Public Bikesharing in North America: Early Operator and User Understanding

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Overview

• Public bikesharing defined
• Public bikesharing: history
• Study methodology
• Bikesharing operations in North America
• N. American bikesharing impacts & developments
• Future innovations
• Summary
What is Public Bikesharing?

- Bikesharing organizations maintain fleets of bicycles in a network of locations.

- Stations typically unattended, concentrated in urban settings and provide a variety of pickup and dropoff locations.

- Allows individuals to access shared bicycles on an as-needed basis.

- Subscriptions offered in short-term (1-7 Day) and long-term (30-365 Day) increments.
Bikesharing Station Examples

Hubway

B-cycle
Station Map

In Service  Out of Service  Planned  New *

Suggest Locations  Download a Printable Map

Source: Hubway
Bikesharing Generations

- 1\textsuperscript{st} Generation: Free Bikes (“White Bikes”)
  - Demonstration and provided increased mobility
- 2\textsuperscript{nd} Generation: Coin-Deposit Systems
  - Emerged from a need to deter theft and incentivize return.
- 3\textsuperscript{rd} Generation: Information Technology (IT) System
  - Provides real-time information; employs technology to assist in rebalancing demand.
- 4\textsuperscript{th} Generation: Demand-Responsive, Multi-Modal Systems
  - Mobile docking stations; smartcard integration with public transit; bike redistribution innovations; GPS tracking, touchscreen kiosks, and electric bikes.
N. America: Historical Overview

• North America’s first IT-based bikesharing system, Tulsa Townies, started operating in 2007 in Tulsa, OK
  • First solar-powered, fully automated docking-based system in the world; provides service free of charge.

• In Canada, first IT-based public bikesharing system, BIXI (BIcycle-TaXI), began operating in 2009 in Montreal
Study Methodology

• Literature review

• Operator interviews with all 19 North American IT-based programs operational as of April 2012

• Conducted 14 expert interviews with transportation personnel, transit operators, policymakers, and community bike coordinators

• Completed online survey with users of early public bikesharing systems in: Montreal; Toronto; Washington, D.C.; and the Twin Cities (Minneapolis and Saint Paul)

• Analyzed operational data from two American operators for 2011
Startup/Closures: 1994 - May 2012
Bikesharing: North America

As of January 2012, 19 IT-based programs:
- 216,422 users and 11,473 shared bicycles

As of May 2012, there were 21 IT-based operations.

18 more planned in 2012-2013 (NYC, Chicago, LA, SF)

Shaheen et al., 2012
Business Models

1. Non-Profit (e.g., Denver B-Cycle)
   – Start-up and operational funding commonly supported through grants, sponsorships and loans

2. Privately Owned and Operated (DecoBike)

3. Publicly Owned and Operated (Golden Community Bike Share)

4. Publicly Owned and Contractor Operated (e.g., Capital Bikeshare)

5. Street Furniture Contract (SmartBike DC—closed)

6. Third-Party Operated (e.g., Chicago B-Cycle)
   – Profit-sharing agreement operated with local business

7. Vendor Operated (Bike Nation)
   – Operated by the same company that designs/manufactures system equipment
Seasonal vs. Year-Round Operations

Shaheen et al., 2012
Business Models

Shaheen et al., 2012
Types of Funding/Revenue Sources

Type of Funding and Revenue

Shaheen et al., 2012
Optimum Distance Between Docking Stations

Shaheen et al., 2012
Optimum Distance From Public Transit

Shaheen et al., 2012

Number of Operators by Country

- Less than 25 yards
- 25 - 50 yards
- 50 - 100 yards
- 100 - 300 yards
- 300 yards - 1/4 mile

Canada
U.S.

n = 9
Docking Station Features

Shaheen et al., 2012
Bicycle Access

- Smart Key: 32%
- Smartcard: 58%
- Access Code (only): 10%

n = 19

Shaheen et al., 2012
## Bikesharing Impacts

<table>
<thead>
<tr>
<th>市</th>
<th>年</th>
<th>日均旅行</th>
<th>日均里程</th>
<th>日均二氧化碳减排量（Kg Per Day）</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIXI Montreal</td>
<td>2011</td>
<td>20,000</td>
<td>50,000</td>
<td>8,760</td>
</tr>
<tr>
<td>Boulder B-Cycle</td>
<td>2011</td>
<td>18,500</td>
<td>47,174</td>
<td></td>
</tr>
<tr>
<td>Denver B-Cycle</td>
<td>2011</td>
<td>202,731</td>
<td>694,942</td>
<td>280,339</td>
</tr>
<tr>
<td>New Balance Hubway (Boston)</td>
<td>2011</td>
<td>140,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madison B-Cycle</td>
<td>2011</td>
<td>18,500</td>
<td>46,805</td>
<td></td>
</tr>
<tr>
<td>San Antonio B-Cycle</td>
<td>2011</td>
<td>22,709</td>
<td>38,575</td>
<td></td>
</tr>
</tbody>
</table>

Shaheen et al., 2012
## Member Survey: Overview
### Fall 2011/Early 2012

<table>
<thead>
<tr>
<th>Program</th>
<th>Users</th>
<th>Bicycles</th>
<th>Stations</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Bikeshare (D.C.)</td>
<td>18,000</td>
<td>1,200</td>
<td>130</td>
<td>5,248</td>
</tr>
<tr>
<td>Nice Ride Minnesota (Twin Cities)</td>
<td>3630</td>
<td>960</td>
<td>116</td>
<td>1238</td>
</tr>
<tr>
<td>BIXI-Montreal</td>
<td>40,000</td>
<td>5,120</td>
<td>411</td>
<td>3,322</td>
</tr>
<tr>
<td>BIXI-Toronto</td>
<td>4,000</td>
<td>1,000</td>
<td>80</td>
<td>853</td>
</tr>
</tbody>
</table>

Shaheen et al., 2012
### Basic City Statistics of Member Survey

<table>
<thead>
<tr>
<th>Transit Facts</th>
<th>Washington, D.C.</th>
<th>Toronto</th>
<th>Montreal</th>
<th>Minneapolis-St.Paul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilometers of Rail Track</td>
<td>341</td>
<td>373</td>
<td>122</td>
<td>40</td>
</tr>
<tr>
<td>Number of Buses</td>
<td>1,495</td>
<td>1,811</td>
<td>1,600</td>
<td>885</td>
</tr>
<tr>
<td>Number of Rail (or Metro) Cars</td>
<td>1,106</td>
<td>951</td>
<td>759</td>
<td>27</td>
</tr>
<tr>
<td>Unlinked trips</td>
<td>418,125,650</td>
<td>477,357,000</td>
<td>388,600,000</td>
<td>78,048,647</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>601,723</td>
<td>2,503,281</td>
<td>1,620,693</td>
<td>667,646</td>
</tr>
<tr>
<td>Area (km²)</td>
<td>177</td>
<td>630</td>
<td>365</td>
<td>288</td>
</tr>
<tr>
<td>Population Density (pop/km²)</td>
<td>3,400</td>
<td>3,972</td>
<td>4,439</td>
<td>2,317</td>
</tr>
<tr>
<td>Year of Data</td>
<td>2010</td>
<td>2010 (transit)</td>
<td>2010 (transit)</td>
<td>2010</td>
</tr>
</tbody>
</table>

*Transportation Sustainability Research Center, University of California, Berkeley*

*Institute of Transportation Studies, Berkeley*
Distribution of Key Demographics

**Income**
- Less than $10,000: 4%
- $10,000 to $14,999: 2%
- $15,000 to $19,999: 4%
- $20,000 to $24,999: 5%
- $25,000 to $29,999: 13%
- $30,000 to $34,999: 14%
- $35,000 to $39,999: 19%
- $40,000 to $44,999: 14%
- $45,000 to $49,999: 12%
- $50,000 to $54,999: 7%
- $55,000 to $59,999: 6%
- $60,000 or more: 0%
- Prefer not to answer: 6%

**Age**
- 16–17 years old: 0%
- 18–24: 11%
- 25–34: 48%
- 35–44: 21%
- 45–54: 10%
- 55–64: 8%
- 65 years or older: 1%
- Prefer not to answer: 0%

**Education**
- Less than high school: 0%
- High school: 2%
- Technical school/Cégep: 9%
- Bachelor's degree: 42%
- Advanced degree: 46%
- Prefer not to answer: 1%

**Race/Ethnicity**
- Asian/Pacific Islander: 6%
- Black/African-American: 2%
- Caucasian: 79%
- Hispanic/Latino: 4%
- Other: 5%
- Prefer not to answer: 4%
Bikesharing Trip Purpose

Montreal

Question: What is your most common trip purpose for using BIXI?

- Go to work or school: 56%
- Go to a meeting: 2%
- Go to a restaurant/meal: 1%
- Go shopping: 1%
- Run errands: 19%
- Exercise/recreation: 10%
- Other (please specify): 3%
- N = 3299

Toronto

Question: What is your most common trip purpose for using BIXI?

- Go to work or school: 50%
- Go to a meeting: 8%
- Go to a restaurant/meal: 2%
- Go shopping: 2%
- Run errands: 11%
- Exercise/recreation: 19%
- Other (please specify): 2%
- N = 843

Minneapolis-St. Paul

Question: What is your most common trip purpose for using Nice Ride Minnesota?

- Go to work or school: 38%
- Go to a meeting: 8%
- Go shopping: 7%
- Go to a restaurant/meal: 1%
- Exercise/recreation: 14%
- Run errands: 14%
- Other (please specify): 9%
- N = 1232

Washington, D.C.

Question: What was the primary purpose of your MOST RECENT Capital Bikeshare trip?

- Go to or from work: 38%
- Go to a meeting: 6%
- Restaurant/meal: 7%
- Shopping: 4%
- Run errands: 21%
- Exercise/recreation: 12%
- Other (please specify): 7%
- N = 5140
Commute Times in the United States

Washington, D.C. and Arlington, VA

- Washington, D.C. and Arlington VA (1-year ACS 2010)
- Capital Bikeshare, N = 4342

Minneapolis, MN

- Minneapolis (1-year ACS 2010)
- Nice Ride Minnesota, N = 971
Commute Times in Canada

Montreal, QC

- Quebec General Social Survey
- Bixi Montreal, N = 2851

Toronto, ON

- Ontario General Social Survey
- Bixi Toronto, N = 733

Kilometers to Work

- 0 to 4: 41% (Quebec), 23% (Bixi)
- 4 to 8: 37% (Quebec), 18% (Bixi)
- 8 to 12: 13% (Quebec), 13% (Bixi)
- 12 to 16: 9% (Quebec), 9% (Bixi)
- 16 to 20: 9% (Quebec), 2% (Bixi)
- 20 to 24: 6% (Quebec), 6% (Bixi)
- 24 to 28: 5% (Quebec), 5% (Bixi)
- 28 to 32: 4% (Quebec), 3% (Bixi)
- 32 to 36: 3% (Quebec), 3% (Bixi)
- 36 to 40: 2% (Quebec), 0% (Bixi)
- 40 to 44: 0% (Quebec), 0% (Bixi)
- 44 to 48: 2% (Quebec), 0% (Bixi)
- 48 to 52: 2% (Quebec), 0% (Bixi)
- 52 to 56: 0% (Quebec), 0% (Bixi)
- 56 to 60: 1% (Quebec), 0% (Bixi)
- More than 60: 2% (Quebec), 2% (Bixi)
One-way and Round-trip

Montreal

- One-way, from station to station, N = 3227
- Round Trip, back to the same station, N = 3204

- Often: 40%
- Sometimes: 17%
- Rarely: 17%
- Never: 38%

Toronto

- One-way, from station to station, N = 824
- Round Trip, back to the same station, N = 806

- Often: 40%
- Sometimes: 15%
- Rarely: 14%
- Never: 33%

Minneapolis-Saint Paul

- One-way, from station to station, N = 1189
- Round Trip, back to the same station, N = 1174

- Often: 53%
- Sometimes: 26%
- Rarely: 17%
- Never: 21%
## System Activity
### CapitalBikeshare & NiceRide Minnesota

<table>
<thead>
<tr>
<th>2011 System Data</th>
<th>Data Type</th>
<th>1st Quarter (limited data)</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Bikeshare (Washington, D.C.)</td>
<td>Total Trips</td>
<td>10,976†</td>
<td>374,203</td>
<td>405,450</td>
<td>313,001</td>
<td>1,103,630†</td>
</tr>
<tr>
<td></td>
<td>Single-Station Round-Trips</td>
<td>584</td>
<td>24,240</td>
<td>23,643</td>
<td>13,553</td>
<td>62,020</td>
</tr>
<tr>
<td></td>
<td>% of Single-Station Round-Trips</td>
<td>5.3%</td>
<td>6.5%</td>
<td>5.8%</td>
<td>4.3%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Nice Ride Minnesota (Minneapolis-Saint Paul)</td>
<td>Total Trips</td>
<td>NA</td>
<td>60,785</td>
<td>117,219</td>
<td>39,526</td>
<td>217,530</td>
</tr>
<tr>
<td></td>
<td>Single-Station Round-Trips</td>
<td>NA</td>
<td>5,840</td>
<td>11,237</td>
<td>2,827</td>
<td>19,904</td>
</tr>
<tr>
<td></td>
<td>% of Single-Station Round-Trips</td>
<td>NA</td>
<td>9.6%</td>
<td>9.6%</td>
<td>7.2%</td>
<td>9.2%</td>
</tr>
</tbody>
</table>

† 1st Quarter 2011 Capital Bikeshare data released was a subset (7%) of total trips during the quarter.
Trip Duration

Washington, D.C.
Capital Bikeshare Operational Data

N = 1,103,598 Trips in 2011

Minutes

Minneapolis-Saint Paul
Nice Ride Minnesota Operational Data

N = 217,530 Trips in 2011

Minutes
Modal Shift Question Structure

As a result of my use of Nice Ride Minnesota, I use the bus...

- Much more often
- More often
- About the same (bikesharing has had no impact)
- Less often
- Much less often
- I did not ride the bus before and I do not ride the bus now.
- I have changed how I use the bus, but not because of Nice Ride Minnesota.
Change in Bicycling

As a result of my use of bikesharing, I ride a bicycle (any bicycle)...

Montreal

- Much more often: 33%
- More often: 28%
- Less often: 7%
- Much less often: 6%
- No Change as a Result of Bikesharing: 27%

N = 3264

Toronto

- Much more often: 29%
- More often: 35%
- Less often: 5%
- Much less often: 2%
- No Change as a Result of Bikesharing: 29%

N = 842

Twin Cities

- Much more often: 26%
- More often: 45%
- Less often: 3%
- Much less often: 0%
- No Change as a Result of Bikesharing: 26%

N = 1218

Washington, D.C.

- Much more often: 36%
- More often: 46%
- Less often: 1%
- Much less often: 0%
- No Change as a Result of Bikesharing: 16%

N = 5219
Change in Driving a Car

As a result of my use of bikesharing, I drive a car...

### Montreal
- Much more often: 0%
- More often: 0%
- Less often: 25%
- Much less often: 12%
- No Change as a Result of Bikesharing: 63%

### Toronto
- Much more often: 0%
- More often: 0%
- Less often: 19%
- Much less often: 6%
- No Change as a Result of Bikesharing: 75%

### Twin Cities
- Much more often: 0%
- More often: 0%
- Less often: 9%
- Much less often: 44%
- No Change as a Result of Bikesharing: 47%

### Washington, D.C.
- Much more often: 0%
- More often: 0%
- Less often: 30%
- Much less often: 11%
- No Change as a Result of Bikesharing: 59%

**Note:** N values vary by city.
Change in Taxi Use

As a result of my use of bikesharing, I use a taxi...

Montreal

- Much more often: 0%
- More often: 2%
- Less often: 27%
- Much less often: 17%
- No Change as a Result of Bikesharing: 53%

Toronto

- Much more often: 0%
- More often: 1%
- Less often: 32%
- Much less often: 13%
- No Change as a Result of Bikesharing: 54%

Twin Cities

- Much more often: 0%
- More often: 1%
- Less often: 14%
- Much less often: 5%
- No Change as a Result of Bikesharing: 80%

Washington, D.C.

- Much more often: 0%
- More often: 1%
- Less often: 36%
- Much less often: 17%
- No Change as a Result of Bikesharing: 46%
Change in Urban Rail

As a result of my use of bikesharing, I use urban rail...

Montreal

- Much more often: 2%
- More often: 9%
- Less often: 33%
- Much less often: 17%
- No Change as a Result of Bikesharing: 38%

N = 3281

Toronto

- Much more often: 1%
- More often: 8%
- Less often: 32%
- Much less often: 12%
- No Change as a Result of Bikesharing: 47%

N = 840

Twin Cities

- Much more often: 2%
- More often: 13%
- Less often: 3%
- Much less often: 0%
- No Change as a Result of Bikesharing: 82%

N = 1221

Washington, D.C.

- Much more often: 1%
- More often: 6%
- Less often: 38%
- Much less often: 10%
- No Change as a Result of Bikesharing: 46%

N = 5210
Change in Bus

As a result of my use of bikesharing, I use the bus...

**Montreal**

- Much more often: 1%
- More often: 5%
- Less often: 30%
- Much less often: 17%
- No Change as a Result of Bikesharing: 46%

**Toronto**

- Much more often: 0%
- More often: 2%
- Less often: 14%
- Much less often: 7%
- No Change as a Result of Bikesharing: 77%

**Twin Cities**

- Much more often: 1%
- More often: 13%
- Less often: 14%
- Much less often: 3%
- No Change as a Result of Bikesharing: 69%

**Washington, D.C.**

- Much more often: 1%
- More often: 4%
- Less often: 32%
- Much less often: 7%
- No Change as a Result of Bikesharing: 56%
Change in Walking

As a result of my use of bikesharing, I walk...

Montreal:
- Much more often: 6%
- More often: 20%
- Less often: 34%
- Much less often: 5%
- No Change as a Result of Bikesharing: 35%

Total: N = 3276

Toronto:
- Much more often: 4%
- More often: 17%
- Less often: 39%
- Much less often: 7%
- No Change as a Result of Bikesharing: 33%

Total: N = 843

Twin Cities:
- Much more often: 6%
- More often: 31%
- Less often: 22%
- Much less often: 1%
- No Change as a Result of Bikesharing: 39%

Total: N = 1221

Washington, D.C.:
- Much more often: 2%
- More often: 15%
- Less often: 29%
- Much less often: 1%
- No Change as a Result of Bikesharing: 52%

Total: N = 5183
Urban Rail Systems of Cities Surveyed

Minneapolis

Montreal

Washington, D.C.

Toronto
Perceptions of Bikesharing as Enhancing Transit

I think of BIXI as an enhancement to the Montreal public transportation system.

- Strongly agree: 81%
- Agree: 17%
- Neutral (no opinion): 1%
- Disagree: 1%
- Strongly disagree: 0%

N = 3291

I think of BIXI as an enhancement to the Toronto public transportation system.

- Strongly agree: 77%
- Agree: 20%
- Neutral (no opinion): 1%
- Disagree: 1%
- Strongly disagree: 0%

N = 841

I think of Nice Ride Minnesota as an enhancement to the Twin Cities public transportation system.

- Strongly agree: 82%
- Agree: 16%
- Neutral (no opinion): 1%
- Disagree: 1%
- Strongly disagree: 0%

N = 1233

Shaheen et al., 2012
Bikesharing with Transit instead of Car

Since joining BIXI, I have made trips with public transit and bikesharing (together) that I would have previously done with a car. [Montreal]

N = 3277

- Strongly agree: 20%
- Agree: 21%
- Neutral (no opinion): 19%
- Disagree: 21%
- Strongly disagree: 18%

Since joining BIXI, I have made trips with public transit and bikesharing (together) that I would have previously done with a car. [Toronto]

N = 845

- Strongly agree: 9%
- Agree: 19%
- Neutral (no opinion): 22%
- Disagree: 30%
- Strongly disagree: 20%

Since joining Nice Ride Minnesota I have made trips with public transit and bikesharing (together) that I would have previously done with a car.

N = 1227

- Strongly agree: 19%
- Agree: 31%
- Neutral (no opinion): 21%
- Disagree: 23%
- Strongly disagree: 6%
Reduction of Vehicle Ownership

Since you joined [public bikesharing], have you sold, donated or otherwise gotten rid of a personal household vehicle or considered selling a personal vehicle?

- No: 7135
- Sold or donated a household vehicle: 398
- Considered selling a personal vehicle: 553

N = 8086

How important has your membership with [public bikesharing] been in your decision to sell or consider selling a personal vehicle?

- Very important: 82
- Somewhat important: 135
- Not at all important: 162
- Don’t know: 14

N = 393

Shaheen et al., 2012
Impact on Local Shopping

As a result of my use of bikesharing, I shop at locations near existing bike stations...

**Montreal**

- Much more often: 9%
- More often: 33%
- Less often: 0%
- Much less often: 0%
- No Change as a Result: 58%

**Toronto**

- Much more often: 7%
- More often: 38%
- Less often: 0%
- Much less often: 0%
- No Change as a Result of Bikesharing: 54%

**Washington, D.C.**

- Much more likely: 31%
- Somewhat more likely: 52%
- Somewhat less likely: 0%
- Much less likely: 0%
- Not more or less likely, no difference: 17%

*Question: If a business, restaurant, or shop is easily accessible by Capital Bikeshare, does that access make you more or less likely to patronize that establishment?*
Impact on Exercise

I get more exercise now that I am a member of BIXI. [Montreal]

- Strongly agree: 34%
- Agree: 39%
- Neutral (no opinion): 18%
- Disagree: 7%
- Strongly disagree: 1%

N = 955

I get more exercise now that I am a member of BIXI. [Toronto]

- Strongly agree: 19%
- Agree: 39%
- Neutral (no opinion): 26%
- Disagree: 13%
- Strongly disagree: 3%

N = 841

I get more exercise now that I am a member of Nice Ride Minnesota.

- Strongly agree: 21%
- Agree: 41%
- Neutral (no opinion): 26%
- Disagree: 10%
- Strongly disagree: 2%

N = 1229
Helmet Use with Public Bikesharing

Montreal

N = 3291

Question: How often do you wear a helmet when using BIXI bikes?

- Always: 8%
- Most of the time: 12%
- Sometimes: 8%
- Rarely: 10%
- Never: 62%

Toronto

N = 842

Question: How often do you wear a helmet when using BIXI bikes?

- Always: 11%
- Most of the time: 18%
- Sometimes: 11%
- Rarely: 15%
- Never: 45%

Minneapolis-St Paul

N = 1232

Question: How often do you wear a helmet while using Nice Ride?

- Always: 16%
- Sometimes: 20%
- Rarely: 14%
- Never: 50%

Washington, D.C.

N = 5248

Question: How often do you wear a helmet when you use Capital Bikeshare?

- Always: 17%
- Most of the time: 19%
- Some of the time: 21%
- Never: 43%

Shaheen et al., 2012
Future Innovations
Summary

• Rapid growth of IT-based programs in North America (2010-ongoing)
  – Approximately 20 planned and existing launches for 2012

• Changing emphasis on business models
  – Profit-based models becoming more prevalent

• Broadly, user survey indicates modal shift away from all other modes (auto and transit)

• Modal shift away from transit may have occurred due to transit congestion at peak times and shorter, faster, or more direct routing with bikesharing

• Transit modal shift increase where service is more limited and less frequent
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