the service area increased. This finding perhaps indicates that access to shared bikes is appealing to a range of people who spend at least part of their day near bike sharing stations, including those who live outside the service area and commute into central downtown. An increase in participation by those outside the service area also suggests that any beneficial effects of using shared bikes extends to a broader geographic area.

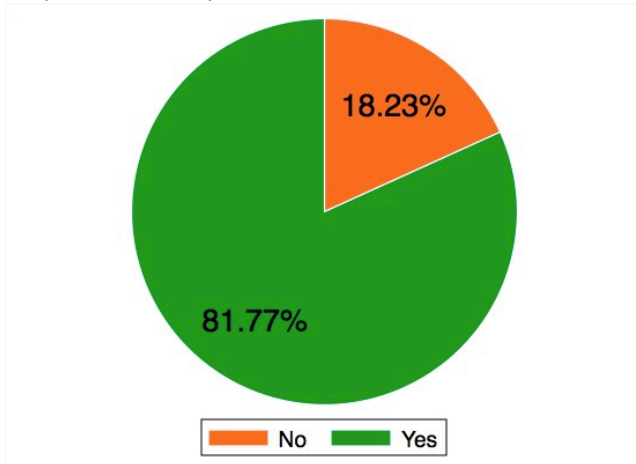
Annual members with ZIP Codes of both home AND work in service area:



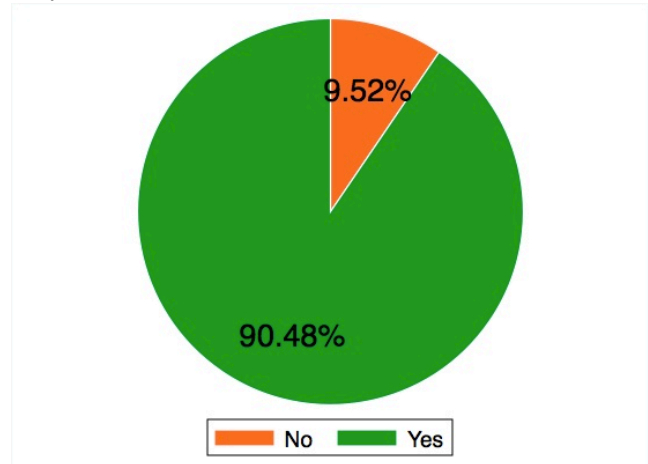
Those annual members who both live *and* work within the Denver B-cycle service area have potentially the greatest exposure to shared bikes and the strongest reasons to purchase memberships. Yet, living *and* working within the service area do not appear to be necessary characteristics for participation, as the percentage of annual members in this category declined between 2011 and 2012. Taken together, these findings suggest that the appeal of Denver B-cycle annual membership is not limited only to those who both live and work near a station.

Transportation and Communication Device Ownership

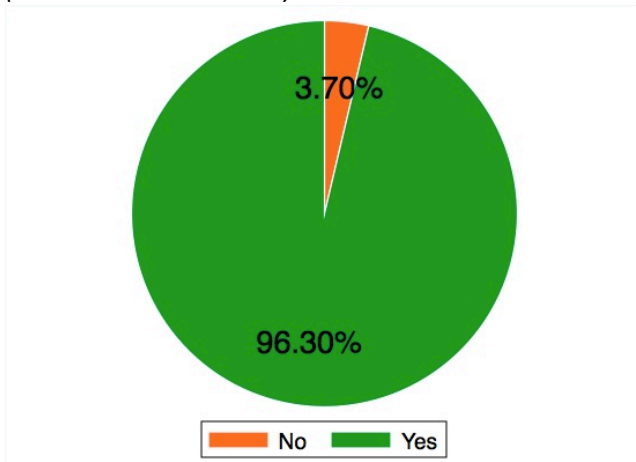
Do you own a bicycle? (2012 Annual Members)



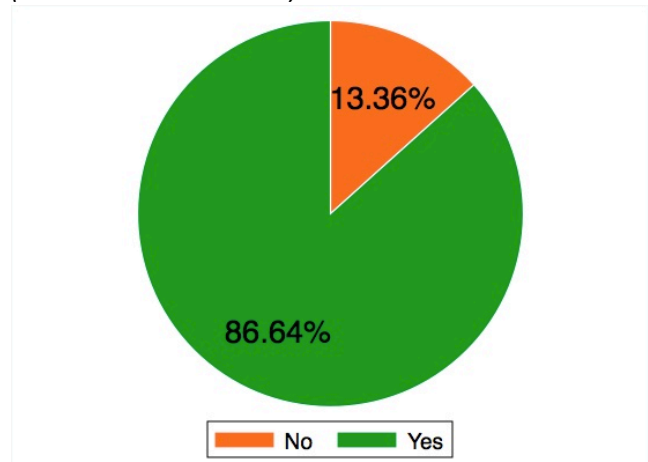
Do you own a car? (2012 Annual Members)



Do you own a cell phone that can text? (2012 Annual Members)



Do you own a smartphone with internet access? (2012 Annual Members)

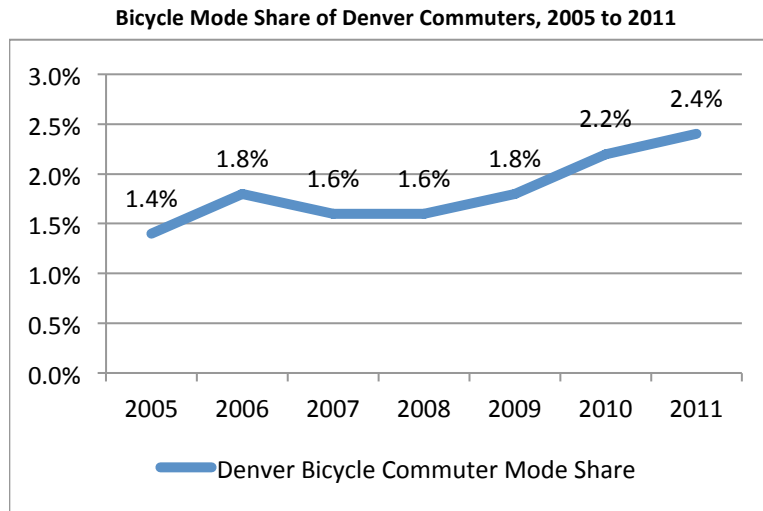


A strong majority of 2012 Denver B-cycle annual members have access to other forms of transportation. Nearly 82% own a bicycle, and more than 90% own a car. Either bicycle or car ownership does not apparently preclude interest in the use of shared bikes.

Nearly all annual members own a cell phone capable of texting, and more than 86% own a smartphone. These findings indicate that data collection through micro surveys or other methods via mobile device is potentially viable. The ability to periodically track subgroups of users using short surveys or GPS tracking with personal mobile devices may add a rich layer of data to more fully understand how annual members use shared bikes.

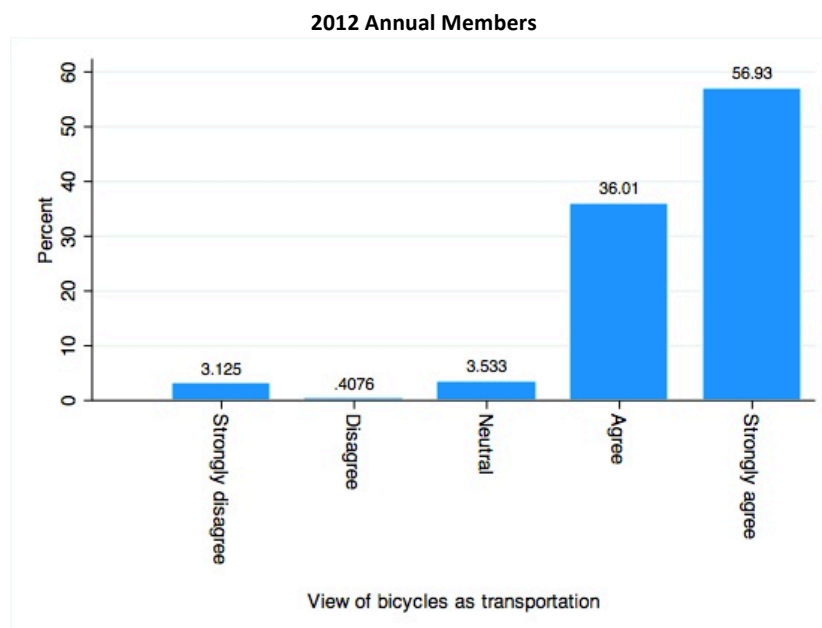
Social Norms and Bicycling Behavior

Bicycling in Denver has been undergoing an upswing over the past several years, as measured by bicycle commuter mode share in the U.S. Census American Community Survey (ACS). The ACS began monitoring bicycling as a commuting mode in 2005. Between 2005 and 2011, bicycle commuter mode share among Denver citizens aged 16 and older rose from 1.4% to 2.4%, a rate of increase of 71.4% (9, 13-18). For comparison, the bicycle commuter mode share for the United States in 2011 was at 0.6% (19), so Denver is presently at four times the national average.



Perception of bicycles as transportation

A bicycle is a good choice for transportation around town.



The recent upward trend to commute by bike as shown by ACS figures over the past several years is an indicator of changing social acceptance of the perception of bicycling for transportation. Denver B-cycle annual members strongly align with this indicator, among which nearly 93% consider a bicycle to a good choice for transportation around town. It is likely that many annual members are not unfamiliar with using bicycles for transportation, as these are people who have self-selected to subscribe to the system. A look at the self-ascribed transportation bicycling type of annual members supports this idea.

Transportation bicycling type

The City of Portland has developed classifications of transportation bicyclists. For self assessment, the four classifications are described as follows (4).

Strong and fearless: You are not intimidated by traffic or road conditions; you ride in any weather, year-round, on any street or any traffic situation. (Thought to be less than 1% of the general population.)

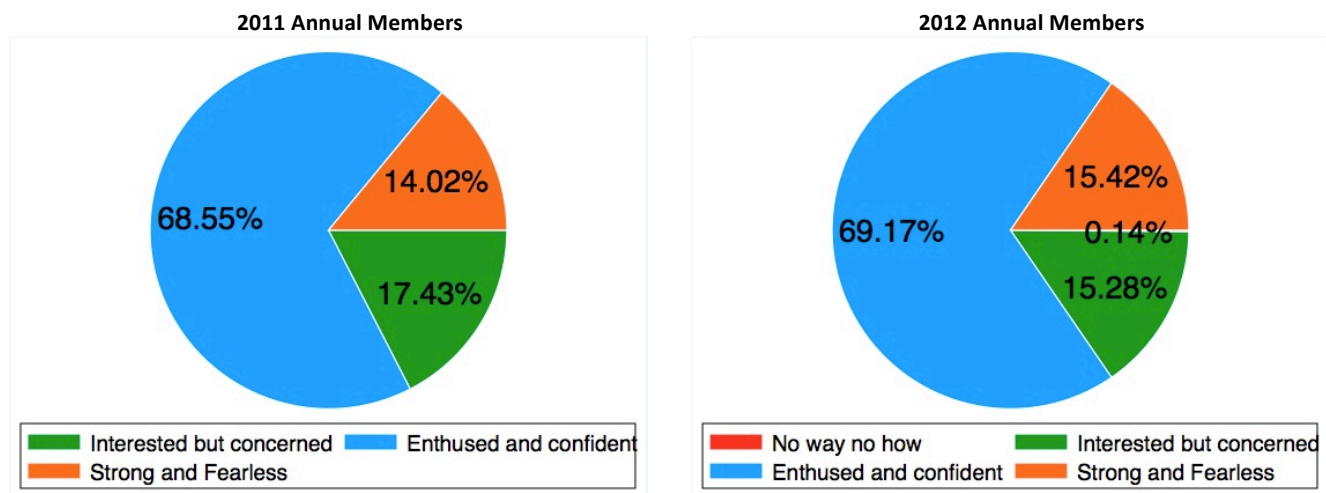
Enthusied and confident: You ride a bike for transportation; you are confident sharing the roadway with car traffic although you prefer using bike lanes and bike routes. (Estimated to be about 6% of the general population.)

Interested but concerned: You prefer to ride on trails and parkways; you are not confident riding among car traffic; you do not feel safe in traffic even where bike lanes exist. (Estimated to be 60% of the general population.)

No way no how: You will not ride a bicycle for transportation because you are not interested or do not know how to ride. (Estimated to be 33% of the general population.)

The descriptions of the four types of transportation bicyclists were presented to survey respondents in conjunction with the following question.

How would you describe yourself as a bicyclist?

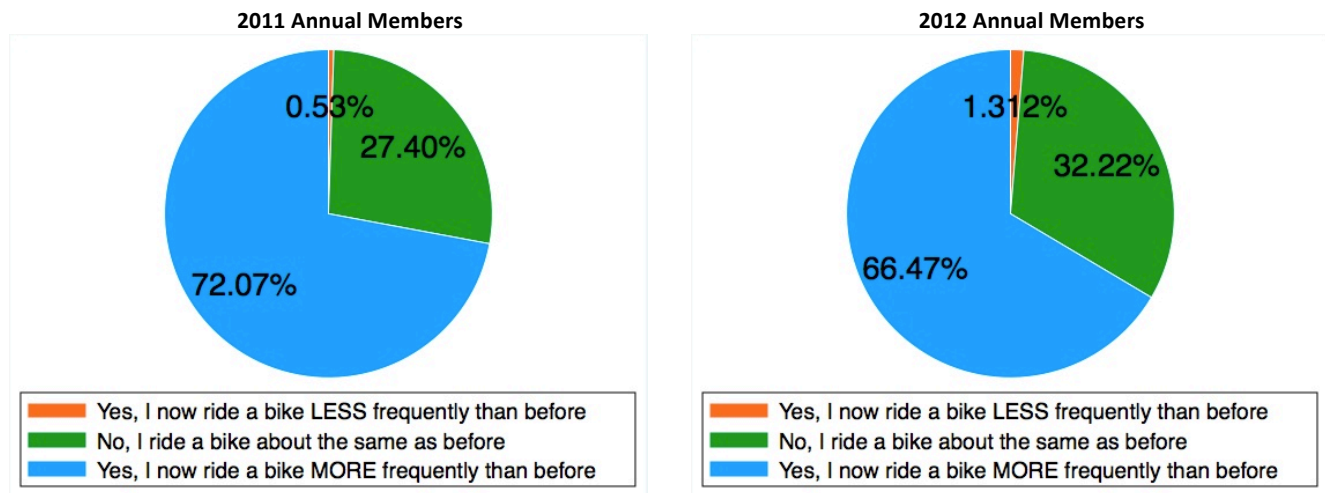


In 2012, nearly 85% of annual members considered themselves to be either *Strong and fearless* or *Enthusied and confident*. These two groups are made up of people who are by and large comfortable riding a bike in many situations and as part of mixed traffic. Although these two categories represent a strong majority of Denver B-cycle annual members, within the general population, they comprise only about the top 7%. The category, *Interested but concerned*, makes up 60% of the general population, but only 15.28% of 2012 annual members. The group of *Interested but concerned* is of high importance for expanding the reach and impact of public bicycle sharing; not only are they the largest segment of the population, but they have the greatest potential for increased bicycling behavior.

As people who consider themselves *Interested but concerned* begin to bicycle more, it is expected that some might reclassify themselves into higher categories after gaining experience. Therefore, it is likely that the *Strong and fearless* and the *Enthusied and confident* will continue to dominate the ranks of Denver B-cycle annual members. A continuing presence of *Interested but concerned* annual members is encouragement that Denver B-cycle is at least in part reaching the large segment of the population who view bicycling for transportation somewhat warily, but are open to the idea. Probably not all of the *Interested but concerned* are riding in traffic or for utilitarian purposes, but they have demonstrated some intention to bicycle more by purchasing memberships.

Bicycling habits

Since using Denver B-cycle, have your bicycling habits changed?



A strong majority of annual members report riding any bicycle more frequently than prior to using Denver B-cycle. The percentage reporting more bicycling activity fell somewhat between 2011 and 2012, perhaps indicating a carry over effect of bicycle use among some annual members, who may have established increased bicycle use in 2011 and maintained that elevated use in 2012.

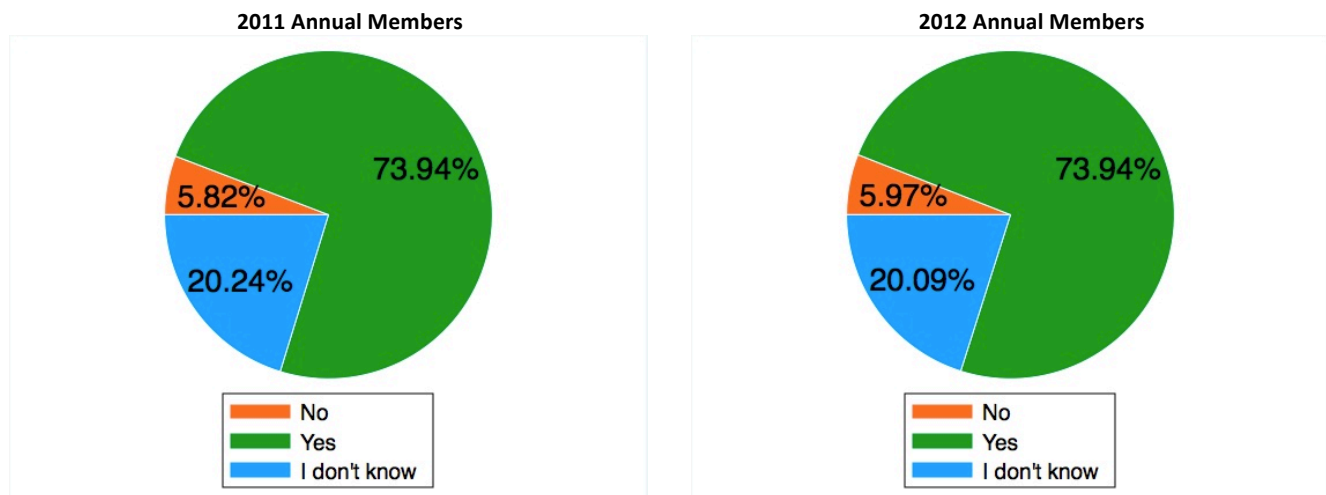
The 2012 annual members who classify themselves as *Interested but concerned*, outperformed annual members as a whole in increased bicycle activity, as shown below. Those who responded as riding a bike more frequently were more than five percentage points higher than the same response for annual members as a whole. At whatever frequency they had previously been bicycling, most are now riding more.



Taken collectively, these findings suggest that Denver B-cycle has produced measurable impacts on the overall quantity of bicycling among its users, and perhaps most notably among those of the *Interested but concerned* category. Denver B-cycle has also possibly contributed to the overall rise of bicycling in the city.

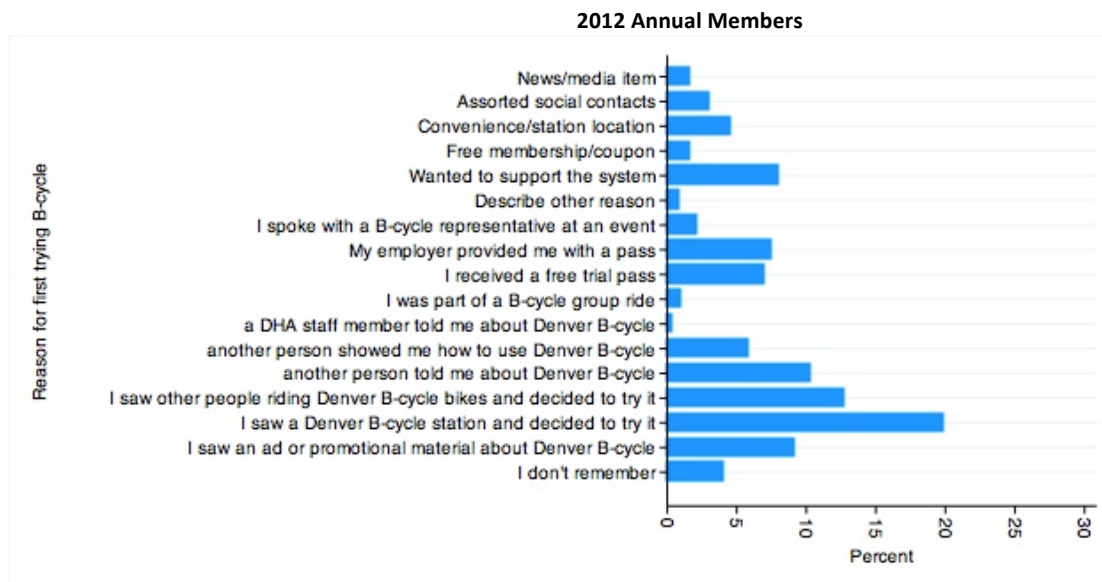
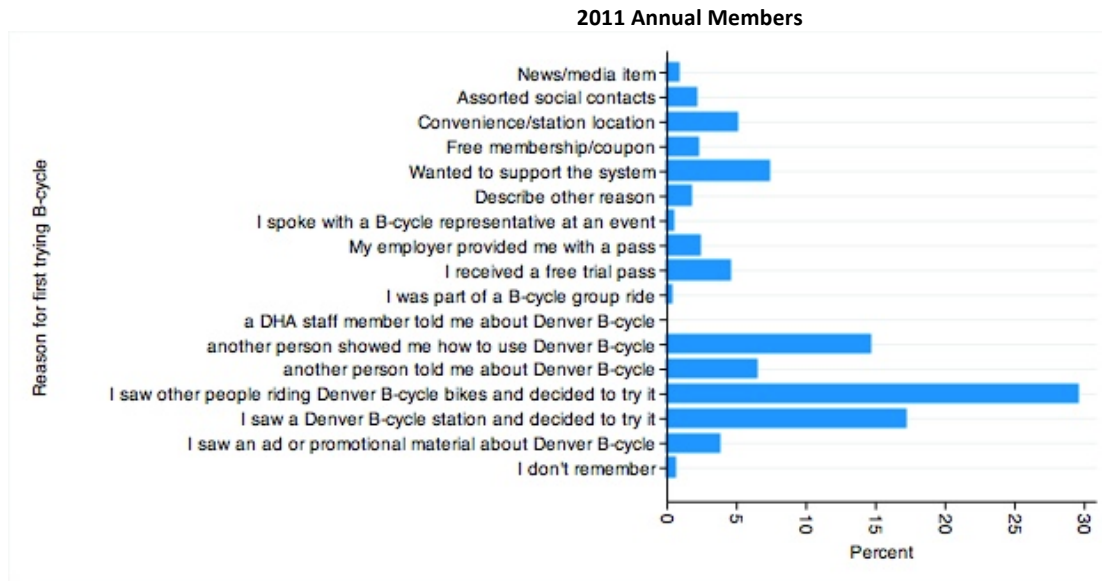
Social influence

Have other people tried Denver B-cycle because of you?



Denver B-cycle annual members appear to be a strong element of propagation of use among their peers. In both 2011 and 2012, nearly 74% reported that they were the cause of other people trying Denver B-cycle. Social interactions and other social influences seem to be a large part of why people initially use Denver B-cycle, as seen in the following graphs.

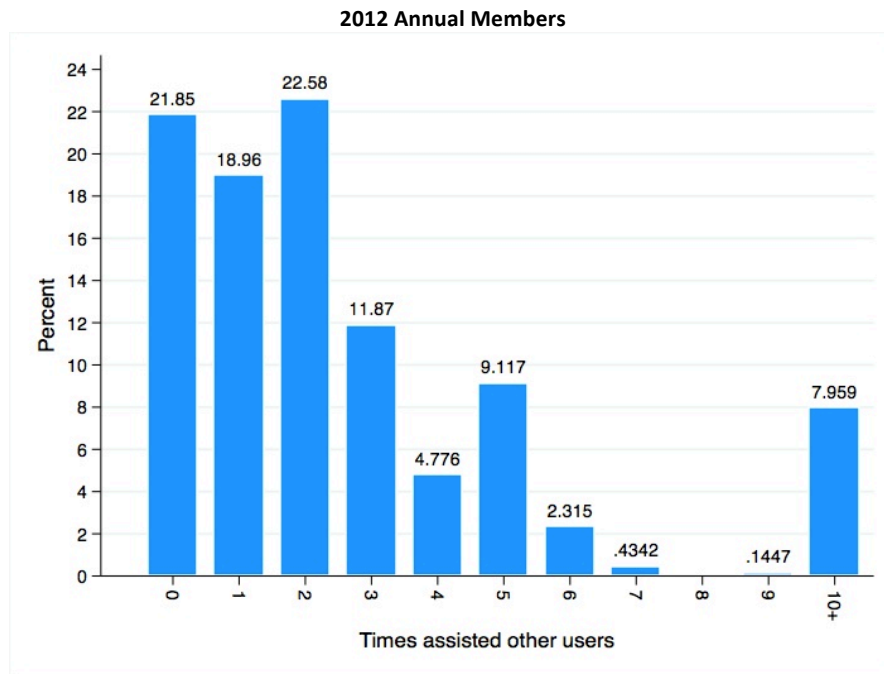
What was the main reason why you first tried Denver B-cycle?



In 2011, more than 50% of annual members reported first trying Denver B-cycle because of various types of social interaction with another person, or because of seeing other people riding B-cycles. Annual members in 2012 also reported social factors as being influential in their first use of Denver B-cycle, but to less of a degree. However, in 2012 the effects of employer-provided passes more than doubled, showing the workplace as another social influence playing a role in disseminating use to more people. Overall, it would appear as though people interacting with each other and the presence of Denver B-cycle stations within the built environment are, to date, the main drivers of first use.

Users as an assisting component

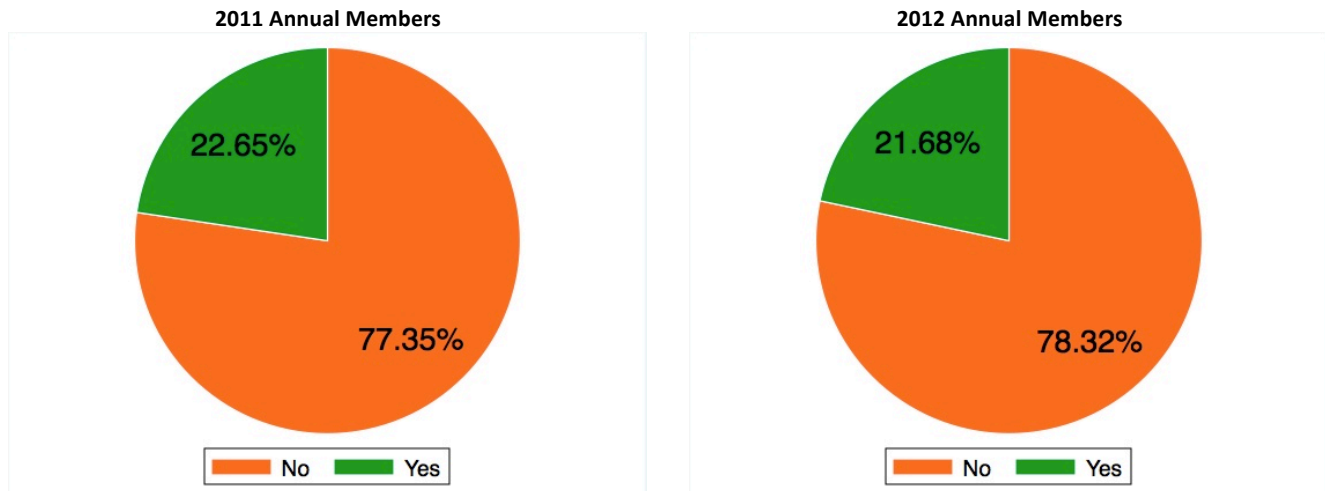
How many times have you helped someone at a B-cycle station to use the system?



Some social influence is due to assistance provided by Denver B-cycle annual members to other people while at stations. Annual members interacting with others who are unfamiliar with the operation of the system appear to be an asset to the function of Denver B-cycle. More than 78% of annual members reported assisting another person at a Denver B-cycle station at least once. Nearly eight percent reported performing assistance ten or more times. These users make up an informal assistance corps and further serve to disseminate understanding of how a shared bicycle system functions.

Helmet use

Thinking about your most recent trip on Denver B-cycle, were you wearing a bike helmet?



The use of bicycle helmets has been debated from a public health standpoint, weighing the benefits of reduced head injuries versus the costs of reduced bicycle use by those who may not ride if required to wear a helmet (20). There is no resolution to the issue, and cases regarding mandatory helmet use offer findings ranging from no effect on bicycling activity (21), to a suppressive effect on bicycling activity (22).

However, in the case of public bicycle sharing, requiring a helmet for use poses a major barrier to participation (23). Observed helmet use among users of public bicycle sharing systems is lower than that of riders of private bikes (24, 25), and Denver B-cycle users have previously reported higher helmet use on their personal bicycles compared to when they are on shared bikes (12).

Although it is generally thought to be a good idea to use a helmet while bicycling, the nature of some of the trips made via shared bikes is different than those made on private bikes. Some trips via shared bike are opportunistic, in that users may not have necessarily planned to ride a bike, or did not have access to a helmet on a given day. Denver Bike Sharing encourages users to wear helmets, and has offered helmet giveaways and various discounts on helmets in conjunction with local bike shops. As of the end of 2012 Denver B-cycle had logged more than 500,000 trips over three years. During this time, no serious head injuries while using Denver B-cycle bikes have been reported.

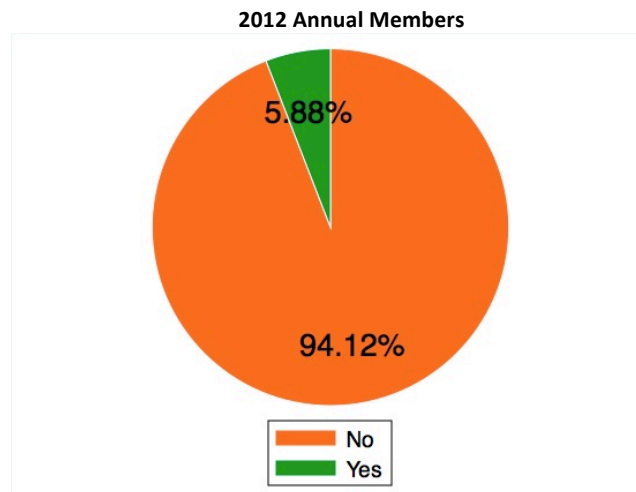
The use of a bike helmet while riding shared bikes has not yet become socially normalized among Denver B-cycle annual members, but the literature suggests that, in general, helmet use among users of shared bikes is not as common as even among the same riders while on their own bicycles (12, 24, 25). Certainly, there is much to learn not only about helmet use, but also of policies designed to encourage and protect bicycle transportation from continued examination of the many cities in Europe and Asia, areas with much higher bike use and lower incidence of bicycle-related injuries.

Economic Impacts

Gauging economic effects of public bicycle sharing is of interest to municipalities in which the programs operate, as well as to the operators themselves who often rely on sponsorship to, in part, fund the system. In turn, those within the bicycle business community and the community of businesses near bike sharing stations may wonder about relevant economic effects of bike sharing use.

Bicycle purchasing activity

Have you purchased a bicycle of your own because of your experience using Denver B-cycle?

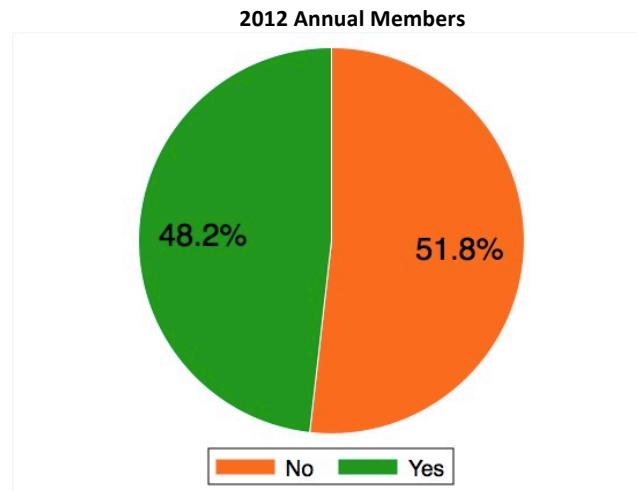


Nearly six percent of Denver B-cycle annual members reported the purchase of a bicycle because of their experience using of Denver B-cycle. However, within the group self-classified as *Interested but concerned*, 7.14% reported buying a bike, which is higher than annual members as a whole. As a group, the *Interested but concerned* annual members also outperformed the groups of more confident bicyclists in the purchase of bikes, reporting a higher bike purchase rates than the groups *Enthusied and confident* at 5.96% and *Strong and fearless* at 4.46%.

Among those who were only short-term users of Denver B-cycle, but who identified as *Interested but concerned*, 6.09% indicated they had purchased a bicycle as a result of their Denver B-cycle experience. Beyond the use of shared bikes, the use of Denver B-cycle appears to have contributed to an overall increase in bicycle interest among the *Interested but concerned*, whether annual members or not.

Business patronage

Do you choose to go to businesses based on how close they are to a Denver B-cycle station?



Nearly half of Denver B-cycle annual members reported choosing to patronize businesses that are close to a Denver B-cycle station. Evidence of this practice is observable when Denver B-cycle stations fill to capacity near popular destinations, such as restaurants and places of entertainment, during lunch hours, on evenings, and on weekends.

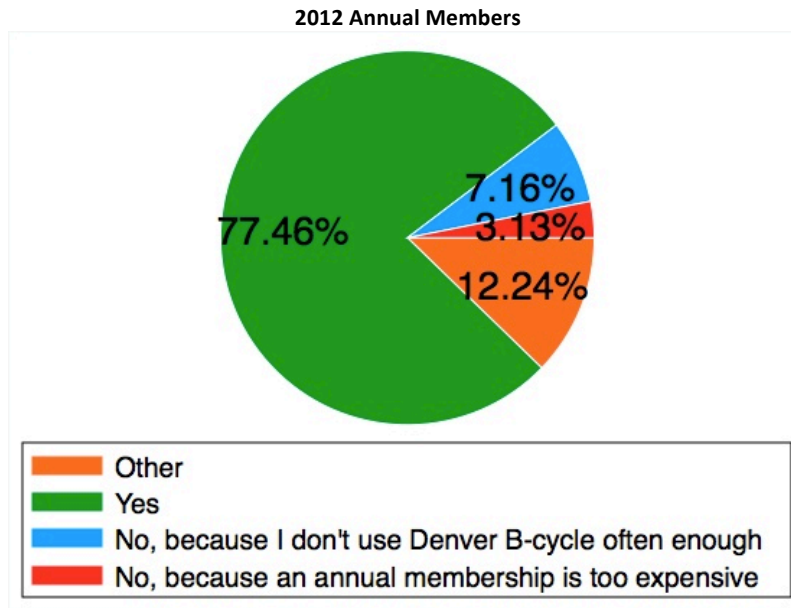
Saved money as a perceived benefit

Using Denver B-cycle saves me money through:

Responses in descending order of frequency:	2012 Annual Members (affirmative responses)
Reduced car fuel expenses	75.68%
Reduced car parking expenses	71.47%
Reduced car ownership expenses	21.32%
Reduced expenses for bus or train fare	13.81%
Access to less expensive food options	4.50%
Reduced gym membership expenses	3.60%

Many Denver B-cycle annual members experience perceived savings as a result of their use of shared bikes. Among annual members, a strong majority reported saving money through reduced expenses for car parking or fuel. More than 21% reported saving money through reduced car ownership expenses. Other transportation related savings included reduced expenses for bus or train fare. Reduced expenses related to food access and gym membership were reported at lower rates.

Are you planning to buy/renew a Denver B-cycle annual membership?



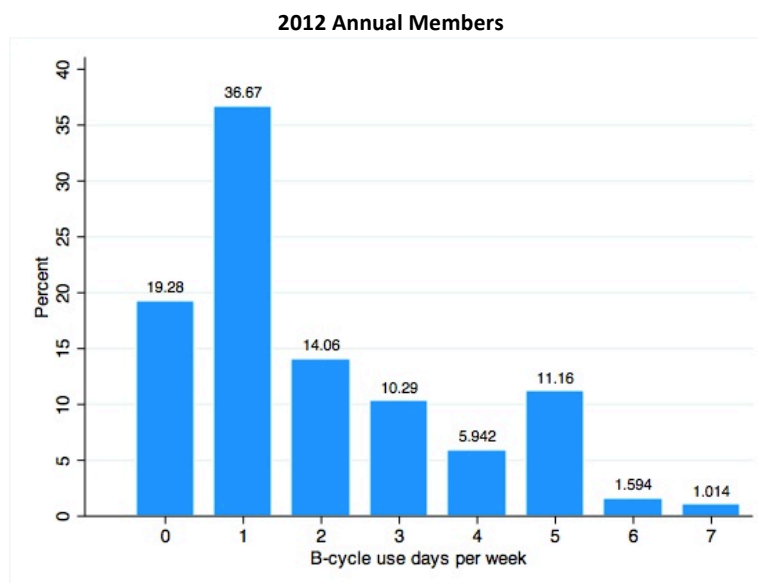
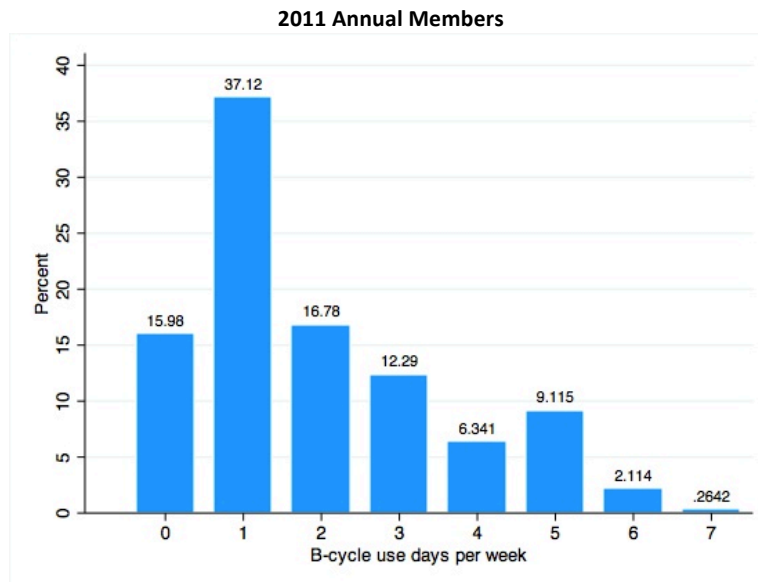
Annual members by and large appear to perceive value in their participation, with 77.46% responding that they plan to renew their membership. Those annual members who responded that they did not intend to renew, did not use the system frequently enough to justify membership, or found it to be too expensive. Of the “other” responses, several stated that their decision to renew had not yet been made, and many stated that they had either moved from the area or had a job change that made it unlikely that they would be able to use Denver B-cycle.

Active Transportation

A primary objective of Denver B-cycle is to provide a non-motorized transportation alternative so that users may engage in active transportation, thus contributing to attainment of overall individual physical activity recommendations. Ideally, users build the incorporation of shared bikes into their everyday activities and develop habitual use. The frequency of use of Denver B-cycle, the types of trips made on shared bikes, and the modes replaced by their use are key items for consideration of the impact of Denver B-cycle on active transportation.

Frequency of use

On average, how many days a week do you use Denver B-cycle?



In 2012, 80.72% of Denver B-cycle annual members reported using the system one or more times per week. As compared to 2011, this is a decrease of more than 3%. Overall, the frequency of use of Denver B-cycle appears to be fairly stable among annual users, with some increases in those reporting five, six, or seven days of B-cycle use per week.

Trip destinations

What are the destinations of the trips you make using Denver B-cycle? Please select any that apply.

Responses in descending order of frequency:	2012 Annual Members (affirmative responses)
A social event or a date	55.87%
A restaurant, bar or pub	55.44%
Commuting to or from work	43.55%
A sporting or entertainment event	34.53%
Work-related meeting or errand	33.38%
Recreation or exercise with no specific destination	29.94%
Shopping for groceries or food	24.21%
To or from a light rail station/stop	22.49%
Shopping for clothes or other goods	20.20%
To or from a bus station/stop	16.76%
To or from car parking	13.75%
A government office, such as the Colorado Department of Human Services	10.03%
Other	7.88%
Commuting to or from school	5.30%

Many of the trip destinations of Denver B-cycle annual members serve regularly occurring utilitarian transportation needs. Shared bikes are becoming integrated into work purposes. More than 43% of annual members reported using Denver B-cycle to commute, and more than 33% used shared bikes for work-related meetings or errands. Work-related trips may include those made by people who arrived at work by other means, but who used Denver B-cycle for incidental trips during the day.

The linkage between other modes and Denver B-cycle is apparent in trips made on shared bikes. Joint use of shared bikes with transit, to access light rail and bus facilities were reported destinations of annual members, with 22.49% and 16.76% respectively. Another 13.75% of annual members reported using Denver B-cycle in conjunction with car parking. People using Denver B-cycle from areas of free or lower-cost car parking can be observed at several stations on the perimeter of the central business district.

Trips via Denver B-cycle by annual members contribute to commercial activities; more than 24% report using shared bikes while food shopping, and more than 20% report shopping for clothes or other goods. In addition, annual members report using shared bikes to go to entertainment-related destinations, such as restaurants, bars and pubs (55.44%), and sporting or entertainment venues (34.53%).

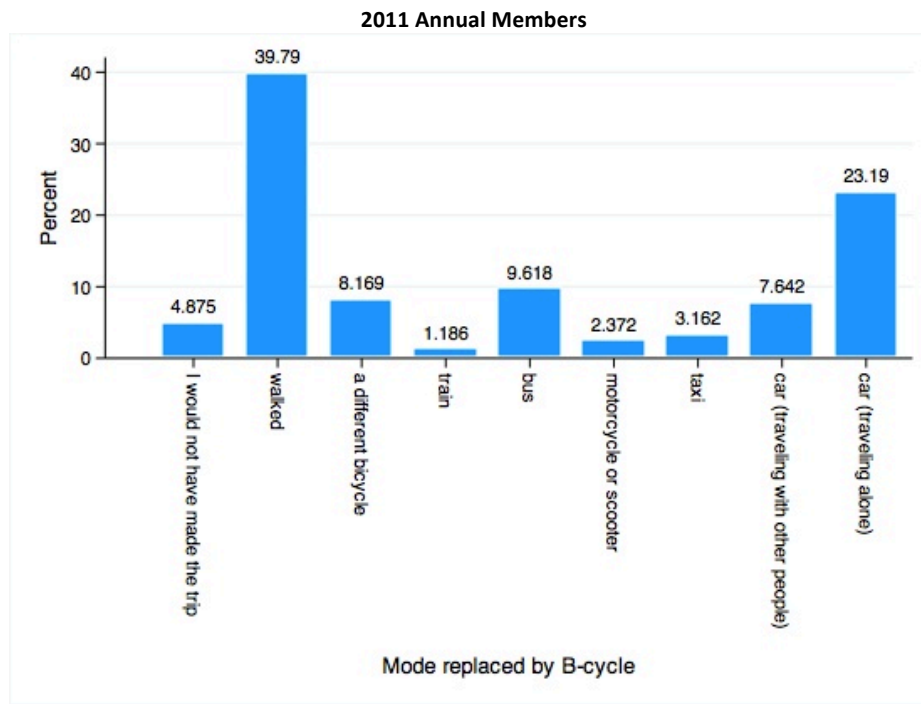
The social component of Denver B-cycle use is strongly represented as a trip purpose. More than 55% of annual members reported using shared bikes for trips to social events or dates. Recreational activities with no specific destination were also reported by annual members, with nearly 30% indicating this trip type. Other destinations cited included riding to car mechanics, church, medical visits, and for one-way trips or part of a trip to be completed via another mode.

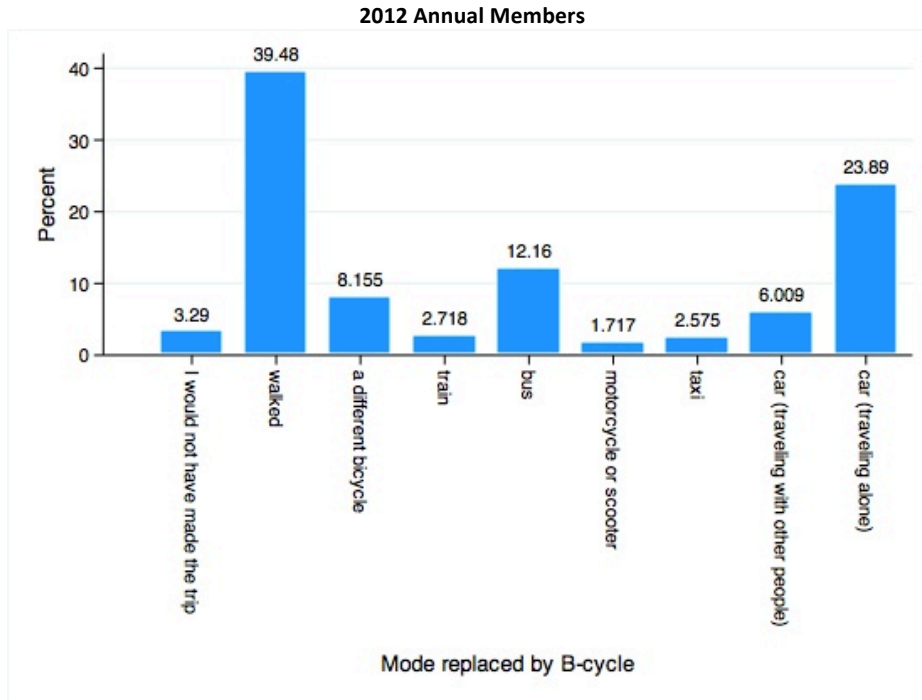
Overall, the destinations of trips made on Denver B-cycle bikes mirrors the variety of trip types common in an urban setting. It appears as though the broad range of destinations for which shared bikes are used indicates some level of integration of their use into the lifestyles of annual members.

Denver B-cycle mode replacement

The degree to which the destinations outlined above replace individual motorized modes is important in determining any impact on active transportation behavior. Shared bike trips that replace walking trips or trips on a different bicycle do not represent a net change in active transportation. Replaced trips that might have otherwise been made by transit or individual motorized modes suggest an increase in active transportation, as do trips that otherwise would not have been made. Of the modes replaced by Denver B-cycle use in 2012, a total of 34.19% were individual motorized modes (car, taxi, and motorcycle or scooter), which are those most closely associated with elevated risk of obesity (6).

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?



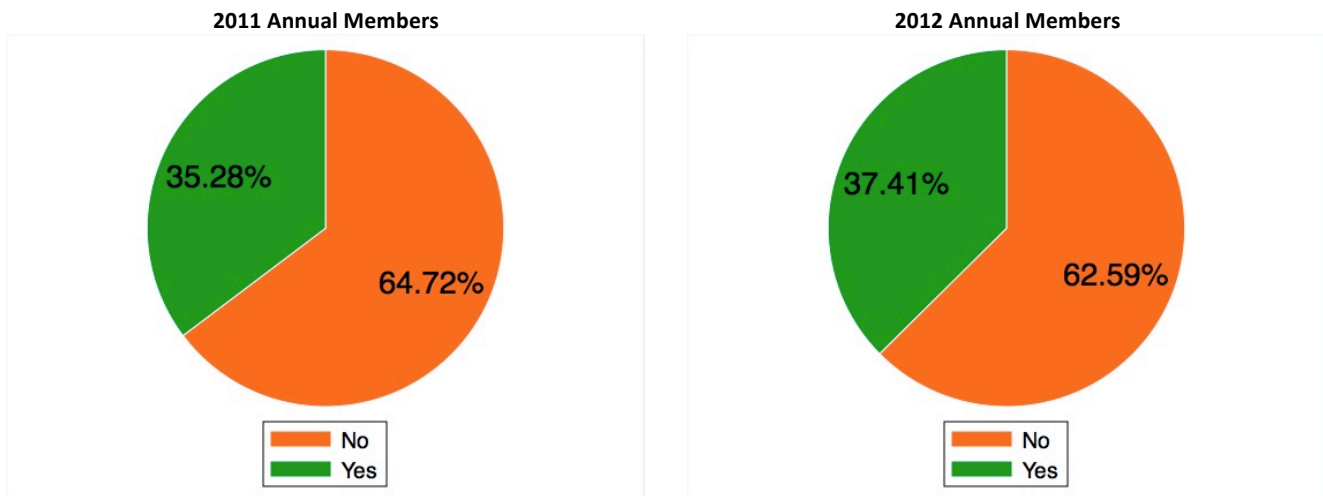


According to usage generated data collected automatically by the Denver B-cycle system, on average, annual members logged 47.3 checkouts at an average duration of 14.2 minutes during 2012. Annual members averaged 11.0 weeks of activity, during which checkout time averaged 60.8 minutes per week. Based on survey responses, an estimated combined 52.4% of trips on shared bikes replaced either non-active modes or trips that would not have been made. Therefore, via Denver B-cycle, annual members benefited from an estimated average 31.9 minutes of additional active transportation behavior per week of activity than they would have otherwise experienced.

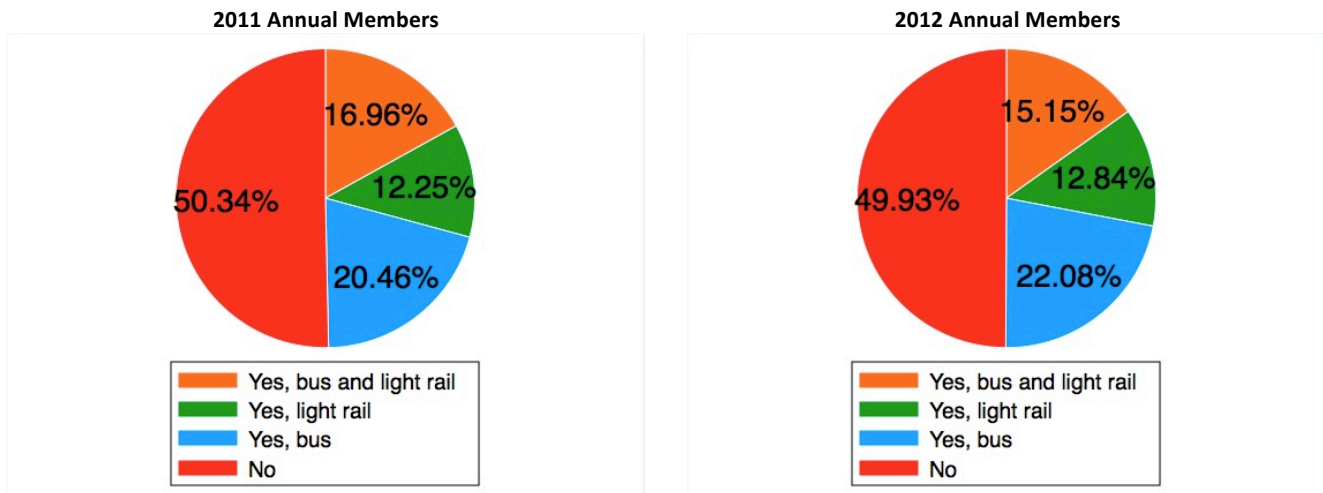
Denver B-cycle and transit

The use of transit is generally regarded as having positive health benefits as compared to individual motorized modes (26, 27). The Denver B-cycle system is designed to function cooperatively with existing bus and train transit modes. Although the replacement of transit modes by Denver B-cycle use among annual members rose between 2011 and 2012, overall, their use of transit increased, as shown in the following.

Do you have an RTD Eco Pass or other public transportation pass, such as a student ID card?

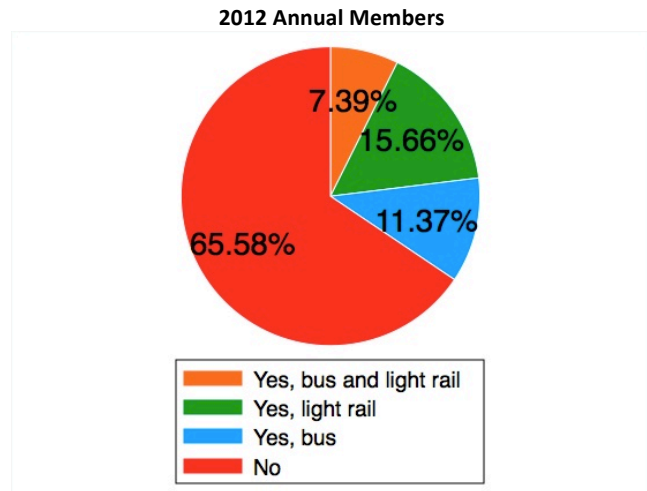
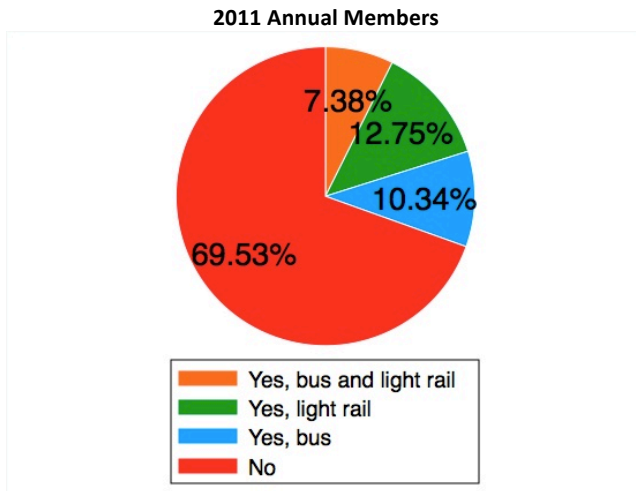


Do you regularly use public transportation?

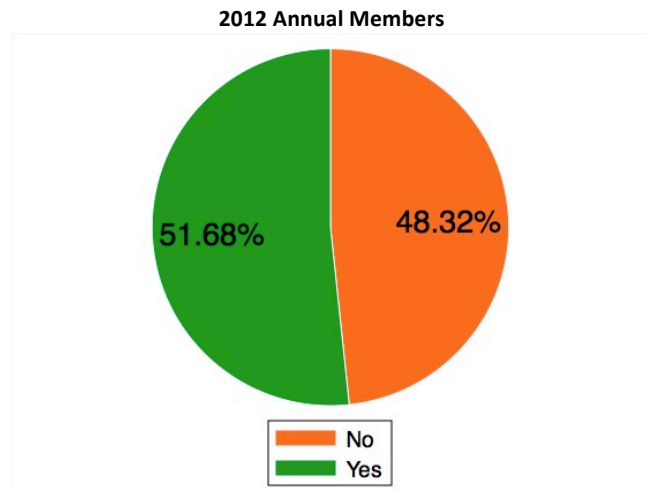
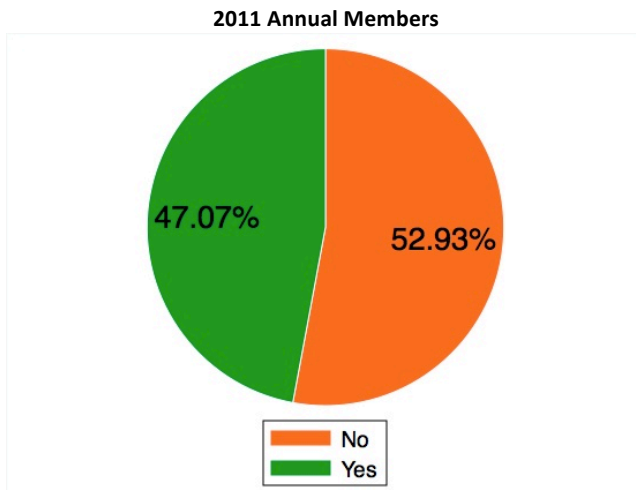


The percentage of Denver B-cycle annual members who have a transit pass increased by a net of more than 2% between 2011 and 2012, and the percentage who responded as regularly using public transportation increased slightly. Similarly, the annual members who responded as using shared bikes to go to or from bus or light rail also increased. In 2012, 34.42% of annual members reported using Denver B-cycle to access transit, versus 30.47% in 2011, as shown in the figure below. The largest gain, a net increase of nearly 3%, was due to annual members going to or from light rail stations on shared bikes.

Do you use Denver B-cycle to go to or from bus or light rail stops or stations?



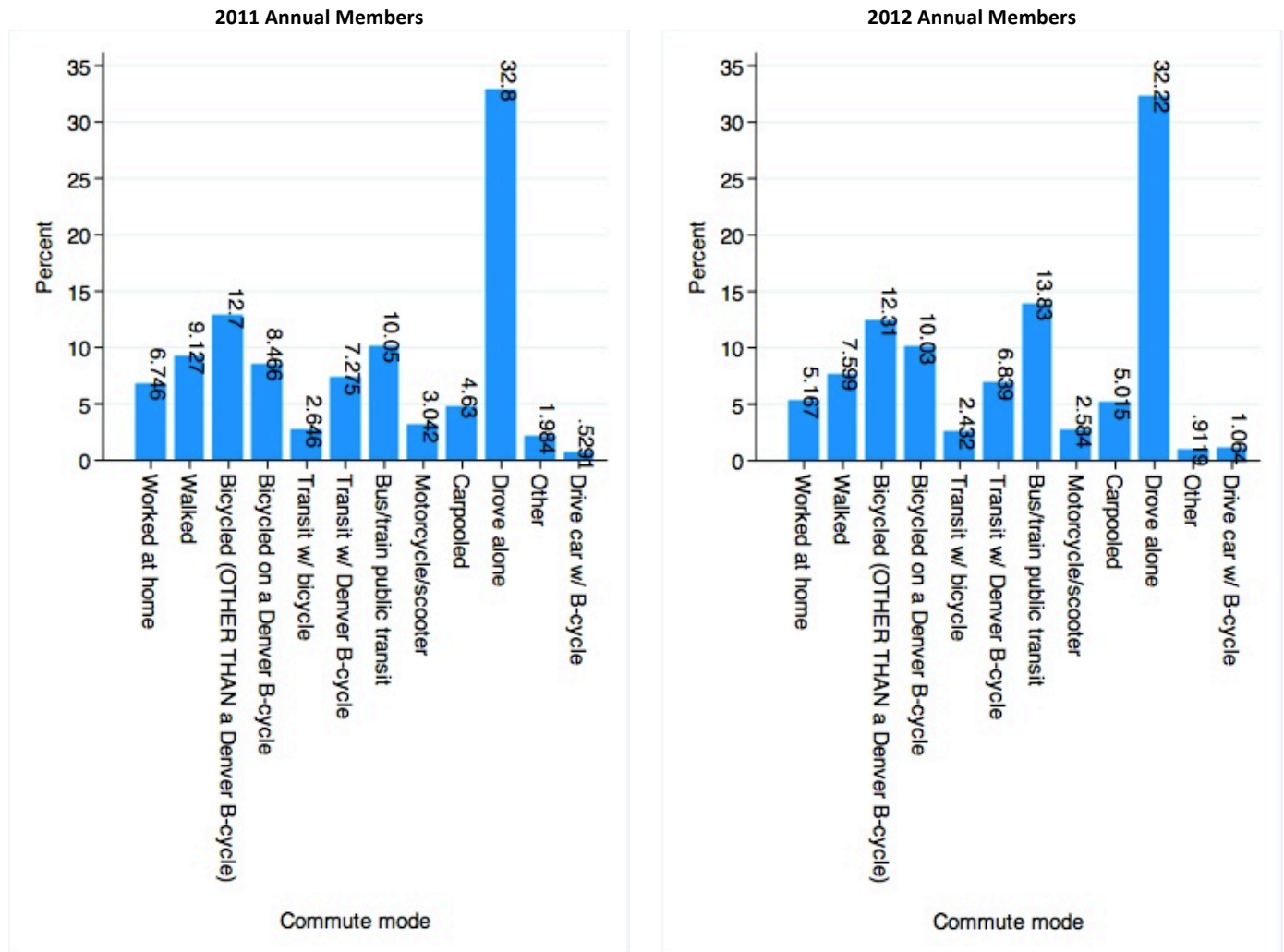
Does joint access to Denver B-cycle and public transportation allow you to leave your car at home?



The combination of transit modes and Denver B-cycle combined to enable annual members to leave their cars at home. Those reporting leaving their car at home as a result of joint transit / shared bike use rose by a net of 4.61% between 2011 and 2012.

Commuting characteristics

What means did you use most often to get to work or school last week?



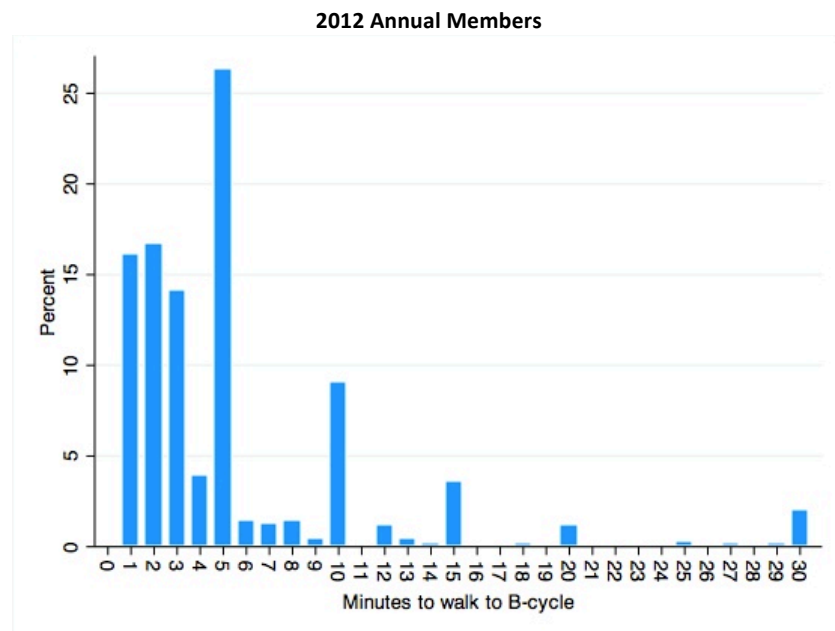
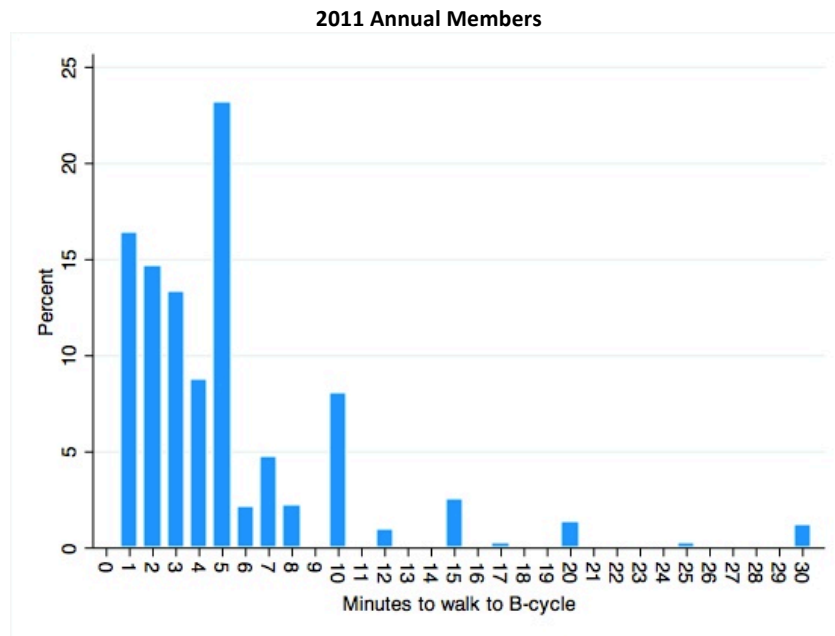
Denver B-cycle annual members differ from the general population in their commuting choices. The popularity of transit among annual members is reflected in their commute mode choice, in which commuting by transit increased between 2011 and 2012. In 2012, annual members were also less likely to commute by car than the general population, with 32.22% driving alone, as compared to 70.4% of Denver's commuters who are solo drivers. They were also more likely to choose active transportation modes than the general population of Denver, among which bicycling accounted for 2.4% of commutes and walking 4.6% of commutes in 2011 (9).

In 2012, 10.03% of annual members reported using Denver B-cycle as a sole commute mode. Additionally, 6.84% commuted via transit with a Denver B-cycle portion, and 1.06% commuted by car with a Denver B-cycle portion. In all, 17.93% of annual members used Denver B-cycle as all or part of their commute, as compared to 16.28% in 2011.

An item of note is the joint use of Denver B-cycle with a car as a commute combination. Car parking was identified previously as a trip destination, and is supported by the observation that this type of joint use for commuting doubled between 2011 and 2012. Although as yet a very small percentage of annual members use cars with shared bikes for commuting, by percent, it was the fastest growing commute choice among annual members.

Walking to access a B-station

On average, how many minutes do you walk to access a Denver B-cycle station?



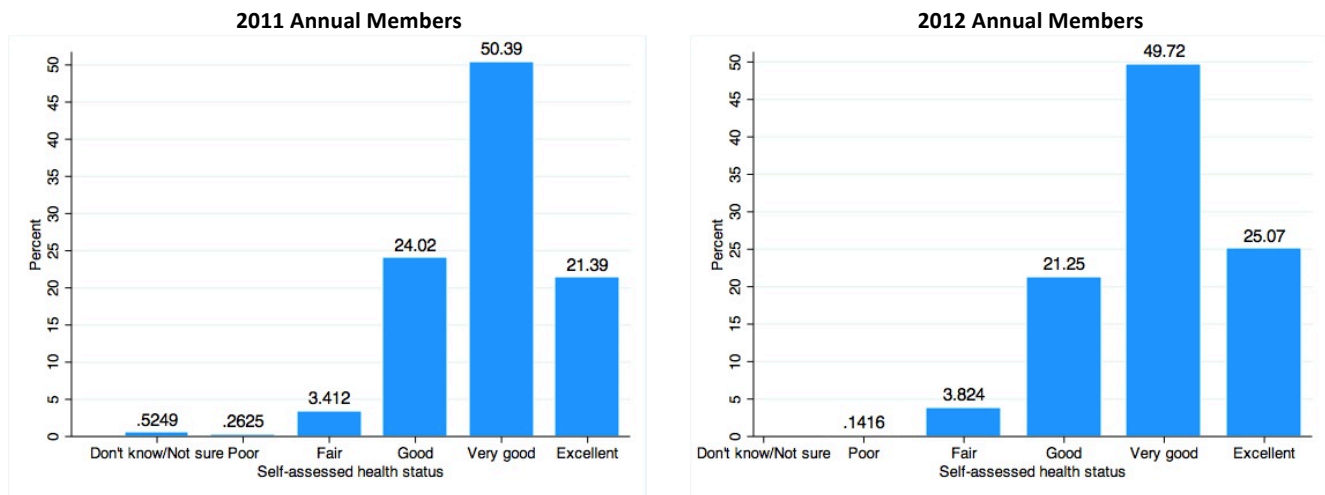
In addition to the activity of riding shared bikes, walking to access a station is integral to the process. Denver B-cycle station locations are often not precisely where a user intends to ultimately travel, so an additional amount of transportation walking occurs in association with each trip. The majority of annual members walk five or fewer minutes to access a bike sharing station, and most of the rest walk ten or fewer minutes. Walking and bicycling are at the core of active transportation, and go hand in hand during the course of completing a trip via shared bicycle.

Health and Quality of Life

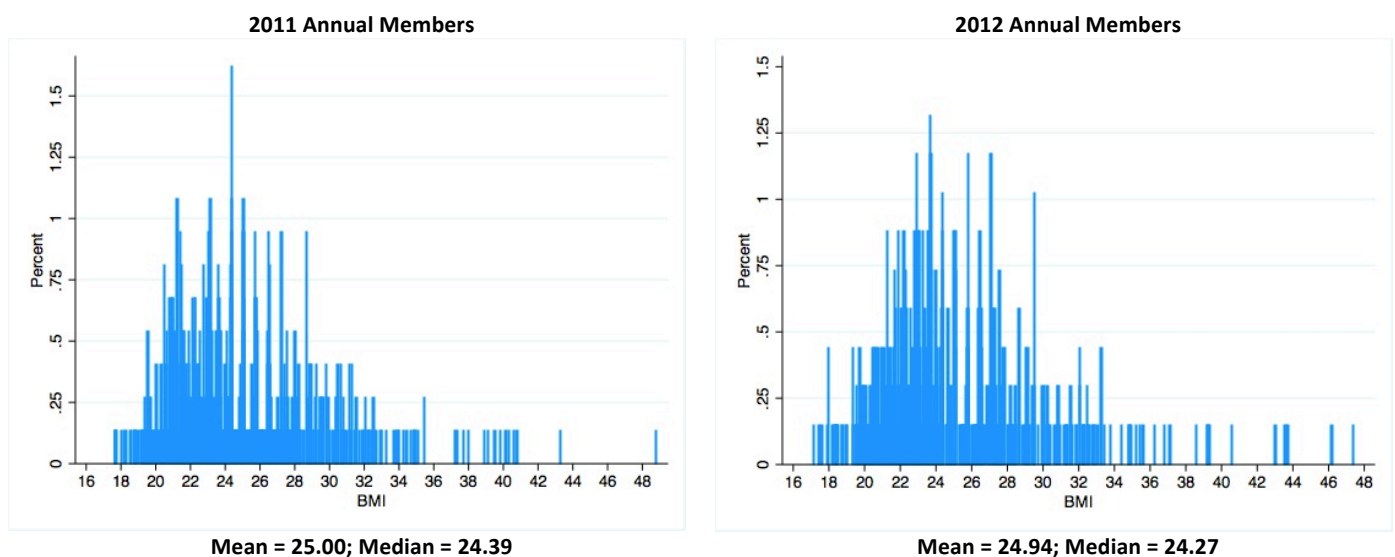
Although Denver B-cycle is positioned as a healthy and fun urban transportation alternative, annual members of the system were found to develop their own motivational reasoning for participation, not all of which is health related (12). The health status of annual members is diverse, but generally includes people who are healthy enough for mild to moderate physical activity, and have sufficient skills to ride a bicycle. By and large, many annual members have a positive assessment of their own health.

Self-assessed health status

Would you say that in general your health is:



Body Mass Index (BMI) derived from self-reported height and weight:



The vast majority of Denver B-cycle annual members reported a self-assessed health status of good, very good, or excellent. However, with regard to body mass index (BMI) derived from self-reported height and weight, nearly half had BMI scores of 25 or more, the break point between normal and overweight classification. About 10% of annual members had BMI scores of 30 or more, the break point for obesity. Therefore, although most of the Denver B-cycle population of annual members consider themselves to be healthy, about half are exposed to increased health risks associated with being overweight or obese. This is a user group not solely comprised of the fittest members of the general population; instead it is largely comprised of people who might most benefit from increases in active transportation afforded through use of Denver B-cycle.

Have you experienced any of the following health effects that you might attribute to your use of Denver B-cycle?

	2011 Annual Members (affirmative responses)	2012 Annual Members (affirmative responses)
Weight loss	14.97%	13.64%
Improved fitness	29.07%	31.52%
Increased energy	26.31%	27.27%
Reduced stress	36.05%	35.45%
Better mood	55.23%	52.27%
I have not experienced any health benefits attributable to Denver B-cycle	28.63%	31.06%

Denver B-cycle annual members attribute improved physical and mental health factors to their use of shared bikes. In 2012, 13.64% of annual members attributed some weight loss to the use of Denver B-cycle. Many also cited improved fitness and increased energy. It is notable that mental health outcomes figured more prominently than physical health outcomes, with 35.45% of annual members reporting reduced stress and 52.27% reporting being in a better mood as a result of using Denver B-cycle. These findings may be interpreted as contributing positively to quality of life, and supportive of related literature that suggests physical activity contributes to improved mental health (28, 29).

Encouragement for use

I would use Denver B-cycle more often if:

Responses in descending order of frequency:	2012 Annual Members (affirmative responses)
there were a station closer to my home	50.16%
there were stations near where I shop or do errands	41.64%
I felt safer riding a bike on the street	20.74%
there were a station closer to my office or school	20.42%
the bikes were lighter or easier to ride	15.43%
there were a station closer to my bus or light rail stop	12.86%
the cost to use Denver B-cycle was lower	9.00%
tricycles were available at Denver B-cycle stations	3.05%
there were help for me to improve my bicycling skills	1.29%
I knew more about how Denver B-cycle worked	0.16%

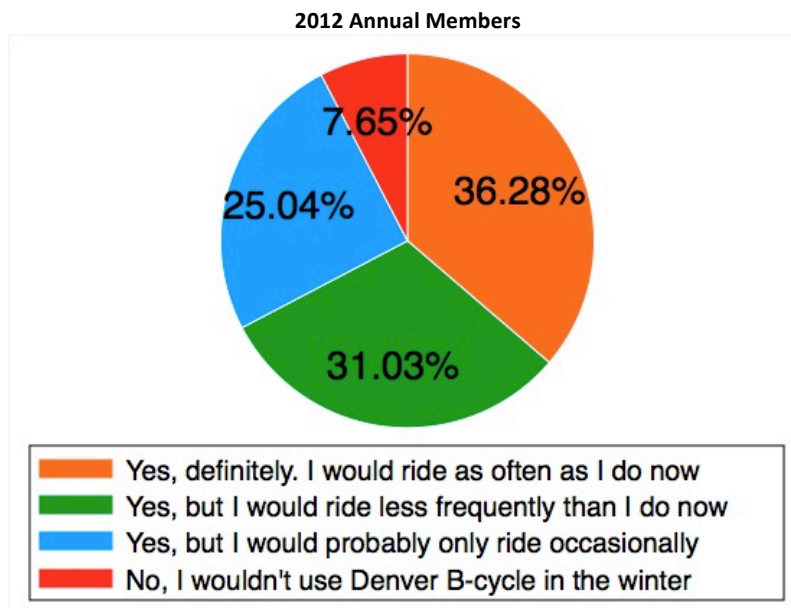
This evidence further supports related findings that proximity to infrastructure supportive of active transportation serves to encourage more active transportation behavior (2, 3, 30). The responses from annual members as to how they might be encouraged toward more use also reinforce an idea that they desire to incorporate the use of Denver B-cycle into their daily activities. Having a station closer to their home or where they shop or do errands are the top two reasons why annual members would use shared bikes more. Having stations near work, school, or transit stops are also highly desired. In total, the desire for stations to be proximate to destinations common to daily activities suggests that, to be most effective, the system must ensure that it serves such destinations.

Another item of note is that 20.74% of annual members said they would ride more if they felt safer riding a bike on the street. This finding illustrates that municipal infrastructural improvements to support bicycling are vital to encourage bike sharing use, particularly to people who may be unaccustomed to riding a bike on the street. Indeed, among annual members who identified as *Interested but concerned*, 49.5% responded affirmatively to this item.

Seasonal closure

Annual members who have integrated use of Denver B-cycle into their transportation behaviors must give up use of the system for a period of three months each year, during the winter hiatus between early December and early March. Many of those who have become dependent on access to shared bikes express interest in maintaining use throughout the year, as shown in the following.

Would you continue to use Denver B-cycle if it were to remain open during the winter months?



Seasonal effects on bicycle use have been documented, in which reduced participation coincides with colder weather and fewer hours of daylight (31, 32). Lower anticipated use during the winter is part of the reason that Denver B-cycle suspends operations during winter months. However, previous research discovered that some Denver B-cycle users find the winter closure to be disruptive to the continuation of behavior patterns that have been established while the system is in operation (12). Because users of shared bikes must establish alternative behaviors during the time when the system is closed, there is a risk that they may not return when it is reopened. This is likely to affect the ridership of Denver B-cycle year to year. Should the system remain open during the winter months, more than 36% of annual members report that they would maintain their frequency of use, and the majority of others report that they would ride at diminished rates during the winter.

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