

How Equitable is Bikesharing? Exploring Population Characteristics and Access to Employment

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INTRODUCTION

Public bikesharing systems have taken off at a rapid pace over the past few years. While shared bicycles can serve multiple purposes and often aim for aspirational goals of mode shift or reduction in car use, they can provide an important first-mile and last-mile link to public transit. Critically, increasing the ease of transit access and egress can substantially increase accessibility to low-wage jobs for transit-dependent populations (1). But bikesharing systems have come under considerable criticism from media and transportation advocates for serving an affluent, largely White population (2-7).

The lack of diversity in bikesharing users does not necessarily reflect a lack of interest in use. For example, when the Minneapolis bikesharing system extended to a low-income area of the city, the program conducted extensive community outreach to determine station placement and barriers to use. The focus groups conducted as part of the outreach found that requiring credit cards for payment excluded members who did not have or did not want to use them for recurring subscriptions. They also found that residents saw cycling as an activity for professionals, or, conversely, as a signifier of lack of success. Other concerns included lack of safe infrastructure for cycling and few attractions to draw visitors to the neighborhood (8). Focus groups of potential users conducted with predominately African American residents in Philadelphia came to similar conclusions about their new bikesharing system. While people were curious about the system, people were hesitant to cycle because of poor infrastructure, and concerns about traffic safety and personal security (9).

Notably, the research to date has investigated the residential characteristics station locations. Given the potential for bikesharing to fill gaps in commute travel both on its own and as a feeder mode to public transit, it is important to examine access to employment as well. This study asks whether bikesharing systems provide equitable access to jobs categorized by employment sector, income level, education needed.

METHODS

There are at least 119 IT-enabled bikesharing systems in the US as of January 2017 (10) (and 153 by another count (11)), but many have only a handful of docking stations and thus do not serve a large proportion of their city's population. I selected the largest 29 bikesharing systems in the United States as measured by docking stations for bicycles (Figure 1). This number represents systems that had at least the median number of docking stations of all systems available with open data sources. The Citybikes application programming interface (API) aggregates bikesharing data feeds into a common technical platform (12). I used this API as the source of docking station location data.

I defined the service area of each bikeshare system as the census block groups located within a 400 m (1/4 mi) radius of all the docking stations, or those within about a five-minute walking distance from a bicycle. The bikeshare systems in New York, Tampa/St Petersburg, Florida, and the San Francisco Bay Area were divided into multiple system groups based on station location clusters. Comparison block groups were those in the same county within 800 m (1/2 mi), 1600 m (1 mi) and 3200 m (2 mi) of the docking stations. Other equity analyses have compared bikesharing service areas to the entire city (13); however, this may not be an appropriate comparison given the infeasibility of bikeshare in lower-density areas (14). I compared sociodemographic and employment variables for the census block groups in each service area with the three other distance bands. Statistical tests of comparison form the basis for analysis. Only results from the comparison with the 3200 m buffer areas appear below.



FIGURE 1 Size and location of largest bikesharing systems.

RESULTS

Results from the population analysis indicate that, for most cities, bikesharing systems serve residential areas that are Whiter, less poor, and more proficient in English (Table 1). Although the absolute values of the proportions vary by small amounts in each of the three buffer distances measured, the signs are consistent in almost every case. By far, the biggest differences between the service areas and comparison areas are in the proportion of the population who is White. Out of 33 system groups analyzed, the share of the White population in 26 services areas was larger than in the 3200 m comparison areas. In half, the difference was at least 10 percentage points greater. In Topeka, San Francisco, Oakland/Berkeley, Minneapolis, and Boulder, however, the bikeshare service areas had more non-White residents than each comparison area; differences ranged from 4 to 14 percent. The differences for the other equity metrics in the population are less disparate and statistically significant, though many still are. For six of the 33 system groups, concentrations of poverty are lower within the service area compared to the largest comparison area, while poverty is higher in 14 service areas. In contrast to the population comparisons, the employment comparisons were more consistent: bikesharing serves higher-status, higher-earning jobs in nearly every city (Table 2).

TABLE 1 Comparison of bikesharing service areas, population characteristics

Bike Share System	Location	White		Black		Latino		Poverty		Limited English proficiency		Zero vehicle households	
		400 m	3200 m	400 m	3200 m	400 m	3200 m	400 m	3200 m	400 m	3200 m	400 m	3200 m
Citi Bike - Brooklyn/Queens	New York, NY	46%	+19%	23%	-6%	21%	-7%	22%	-2%	8%	-9%	65%	+4%
Citi Bike - Manhattan	New York, NY	60%	+30%	7%	-20%	15%	-16%	14%	-11%	8%	-5%	78%	+7%
Divvy	Chicago, IL	39%	+16%	30%	+1%	21%	-22%	23%	+2%	8%	-4%	31%	+13%
Capital BikeShare	Washington, DC	39%	+17%	44%	-24%	11%	+4%	17%	-5%	3%	+1%	37%	+5%
Nice Ride	Minneapolis, MN	61%	-5%	18%	+6%	9%	+1%	25%	+10%	7%	+3%	20%	+10%
Hubway	Boston, MA	56%	-2%	12%	-2%	16%	0%	21%	+7%	10%	0%	37%	+17%
Ford GoBike - East Bay	San Francisco Bay Area, CA	38%	-6%	20%	+8%	14%	-4%	24%	+9%	12%	+3%	26%	+14%
Ford GoBike - San Francisco	San Francisco Bay Area, CA	42%	-12%	5%	0%	18%	+4%	20%	+9%	17%	+10%	53%	+26%
Ford GoBike - San Jose	San Francisco Bay Area, CA	33%	+8%	5%	+2%	37%	-8%	21%	+4%	13%	-3%	14%	+8%
Citi Bike Miami	Miami Beach, FL	36%	+23%	8%	-16%	53%	-8%	19%	-10%	22%	-9%	20%	-2%
Topeka Metro Bikes	Topeka, KS	70%	-14%	10%	+7%	13%	+4%	18%	+9%	2%	0%	9%	+5%
BIKETOWN	Portland, OR	77%	+1%	6%	+1%	7%	-1%	18%	+4%	2%	-1%	24%	+14%
Indego	Philadelphia, PA	46%	+24%	33%	-23%	8%	-9%	26%	-9%	5%	-1%	42%	+2%
Grid Bike Share	Phoenix, AZ	47%	+5%	6%	-1%	35%	-7%	30%	+3%	8%	0%	18%	+6%
Decobike San Diego	San Diego, CA	60%	+11%	5%	-1%	25%	-9%	18%	-1%	6%	-1%	14%	+7%
Metro Bike Share	Los Angeles, CA	24%	+10%	11%	+4%	42%	-20%	30%	+1%	20%	-6%	27%	+6%
Breeze Bike Share	Santa Monica, CA	66%	+9%	4%	0%	16%	-1%	11%	-2%	5%	-1%	9%	+3%
Denver B-cycle	Denver, CO	70%	+15%	6%	-1%	18%	-14%	19%	+2%	3%	-2%	17%	+8%
Relay Bike Share	Atlanta, GA	48%	+3%	36%	-7%	5%	-1%	23%	+2%	2%	0%	16%	+2%

Coast Bike Share - St Pete	Tampa, FL	59%	+5%	29%	-5%	8%	+2%	27%	+6%	2%	0%	25%	+15%
Coast Bike Share - Tampa	Tampa, FL	60%	+21%	17%	-14%	19%	-8%	21%	-3%	6%	-2%	14%	+1%
San Antonio B-cycle	San Antonio, TX	22%	+9%	5%	+1%	68%	-12%	28%	0%	10%	-2%	19%	+5%
BublR Bikes	Milwaukee, WI	66%	+27%	13%	-19%	15%	-8%	27%	-2%	4%	-2%	20%	+1%
Austin B-cycle	Austin, TX	61%	+12%	5%	-3%	23%	-14%	23%	-6%	3%	-3%	11%	0%
Healthy Ride	Pittsburgh, PA	66%	+4%	19%	-10%	3%	0%	30%	+10%	4%	+2%	31%	+9%
CoGo	Columbus, OH	71%	+9%	17%	-11%	3%	0%	36%	+8%	2%	0%	18%	+3%
Fort Worth Bike Sharing	Fort Worth, TX	54%	+24%	12%	+2%	29%	-27%	26%	-1%	5%	-9%	10%	+2%
Houston B-cycle	Houston, TX	49%	+9%	16%	0%	26%	-10%	17%	-2%	6%	-3%	9%	-1%
Cincy Red Bike	Cincinnati, OH	56%	+22%	33%	-27%	3%	+1%	39%	-2%	3%	+2%	26%	-2%
B-cycle	Madison, WI	78%	+6%	4%	-5%	5%	-4%	30%	+17%	4%	0%	20%	+12%
Boulder B-cycle	Boulder, CO	82%	-4%	1%	+1%	8%	+1%	27%	+19%	3%	+1%	11%	+8%
Bike Chattanooga	Chattanooga, TN	63%	+10%	32%	-6%	2%	-4%	30%	0%	2%	0%	22%	+9%
GREENbike	Salt Lake City, UT	68%	+7%	3%	+1%	18%	-5%	25%	+3%	5%	-1%	24%	+13%

Note: 400 m indicates service area, percentages are the population proportion inside service area. 3200 m indicates larger buffer area, values are the percentage point difference the service area is from the larger buffer. (Positive means higher proportion in service area, negative means higher proportion in larger buffer area.) Bold values indicate statistically significant differences ($p < 0.05$). Only larger buffer is shown. Darker colors indicate larger differences.

TABLE 2 Comparison of bikesharing service areas, employment characteristics

Bike Share System	Location	College educated jobs		Less than college educated jobs		Low-income jobs		“Blue-collar”		“White-collar”	
		400 m	3200 m	400 m	3200 m	400 m	3200 m	400 m	3200 m	400 m	3200 m
Citi Bike - Brooklyn/Queens	New York, NY	29%	+5%	28%	-2%	16%	-3%	31%	-10%	9%	+2%
Citi Bike - Manhattan	New York, NY	35%	+7%	22%	-5%	16%	-8%	21%	-19%	41%	-9%
Divvy	Chicago, IL	29%	+5%	26%	-2%	21%	-4%	24%	-12%	29%	+17%
Capital BikeShare	Washington, DC	34%	+7%	27%	-6%	12%	-1%	15%	-25%	25%	+22%
Nice Ride	Minneapolis, MN	31%	-5%	23%	0%	18%	+2%	21%	+9%	29%	-11%
Hubway	Boston, MA	35%	-1%	21%	+1%	17%	-3%	20%	+7%	28%	+4%
Ford GoBike - East Bay	San Francisco Bay Area, CA	35%	+7%	23%	-4%	18%	-9%	23%	-15%	21%	+9%
Ford GoBike - San Francisco	San Francisco Bay Area, CA	36%	+12%	22%	-11%	16%	-6%	23%	-8%	40%	+12%
Ford GoBike - San Jose	San Francisco Bay Area, CA	35%	+1%	22%	-3%	18%	-1%	19%	-14%	25%	+5%
Citi Bike Miami	Miami Beach, FL	24%	+6%	33%	-5%	19%	-10%	30%	-5%	17%	-1%
Topeka Metro Bikes	Topeka, KS	21%	+12%	30%	-9%	25%	-11%	27%	-13%	15%	+29%
BIKETOWN	Portland, OR	31%	+1%	24%	-1%	17%	-1%	25%	+1%	31%	-5%
Indego	Philadelphia, PA	31%	+5%	25%	-4%	17%	-6%	18%	-18%	26%	+7%
Grid Bike Share	Phoenix, AZ	25%	+5%	29%	-3%	17%	-2%	18%	-23%	21%	-7%
Decobike San Diego	San Diego, CA	23%	+10%	30%	-7%	23%	-5%	39%	-20%	20%	+15%
Metro Bike Share	Los Angeles, CA	30%	-1%	27%	0%	15%	-5%	22%	+8%	22%	+3%
Breeze Bike Share	Santa Monica, CA	29%	+6%	26%	-5%	20%	-5%	32%	-15%	35%	+15%
Denver B-cycle	Denver, CO	30%	+8%	25%	-7%	17%	-8%	23%	-21%	29%	+20%
Relay Bike Share	Atlanta, GA	30%	+6%	26%	-4%	17%	-5%	22%	-13%	36%	+2%
Coast Bike Share - St Pete	Tampa, FL	27%	+4%	28%	-3%	21%	-6%	20%	-6%	22%	+28%
Coast Bike Share - Tampa	Tampa, FL	26%	+4%	28%	-5%	19%	+3%	15%	-23%	20%	+6%
San Antonio B-cycle	San Antonio, TX	16%	+7%	36%	-7%	23%	-5%	31%	-34%	16%	+3%

BublR Bikes	Milwaukee, WI	26%	+4%	26%	-4%	24%	+6%	19%	-15%	25%	+26%
Austin B-cycle	Austin, TX	26%	+4%	28%	-3%	16%	-3%	17%	-19%	18%	+2%
Healthy Ride	Pittsburgh, PA	31%	+8%	25%	-7%	16%	-7%	14%	-12%	33%	+14%
CoGo	Columbus, OH	33%	+1%	22%	-1%	16%	+1%	13%	-6%	27%	+8%
Fort Worth Bike Sharing	Fort Worth, TX	23%	+4%	30%	-3%	17%	-6%	20%	-8%	17%	+5%
Houston B-cycle	Houston, TX	26%	+8%	29%	-6%	16%	-9%	22%	-17%	23%	+16%
Cincy Red Bike	Cincinnati, OH	30%	+10%	24%	-8%	17%	-11%	16%	-23%	37%	+11%
B-cycle	Madison, WI	29%	+6%	24%	-3%	18%	-7%	17%	-17%	14%	+12%
Boulder B-cycle	Boulder, CO	31%	0%	22%	-2%	20%	-1%	36%	-11%	25%	-11%
Bike Chattanooga	Chattanooga, TN	22%	+4%	32%	0%	17%	-13%	33%	-11%	23%	-2%
GREENbike	Salt Lake City, UT	30%	+1%	22%	-3%	24%	-4%	27%	-12%	38%	+4%

Note: 400 m indicates service area, percentages are the population proportion inside service area. 3200 m indicates larger buffer area, values are the percentage point difference the service area is from the larger buffer. (Positive means higher proportion in service area, negative means higher proportion in larger buffer area.) Bold values indicate statistically significant differences ($p < 0.05$). Only larger buffer is shown. Darker colors indicate larger differences.

DISCUSSION AND CONCLUSION

By most metrics in this study, the largest bikesharing systems in the United States serve more socially and economically advantaged neighborhoods—those with higher proportions of White residents, lower poverty rates, and higher-paying skilled jobs. The record is slightly more mixed for residential characteristics, in that bikesharing systems are more likely to serve zero-vehicle households and in several cities serve more higher-poverty neighborhoods. But the patterns are clearer for the employment data; bikesharing is not likely to meet the needs of lower-income job holders. This is an important point to consider: commute trips, while not making up the majority of all bikeshare trips, are the most common type of trip in several of the systems analyzed (15). The findings corroborate this study's hypothesis that bikesharing systems do not provide equitable access to employment.

Partly in response to criticism that bikeshare tends to attract wealthier, more educated, White users, several system operators have made concerted efforts to incorporate program elements that would reduce the barriers to use for people who do not fit that profile. For example, a partnership between the regional bicycle coalition and transportation equity groups advocated for an expansion of the San Francisco Bay Area's bikesharing system into predominately low-income Black and Latino neighborhoods near two rail stations in Oakland. They also worked to secure discounts for low-income users and will conduct outreach in partnership with two bicycle organizations led by people of color (16). These efforts are reflected in the study results, which show the East Bay portion of the bikesharing system as serving more neighborhoods with higher proportions of Black residents, people in poverty, and limited-English speakers. Indeed, many large systems now have written plans or goals to meet equity considerations (17). But targeted outreach still remains a challenge for many operators and is critical for educating and engaging potential new users. The efforts require investment by cities and bikesharing operators; research suggests that simple online outreach is not adequate to reaching targeted populations (18).

Bikesharing requires density to work well. Because lower-income and lower-skilled jobs tend to be spatially dispersed in metropolitan areas, it is unlikely that traditional bikesharing will be able to provide equitable access to employment without a robust public transit network. Where there are disparities, cities and bikesharing operators should consider integration in both transit-dense areas and transit-poorer areas, such as suburban locations to where lower-wage workers would be commuting. Integration could also mean linking fare policies and media so that access to transit by shared bicycle would be treated as if traveling the transit network itself. Finally, incorporating the business community as a partner in bikeshare station planning could help bring systems to areas where lower-skilled jobs are clustered. For these reasons, future work should analyze bikesharing systems in conjunction with public transit networks to understand whether they provide equitable access to employment. Additional research should also focus spatial analysis on other destination types paired with residential locations to understand individual levels of accessibility by bikesharing.

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