Worldwide Carsharing Trends and Research Highlights

CarSharing Association 2015 Annual Meeting

Susan A. Shaheen, Ph.D.
Adjunct Professor and Co-Director, Transportation Sustainability Research Center
University of California, Berkeley
September 23, 2015
Overview

- Worldwide growth trends
- Insurance study highlights
- EV carsharing study findings
- Summary
Growth of Worldwide Carsharing

<table>
<thead>
<tr>
<th>Year</th>
<th>Members</th>
<th>Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>346,610</td>
<td>11,501</td>
</tr>
<tr>
<td>2008</td>
<td>670,822</td>
<td>19,403</td>
</tr>
<tr>
<td>2010</td>
<td>1,163,405</td>
<td>31,967</td>
</tr>
<tr>
<td>2012</td>
<td>1,788,027</td>
<td>43,554</td>
</tr>
<tr>
<td>2014</td>
<td>4,842,616</td>
<td>104,125</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015

© UC Berkeley, 2015
2014 Membership: One-Way & Roundtrip

<table>
<thead>
<tr>
<th>Region</th>
<th>Round-trip</th>
<th>One-way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>926,280</td>
<td>29,600</td>
</tr>
<tr>
<td>Europe</td>
<td>1,834,418</td>
<td>372,466</td>
</tr>
<tr>
<td>North America</td>
<td>1,179,930</td>
<td>445,722</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>3,500</td>
</tr>
<tr>
<td>Oceania</td>
<td>50,000</td>
<td>700</td>
</tr>
<tr>
<td>Global</td>
<td>3,990,628</td>
<td>851,988</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015
2014 Vehicles: One-Way & Roundtrip

<table>
<thead>
<tr>
<th>Region</th>
<th>Round-trip</th>
<th>One-way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>20,199</td>
<td>145</td>
</tr>
<tr>
<td>Europe</td>
<td>39,904</td>
<td>18,043</td>
</tr>
<tr>
<td>North America</td>
<td>18,267</td>
<td>5,943</td>
</tr>
<tr>
<td>South America</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Oceania</td>
<td>1,500</td>
<td>24</td>
</tr>
<tr>
<td>Global</td>
<td>79,859</td>
<td>24,266</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015
World Carsharing Growth Rates

<table>
<thead>
<tr>
<th></th>
<th>2006-08</th>
<th>2008-10</th>
<th>2010-12</th>
<th>2012-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>39%</td>
<td>32%</td>
<td>24%</td>
<td>64%</td>
</tr>
<tr>
<td>Vehicles</td>
<td>30%</td>
<td>28%</td>
<td>17%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015
South American Longitudinal Trends

<table>
<thead>
<tr>
<th>Year</th>
<th>Members</th>
<th>Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>110</td>
<td>13</td>
</tr>
<tr>
<td>2012</td>
<td>1,500</td>
<td>60</td>
</tr>
<tr>
<td>2014</td>
<td>3,500</td>
<td>100</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015

© UC Berkeley, 2015
European Longitudinalal Trends

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>212,124</td>
<td>334,168</td>
<td>552,868</td>
<td>691,943</td>
<td>2,206,884</td>
</tr>
<tr>
<td>Vehicles</td>
<td>7,491</td>
<td>10,833</td>
<td>16,779</td>
<td>20,464</td>
<td>57,947</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015
Asian Longitudinalal Trends

<table>
<thead>
<tr>
<th>Year</th>
<th>Members</th>
<th>Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>15,700</td>
<td>608</td>
</tr>
<tr>
<td>2008</td>
<td>12,546</td>
<td>810</td>
</tr>
<tr>
<td>2010</td>
<td>81,817</td>
<td>4,315</td>
</tr>
<tr>
<td>2012</td>
<td>160,500</td>
<td>6,155</td>
</tr>
<tr>
<td>2014</td>
<td>955,880</td>
<td>20,344</td>
</tr>
</tbody>
</table>

Shaheen and Cohen, 2015
Insurance Study Highlights
Methodology

- Analyzed 28 operator-years of trips and claims data for 334 vehicles
- Six U.S. carsharing operators, with data spanning a time range of 2008 to 2015
- Total of 328,726 valid trips
- 125 valid insurance claims occurred during this period
- Focus on estimating crash risk, measured on a per mile and per insured vehicle-year basis
- Deductible was US$1000, for policies in which the deductible was higher we calculated it as if it was US$1000
Key Observations

- During 2012-2014, number of claims and costs generally increased
- Average distance traveled 11,185 miles/year; similar to national average (11,244 miles)
- Average trip distance 24.95 miles (40.15 km)
- Average duration of reservation = 3.72 hours
- Average crash claim = 17.05/100 insured vehicle years
# Summary of Trip Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Availability (Operator-Years)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Active Vehicles</td>
<td>137</td>
<td>192</td>
<td>209</td>
<td>334</td>
</tr>
<tr>
<td>Trips</td>
<td>62,563</td>
<td>68,703</td>
<td>78,456</td>
<td>328,726</td>
</tr>
<tr>
<td>Average Trip Distance (Miles)</td>
<td>24.93</td>
<td>24.46</td>
<td>23.5</td>
<td>24.95</td>
</tr>
<tr>
<td>Average Trip Distance (Km)</td>
<td>40.12</td>
<td>39.36</td>
<td>37.82</td>
<td>40.15</td>
</tr>
<tr>
<td>Average Trip Duration (Hrs)</td>
<td>3.65</td>
<td>3.67</td>
<td>3.55</td>
<td>3.72</td>
</tr>
<tr>
<td>Proportion of Female Trips</td>
<td>0.5</td>
<td>0.49</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Average Age of Drivers When Trips Occurred</td>
<td>35.43</td>
<td>35.64</td>
<td>34.88</td>
<td>35.2</td>
</tr>
<tr>
<td>Proportion: Ages 18-25</td>
<td>0.26</td>
<td>0.25</td>
<td>0.28</td>
<td>0.27</td>
</tr>
<tr>
<td>Proportion: Ages 66+</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td>0.02</td>
</tr>
</tbody>
</table>
Claims Per Million Miles

- Female, n = 45, N = 135496
- Male, n = 59, N = 138650
- All, n = 106, N = 323493

Claims Per Million Miles

Age When Trip Occurred

Costs Per 1 Million Miles

Costs Per 1 Million Miles

- Female, n = 45, N = 135496
- Male, n = 59, N = 138650
- All, n = 106, N = 323493

© UC Berkeley, 2015
Estimated Cost Per Claim

Cost per Claim

$0

$5,000

$10,000

$15,000

$20,000

Age When Trip Occurred

18-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71+

Female, n = 45
Male, n = 59
All, n = 106
National Comparison: Claims and Costs

Comparison With National Data: Claims per 100 Insured Vehicle-Years

- Current Study, n = 122 Claims, N = 733 Insured Vehicle-Years

Comparison With National Data: Costs per 100 Insured Vehicle-Years

- Current Study, n = 125 Claims, N = 733 Insured Vehicle-Years
Key Findings

- 50% made by female drivers
- 27% made by young adults 18-25
- 2% made by drivers at or about age 66
- Average age of drivers = 35.2
- Average cost per claim = US$4,630 and median US$2,189
- Average insurance claim cost/mile = US$.0.7
- Average insurance claim cost/trip = US$1.76
Key Findings (cont’d)

- Heightened risk for drivers above age 65
- 18-25 aged drivers had moderately higher risk compared to other adults
- Mid-age adults (30-65 age) had lowest risk (similar to national average)
- Average claims cost per insured-vehicle year of US$789 for carsharing
- Risk could be higher or lower due to local circumstances and unobserved factors
Overview of ZEV Mandate

- Adopted in 1990
- In 2001, CARB allowed for additional incentives for placing EVs in “transportation systems”
  - Carsharing
  - Station car fleets
- “Transportation systems” incentive program set to sunset in 2018
Carsharing programs featuring PHVs/EVs provide access to those who would otherwise not have access to such vehicles.
### Control: Active carsharing users (active in last 18 months) but had not used PHVs/ EVs through their carsharing provider

<table>
<thead>
<tr>
<th>Control Survey</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Launched</td>
<td>Dec 4, 2014</td>
</tr>
<tr>
<td>Closed</td>
<td>Feb 18, 2015</td>
</tr>
<tr>
<td>Avg. Completion Time</td>
<td>14 minutes</td>
</tr>
<tr>
<td>Total Completions</td>
<td>1,742</td>
</tr>
<tr>
<td>Completion Rate</td>
<td>77%</td>
</tr>
<tr>
<td>Participating Programs</td>
<td>car2go, Zipcar</td>
</tr>
<tr>
<td>Cities Surveyed</td>
<td>Portland, Austin, New York City, Boston</td>
</tr>
</tbody>
</table>

### Experiment: Active carsharing users who had used PHVs/EVs within the 6 months

<table>
<thead>
<tr>
<th>Experiment Survey</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Launched</td>
<td>Nov 7, 2014</td>
</tr>
<tr>
<td>Closed</td>
<td>Feb 15, 2015</td>
</tr>
<tr>
<td>Avg. Completion Time</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Total Completions</td>
<td>1,920</td>
</tr>
<tr>
<td>Completion Rate</td>
<td>74%</td>
</tr>
<tr>
<td>Participating Programs</td>
<td>car2go, Zipcar, DriveNow, eGo</td>
</tr>
<tr>
<td>Cities Surveyed</td>
<td>Portland, San Diego, Austin, New York City, Boston, San Francisco Bay Area, Boulder</td>
</tr>
</tbody>
</table>
Demographics and Market Penetration

Carsharing appears to be exposing more women as well as younger individuals to PHVs/EVs relative to the traditional demographic profile of PHV/EV owners.

PHV/EV carsharing users also appear willing to play an influencer role among their social circles in spreading the use of these vehicles.
## Demographic Profile of Users

Comparison of Demographics Between California PHV Owners and PHV/EV Carsharing Users (CCSE, 2014)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages 65 and over</td>
<td>12%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Ages 55 – 64</td>
<td>25%</td>
<td>6%</td>
</tr>
<tr>
<td>Ages 45 – 54</td>
<td>34%</td>
<td>12%</td>
</tr>
<tr>
<td>Ages 35 – 44</td>
<td>23%</td>
<td>26%</td>
</tr>
<tr>
<td>Ages 25 – 34</td>
<td>6%</td>
<td>50%</td>
</tr>
<tr>
<td>Ages 18 – 24</td>
<td>&lt;1%</td>
<td>4%</td>
</tr>
<tr>
<td>Males</td>
<td>79%</td>
<td>59%</td>
</tr>
<tr>
<td>Females</td>
<td>21%</td>
<td>41%</td>
</tr>
</tbody>
</table>
Driven a Hybrid-Electric Vehicle

Been a passenger in a Hybrid-Electric Vehicle

Driven a Plug-in Hybrid Vehicle

Been a passenger in a Plug-in Hybrid Vehicle

Driven an All-Electric Vehicle

Been a passenger in an All-Electric Vehicle

Not been exposed to any All-Electric or Plug-in Hybrid Vehicles outside of carsharing

Control, N = 1740

Experiment, N = 1921
Reasons for Not Using a Plug-In Hybrid (PHV) or Electric Vehicle (EV)

What Is The Main Reason You Have Not Used A Plug-In Hybrid Electric Vehicle Through Carsharing?

- Other: 10%
- There are no Plug-in Hybrid Vehicles in my fleet that I am aware of: 33%
- I would like to use them, but they are often not available: 7%
- I would like to use them, but they are too expensive to use: 1%
- I do not like Plug-in Hybrid Vehicles and will not use them: 1%
- I do not live or work near where these cars are located: 1%
- I do not work near where these cars are located: 1%
- I do not live near where these cars are located: 1%
- I do not know what they look like: 10%

What Is The Main Reason You Have Not Used An Electric Vehicle Through Carsharing?

- Other: 14%
- Would like to use them, but they are not available: 38%
- I would like to use them, but they are too expensive: 1%
- Charge points are difficult to access: 1%
- I am unfamiliar with the charging process: 4%
- Battery range is insufficient for my needs: 1%
- I do not like electric vehicles: 0%
- I do not live or work near these cars: 12%
- Do not work near these cars: 1%
- Do not live near these cars: 16%
- I do not know what they look like: 11%
Impact of Exposure to PHVs on Desire to Own These Vehicles

As A Result of My Exposure to Plug-In Hybrid Electric Vehicles Through Carsharing, My desire To Own One Is Now...

- Much greater: 11%
- Greater: 30%
- About the same: 41%
- Less: 2%
- Much less: 1%
- Changed, but not due to carsharing: 2%
- Never wanted to own: 12%
- I have had no exposure through carsharing: 0%

As A Result of My Exposure to All-Electric Vehicles Through Carsharing, My Desire To Own One Is Now...

- Much greater: 13%
- Greater: 29%
- About the same: 36%
- Less: 3%
- Much less: 2%
- Changed, but not due to carsharing: 3%
- Never wanted to own: 10%
- I have had no exposure through carsharing: 4%
Distribution of Recommendations to Driving or Buying PHVs or EVs

I Would Recommend Others Try Driving A Plug-In Hybrid Electric Vehicle or All-Electric Vehicle

- **Experiment, N = 1894**
  - Strongly Agree: 36%
  - Agree: 44%
  - Neutral: 18%
  - Disagree: 2%
  - Strongly Disagree: 1%

- **Control, N = 1716**
  - Strongly Agree: 25%
  - Agree: 34%
  - Neutral: 38%
  - Disagree: 2%
  - Strongly Disagree: 1%

I Would Recommend Others Buy a Plug-In Hybrid Electric Vehicle or All-Electric Vehicle

- **Experiment, N = 1893**
  - Strongly Agree: 22%
  - Agree: 34%
  - Neutral: 39%
  - Disagree: 4%
  - Strongly Disagree: 2%

- **Control, N = 1719**
  - Strongly Agree: 18%
  - Agree: 29%
  - Neutral: 48%
  - Disagree: 3%
  - Strongly Disagree: 2%
Data suggest carsharing programs with PHVs and EVs play a role in promoting greater adoption of these technologies.

91% of control group exposed to ZEVs outside of carsharing, but greater impact on perceptions toward PHV/EVs in experimental group:
- Demonstrates use of these vehicles through carsharing has had a distinct impact.
- Positive disposition impacted by frequency of use (more than 1/month).

On a longer-term basis, carsharing programs with ZEVs could act as gateways to improving market penetration of PHVs and EVs.
Summary

- Worldwide Growth Trends
- Insurance Study Highlights
- EV Carsharing Study Highlights
White Paper Released Today!

ZERO- AND LOW-EMISSION VEHICLES IN U.S. CARSHARING FLEETS
IMPACTS OF EXPOSURE ON MEMBER PERCEPTIONS

SUSAN SHAHEEN, Ph.D.
TRANSPORTATION SUSTAINABILITY RESEARCH CENTER, CO-DIRECTOR
UNIVERSITY OF CALIFORNIA, BERKELEY, ADJUNCT PROFESSOR

ELLIOT MARTIN, Ph.D.
TRANSPORTATION SUSTAINABILITY RESEARCH CENTER, RESEARCH ENGINEER

APAAR BANSAL
TRANSPORTATION SUSTAINABILITY RESEARCH CENTER, RESEARCH ASSOCIATE

SEPTEMBER 2016

http://tsrc.berkeley.edu/node/956
Disrupting Mobility Summit

A Global Summit Investigating Sustainable Futures, November 11-13, 2015, Cambridge, MA

Early Bird (Registration before September 30, 2015): $375

http://www.disrupting-mobility.org/#welcome-
Apaar Bansal, Adam Cohen, Matt Christensen, and Elliot Martin, TSRC, UC Berkeley

Special thanks to Assurant, Metavera, Guy Fraker, Alan Woodland, Tony Simopoulos, Paul Dyck, car2go, DriveNow, eGo CarShare, Zipcar, Nissan, Toyota, worldwide shared mobility operators, experts, and the CarSharing Association for making this research possible.