

Implementing a Public Bicycle Share Program: Impact on Perceptions and Support for Public Policies for Active Transportation

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Background: Favorable public opinion and support for policies are essential to favor the sustainability of environmental interventions. This study examined public perceptions and support for active living policies associated with implementing a public bicycle share program (PBSP). **Methods:** Two cross-sectional population-based telephone surveys were conducted in 2009 and 2010 among 5011 adults in Montréal, Canada. Difference-in-differences analyses tested the impact of the PBSP on negative perceptions of the impact of the PBSP on the image of the city, road safety, ease of traveling, active transportation, health, and resistance to policies. **Results:** People living closer to docking stations were less likely to have negative perceptions of the effect of the PBSP on the image of the city (OR = 0.5; 95% CI, 0.4–0.8) and to be resistant to policies (OR = 0.8; 95% CI, 0.6–1.0). The likelihood of perceiving negative effects on road safety increased across time (OR = 1.4; 95% CI, 1.2–1.8). Significant interactions were observed for perceptions of ease of traveling (OR = 0.5; 95% CI, 0.4–0.8), active transportation (OR = 0.6; 95% CI, 0.4–1.0), and health (OR = 0.6; 95% CI, 0.4–0.8): likelihood of negative perceptions decreased across time among people exposed. **Conclusion:** Findings indicate that negative perceptions were more likely to abate among those living closer to the PBSP.

Keywords: exercise, built environment intervention, cycling, public opinion, public policy, commuting

Recent research shows the dramatic consequences of sedentary lifestyle and the urgent need to address this public health issue.^{1,2} To achieve a sufficient amount of physical activity (PA) at the population level, promoting cycling and/or active transportation offers great potential.^{3,4} Moreover, accumulating evidence suggests that cycling or walking has a positive impact on health and longevity.^{5–8}

In line with the idea of creating active living communities,⁹ one promising avenue is the implementation of public bicycle share programs (PBSP).^{3,10} These programs provide the population with self-service bicycles for short distance travel. A recent impact evaluation of a fourth-generation PBSP (bicycle-taxi, or BIXI) implemented in May 2009 in Montréal, Canada, showed that this PBSP was associated with a significant increase in the likelihood of cycling.¹¹ A prerequisite to the creation of active living communities is that environmental and policy interventions can only be implemented with broad public support.¹² In this regard, strong public support has been shown to have significant influence on the adoption of public policy,^{13,14} including public health policies.¹⁵ Although consensus has yet to be achieved regarding the link between public opinion and policies, Burstein¹⁴ states that “opinion affects policies most of the time,” particularly when issues are salient to the public. Similarly, Page and Shapiro¹³ reported that changes in public opinion

observed in the United States between 1935 and 1979 frequently (or consistently) led to congruent changes in public policies.

In the context of PA, there is an emerging literature investigating public opinion, attitude, or support for public policies.^{16–20} For instance, Brownson et al¹⁷ reported substantial public support for zoning regulations and the use of governmental funds, particularly among physically active respondents and those with higher PA self-efficacy or outcome efficacy beliefs. Similarly, Carlson et al²⁰ observed that the majority of respondents rated their neighborhood features as having moderate to very important influences on PA. They also observed that a substantial proportion of the respondents expressed willingness to take civic actions to support urban design policies for PA. However, most of the results from previous studies on public support and PA reported opinions in relation to hypothetical situations. Indeed, there is still a dearth of information regarding the extent to which the population is supportive of (or resistant to) the implementation of concrete environmental and policy interventions to promote active living and particularly how to address potential effects of resistance to policies.¹² Moreover, virtually no study has examined perceptions of populations toward the implementation of PBSPs.¹⁰ Thus, this study examined public perceptions and support for policies aimed at active living in transportation associated with implementing a PBSP.

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Methods

Design and Procedures

Two cross-sectional population-based random digit dialing telephone surveys were conducted among the general population of adults living on the Island of Montréal in the fall of 2009 (T₁) and of 2010 (T₂). These 2 survey periods represent the end of the first

and the end of the second year of program implementation. It is noteworthy to mention that preimplementation public opinion data were not collected because we believed that many respondents could not have formed positive or negative perceptions of selected outcomes of the PBSP before its actual implementation. Full details of the sampling strategy and general survey procedures are described elsewhere.^{11,21,22} Briefly, the surveys were conducted among adults aged 18 years or older having a landline telephone at home. An oversampling strategy was applied among individuals exposed to the PBSP docking stations to ensure adequate statistical power on the basis that cycling is a relatively rare phenomenon. The study was approved by the Human Research Ethics committee of the Centre Hospitalier de l'Université de Montréal, and all participants provided oral consent to participate.

Measures

In the current study, we focused on negative perceptions and low support because strong resistance from the population toward novel environmental transformations and departures from habitual actions which consist of improving motor vehicle amenities represent important barriers to promoting active transportation. Indeed, private motorized vehicles represent the dominant transportation modal share in the metropolitan area of Montréal (67.8%), particularly among suburban residents that commute to work in the city (72.4% to 81.3%).²³ Moreover, Douglas et al²⁴ reported very low public support for measures that may reduce car ownership and car use.

Public Perceptions. Participants were asked to rate the extent to which they perceived that the PBSP had had an impact on (1) the image of the city of Montréal, (2) road safety, (3) ease of traveling within Montréal, (4) promotion of active transportation, and (5) the health of the population. Perceptions were obtained on a 5-point scale ranging from 1 (*very positive*) to 5 (*very negative*). To examine the effect of implementing the PBSP on negative perceptions, the scores of each selected perception of the outcome of program implementation were dichotomized as being positive ([0]; scores of 1 and 2 on the scale) versus being neutral or negative ([1]; scores of 3, 4, and 5 on the scale).

Public Support for Policies. Public support for policies aimed at promoting active living was measured by a questionnaire (the public support for Policies for Active Living in Transportation questionnaire; PAL-T) assessing willingness to endorse a set of policies expected to increase the active living potential of their neighborhood.²¹ The PAL-T included 17 items (see Fuller et al¹⁷ for the complete description of these items) requiring respondents to indicate to what extent they would agree with the implementation of specific actions (eg, stiffer fines for motorists and cyclists, reducing automobile speed limits, traffic calming measures, reserved lines for cyclists, increases in the cost of parking, etc). Answers were obtained on a 4-point scale ranging from 1 (*completely agree*) to 4 (*completely disagree*) with no neutral choice to force respondents to side 1 way or the other. An index of public support for policies (the PAL-T score) was created by summing raw scores for each item. Higher PAL-T scores indicate weaker support for public policies. This instrument showed adequate internal consistency, as well as good concurrent and discriminant validity.²¹ Again, to examine the resistance of the population regarding public policies, the PAL-T score was dichotomized as being highly unfavorable to the implementation of public policies favoring active living in transportation ([1]; the highest quintile of PAL-T scores ≥ 41) versus the scores distributed in the other quintiles (0).

Statistical Analysis

First, we estimated the prevalence of perceptions of implementing the PBSP. Descriptive results and prevalence rates were weighted for age and gender according to Canadian census data. Second, we evaluated the effect of implementing the PBSP on negative perceptions and low support for policies, using a series of logistic regression difference-in-differences analyses (DD). This type of analysis has been recommended to evaluate the effect of experiments conducted in natural settings, using either repeated cross-sectional or longitudinal survey designs.^{25,26} Negative perceptions of the outcomes of implementing the PBSP and low support for policies for active living in transportation were the dependent variables and were examined separately. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were estimated using the maximum likelihood method and represented the likelihood of having negative perceptions of the implementation of the PBSP and expressing low support for active living policies in transportation.²⁷ All the regression analyses were performed using unweighted data.

The independent variables were the survey periods (main effect of time between T₁ and T₂), residential exposure to PBSP docking stations (main effect of living within 500 m of a bicycle docking station), and the interaction between survey periods and residential exposure. For each of the 6 outcomes assessed (5 perceptions and policy resistance), the effect of survey period was first entered into the model. In Step 2, the effect of exposure to the PBSP was tested. The interaction effect between survey periods and exposure was entered in the third step and finally, models were adjusted for sociodemographic and anthropometric covariates (fourth step).

Covariates included current cycling behavior (assessed with a modified version of the International Physical Activity Questionnaire [IPAQ]),¹¹ using the PBSP at least once in 2009 or 2010, sociodemographic variables (age, sex, education and annual household income), and categories of Body Mass Index (BMI). The largest samples without missing data were used for each analysis. Respondents who had missing data on at least 1 of the variables included in the analyses were significantly more likely to harbor negative views of the impact of implementing the PBSP on the image of Montréal, ease of traveling within the city, and the promotion of active transportation ($P_s < .002$) in comparison with those who provided complete data ($N = 2884$). Where appropriate we report analysis results that differ across smaller and larger subsets.

Results

Description of the Sample

The pooled sample consisted of 5011 participants ($n = 2502$ at T₁ and $n = 2509$ at T₂). The response rates for the surveys were 34.6% and 35.7%, respectively. The sociodemographic characteristics of the pooled sample appear in Table 1. The proportion of individuals having used the PBSP at least once was 9.5% and 2.1% of the pooled sample cycled for utilitarian purposes at least 3 times weekly for at least 30 minutes. For the specific survey periods, the mean age of respondents was 42.4 (95% CI, 41.7–43.1) and 44.2 (95% CI, 43.4–44.9) years for T₁ and T₂, respectively. The mean BMI was 24.8 (95% CI, 24.5–25.0) and 24.7 (95% CI, 24.5–24.9) kg/m² for the same survey periods, respectively. At T₁ and T₂, over half the sample was female (54.1%, 95% CI, 54.0–54.2; and 59.2%, 95% CI, 59.1–59.2, respectively) and a substantial proportion of the sample had completed a college or university degree (62.7%, 95% CI, 62.6–62.8; and 67.1%, 95% CI, 67.1–67.2, respectively).

Table 1 Characteristics of the Study Respondents Surveyed in the Fall of 2009 and 2010 (n = 5011) in Montreal, Canada

Characteristics	n (%)	Weighted% (95% CI)
Sex		
Male	1966 (39.3)	43.4 (43.3–43.4)
Female	3040 (60.7)	56.6 (56.6–56.7)
Age group (years)		
18–24	330 (6.8)	16.7 (16.7–16.8)
25–34	917 (18.9)	23.1 (23.1–23.2)
35–44	882 (18.2)	16.8 (16.7–16.8)
45–54	949 (19.6)	16.0 (15.9–16.0)
55–64	884 (18.2)	12.2 (12.1–12.2)
≥65	884 (18.2)	15.2 (15.2–15.3)
Education		
High school or less	1298 (26.3)	28.4 (28.3–28.4)
Trade school	299 (6.1)	6.7 (6.7–6.7)
College degree	728 (14.8)	15.4 (15.3–15.4)
University degree	2603 (52.8)	49.6 (49.5–49.6)
Household income (\$CDN)		
<20,000	664 (17.1)	18.8 (18.8–18.9)
≥20,000 and <50,000	1452 (37.4)	37.1 (37.1–37.2)
≥50,000 and <100,000	1155 (29.8)	29.4 (29.3–29.4)
≥100,000	610 (15.7)	14.7 (14.6–14.7)

Abbreviations: CI, confidence interval.

A small proportion of the sample had a household income of \$100 000 CAD or more (14.1%, 95% CI, 14.0–14.1; and 15.2%, 95% CI, 15.2–15.3, respectively).

Prevalence of Positive Perceptions of Implementing the PBSP

Substantial proportions of the respondents perceived that implementing the PBSP had a positive (very or somewhat positive) impact on the image of the city of Montréal (91.2%, 95% CI, 91.2–91.2), the promotion of active transportation (85.9%, 95% CI, 85.9–86.0), the ease of traveling within the city (83.9%, 95% CI, 83.6–83.9), and on the health of the population (74.7%, 95% CI, 74.6–74.7). A different pattern of perceptions was observed for the impact of implementing the PBSP on road safety; less than half of the pooled sample (44.6%, 95% CI, 44.5–44.6) perceived that the PBSP had had a positive impact on this outcome. The mean PAL-T score for the pooled sample was 35.2, with a maximal value of 68. The proportion of respondents highly favorable (PAL-T scores ≤34; scores of either 1 or 2 on the entire set of 17 items of the PAL-T) to the implementation of public policies represented slightly less than half of the sample (46.3%, 95% CI, 46.2–46.3).

Changes in Public Perceptions and Support for Policies

The complete results of the DD analyses appear in Table 2. In the fully adjusted models, a main effect of residential exposure was observed for impact on the image of Montréal (n = 3471; OR =

0.5; 95% CI, 0.4–0.8) indicating that participants living in closer proximity to the bicycle docking stations were significantly less likely to have negative perceptions when compared with those not exposed. A negative effect of survey periods was observed for road safety (n = 3219; OR = 1.4; 95% CI, 1.2–1.8) revealing that the likelihood of having negative perceptions of the effect of the PBSP on road safety increased across the 2 survey periods. Finally, significant survey period by exposure interactions for the ease of traveling within the city (n = 3357; OR = 0.5; 95% CI, 0.4–0.8), the promotion of active transportation (n = 3338; OR = 0.6; 95% CI: 0.4–1.0)^l, and the improvement in health of the population (n = 3298; OR = 0.6; 95% CI, 0.4–0.8) were observed in the fully adjusted models. Probing of the 3 interactions showed that the likelihood of having negative perceptions decreased across survey periods among respondents who lived near PBSP docking stations following the second year of implementation when compared with those living further away following the first year.

For resistance to public policies aimed at promoting active living in transportation, a main effect of residential exposure was observed (n = 3610; OR = 0.8; 95% CI, 0.6–1.0), showing that respondents living closer to PBSP bicycle docking stations were less likely to be resistant to actions that might render neighborhood environments more favorable to cycling and walking for transportation.

Discussion

Although implementation of PBSPs are often met with some skepticism,^{10,28} findings from this study show that the population living in an urban area where a PBSP was recently implemented had a generally positive opinion toward the outcomes of implementing this PBSP (with the exception of road safety). This result is in line with previous observations reported after the implementation of PBSPs in Paris (Vélib') and Washington, DC (SmartBike).¹⁰ Also in line with previous studies,^{17,20} we observed that just under half of respondents were highly supportive of the implementation of public policies favorable to active transportation.

Results of the DD analyses revealed that individuals living in closer proximity to PBSP docking stations were less likely to have negative perceptions of the impact of the PBSP and to be resistant to public policies. Indeed, a main effect of exposure was observed for harboring negative perceptions about the effects on the image of Montréal and being resistant to public policies aimed at active living in transportation. Moreover, the likelihood of having negative perceptions of the effect of implementing the PBSP on the ease of traveling within the city, the promotion of active transportation, and the health of the population decreased across time among individuals exposed to the PBSP (significant interaction effects). Interestingly, these findings suggest that exposure to a PBSP (an environmental intervention) might be sufficient to dissipate negative perceptions among selected segments of the population and reduce strong resistance to implementing policies aimed at active living in transportation.²⁹

In this specific context, however, a self-selection bias cannot be ruled out to explain this result.³⁰ Indeed, it is possible that respondents living in closer proximity to PBSP docking stations choose these specific neighborhoods because they correspond to their preferences. Moreover, perhaps for purposes of optimal marketing and appropriation of the PBSP by the population, the PBSP was implemented in the central, urbanized areas of the city. Hence, it can be anticipated that residents living in these areas were more positively predisposed toward the implementation of the PBSP at baseline. Moreover, it is possible that respondents exposed to the PBSP were also exposed

Table 2 Effect of Survey Periods, Exposure to the PBSP, and Their Interactions on Negative Public Perceptions of Outcomes of Implementing a PBSP and Resistance to Implementing Policies Aimed at Active Living in Transportation Among Respondents Surveyed in the Fall of 2009 and 2010 in Montreal, Canada.

Dependent variables	OR (95% CI)			
	Step 1	Step 2	Step 3	Step 4 ^a
Image of Montreal (N = 4711)				
Time 1 (Ref)	1.0	1.0	1.0	1.0
Time 2	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.6–1.2)	0.9 (0.6–1.2)
Not exposed (Ref)		1.0	1.0	1.0
Exposed		0.5 (0.4–0.6)***	0.5 (0.4–0.7)***	0.5 (0.4–0.8)**
Time 1 × Not Exposed (Ref)			1.0	1.0
Time 2 × Exposure			1.0 (0.7–1.6)	1.1 (0.6–1.9)
Road safety (N = 4340)				
Time 1 (Ref)	1.0	1.0	1.0	1.0
Time 2	1.2 (1.1–1.4)**	1.2 (1.1–1.4)**	1.3 (1.1–1.6)**	1.4 (1.2–1.8)**
Not exposed (Ref)		1.0	1.0	1.0
Exposed		1.1 (1.0–1.2)	1.2 (1.0–1.4)	1.2 (1.0–1.5)
Time 1 × Not Exposed (Ref)			1.0	1.0
Time 2 × Exposure			0.8 (0.7–1.1)	0.8 (0.6–1.0)
Ease of traveling within the city (N = 4551)				
Time 1 (Ref)	1.0	1.0	1.0	1.0
Time 2	0.9 (0.8–1.0)	0.9 (0.7–1.0)	1.0 (0.8–1.3)	1.1 (0.8–1.4)
Not exposed (Ref)		1.0	1.0	1.0
Exposed		0.5 (0.5–0.6)***	0.7 (0.5–0.8)**	0.8 (0.6–1.0)
Time 1 × Not Exposed (Ref)			1.0	1.0
Time 2 × Exposure			0.6 (0.5–0.9)**	0.5 (0.4–0.8)**
Promotion of active transportation (N = 4488)				
Time 1 (Ref)	1.0	1.0	1.0	1.0
Time 2	1.0 (0.9–1.2)	1.0 (0.9–1.2)	1.2 (1.0–1.4)	1.2 (1.0–1.6)
Not exposed (Ref)		1.0	1.0	1.0
Exposed		0.6 (0.5–0.7)***	0.7 (0.6–0.9)**	0.8 (0.6–1.1)
Time 1 × Not Exposed (Ref)			1.0	1.0
Time 2 × Exposure			0.7 (0.5–1.0)*	0.6 (0.4–1.0)*
Health of the population (N = 4442)				
Time 1 (Ref)	1.0	1.0	1.0	1.0
Time 2	1.1 (0.9–1.2)	1.1 (0.9–1.2)	1.3 (1.1–1.6)**	1.4 (1.1–1.8)*
Not exposed (Ref)		1.0	1.0	1.0
Exposed		0.8 (0.7–0.9)**	1.1 (0.9–1.3)	1.0 (0.8–1.3)
Time 1 × Not Exposed (Ref)			1.0	1.0
Time 2 × Exposure			0.6 (0.5–0.8)**	0.6 (0.4–0.8)**
Public support for policies (N = 4988)				
Time 1 (Ref)	1.0	1.0	1.0	1.0
Time 2	1.1 (1.0–1.3)	1.1 (1.0–1.3)	1.1 (0.9–1.4)	1.2 (1.0–1.5)
Not exposed (Ref)		1.0	1.0	1.0
Exposed		0.7 (0.6–0.8)***	0.7 (0.6–0.9)**	0.8 (0.6–1.0)*
Time 1 × Not Exposed (Ref)			1.0	1.0
Time 2 × Exposure			1.0 (0.7–1.3)	1.0 (0.7–1.3)

^aAnalyses were controlled for current cycling behavior, use of bicycle-taxi, age, gender, body mass index, education, and household income.

* $P < .05$; ** $P < .01$; *** $P < .001$.

Abbreviations: PBSP, public bicycle share program; OR, odds ratio; CI, confidence interval; Ref, reference.

to higher traffic density, leading to a more favorable opinion regarding any actions that might reduce road traffic. On the other hand, an evaluation study of the impact of implementing the PBSP¹¹ on cycling showed that although there was a larger proportion of persons reporting cycling in areas where the PBSP docking stations were located and, thus, where road density was higher, there were even larger numbers of persons from outside the PBSP neighborhoods reporting using the bicycles in terms of raw numbers (ie, perhaps because the bikes were located in proximity of their place of work).

Although the present findings suggest that implementing PBSPs is associated with positive public perceptions and opinion, Shill et al³¹ highlight challenges associated with the implementation of public policies to create environments supportive of PA. According to these authors, the “road lobby” and cost of modifying existing urban infrastructures were among the most important barriers perceived by state level stakeholders to implementing measures aimed at reducing motorized vehicle use and improving urban planning. Similarly, Grant et al³² reported that policy-makers identified, among other issues, financial constraints and the heritage of car-oriented environments as important barriers to changing built environments. In the specific context of this study, the influence of another group of citizens on policy-makers might also be considered, namely dwellers of areas that do not have access to efficient public transportation. Indeed, such individuals (who are constrained to rely heavily on private motor vehicles to move around) might understandably be expected to be more strongly opposed to actions aimed at reducing automobile amenities in favor of active transportation when compared with residents of the city who have better access. The implementation of policies aimed at promoting active living and sustainable travel will require attention to meeting the needs of entire populations. Nevertheless, the present results suggest that large-scale deployment of a PBSP is associated with positive opinion, support and attitude toward active transportation (and active transportation policies) among a larger proportion of the population.

Notwithstanding the overall positive public opinion about selected outcomes of the PBSP, more than half of respondents did not believe that the PBSP was associated with improvements in road safety. Moreover, the significant change across time indicated that the likelihood of having a negative opinion about the impact of the PBSP on safety increased over time in the population, regardless of residential exposure to the PBSP. This might be explained in part by the fact that cycling is not the main mode of transportation in Montréal and represents only a relatively small proportion of modal share.¹¹ In this context, the principle of “safety in numbers” may not apply and respondents might perceive cycling as a risky activity during rush-hour traffic. Another explanation might reside in the fact that these bicycles are more visible (with distinctive designs and colors) and attract more attention than privately owned bicycles. Thus, other cyclists, pedestrians, and drivers may overestimate the potential dangerousness of using these bikes. In addition, it cannot be excluded that respondents perceived users of the PBSP as less experienced cyclists and were consequently more concerned about the behavior of these specific cyclists. It could be interesting to investigate the perception of the PBSP users by car drivers, other cyclists, and pedestrians in future studies.

This study includes several strengths. First, this is among the first evaluations of the impact of a PBSP on public perceptions and resistance to policies aimed at active living in transportation using a rigorous evaluation design. Second, this study provides some practical information for public health officials and urban planners that are working toward improvements in active living potential through environmental interventions. Some limitations should be mentioned.

First, it is possible that individuals more favorably predisposed to PBSPs were more likely to respond to the surveys. Moreover, respondents who had no missing data were more likely to be male, younger, and to report higher socioeconomic status compared with those who had incomplete data on all variables suggesting the possibility of a selection bias. This is a limitation for the generalization of the present findings, although results remained quite stable across subsets of the entire sample. In addition, as mentioned by Fuller et al,¹¹ repeated cross-sectional studies do not allow for the control of omitted variables. In the same way, additional confounding variables known to be associated with public opinion regarding, for example, land use modifications (eg, political ideology)³³ were not included in the present analyses. Finally, as now routinely observed in population-based surveys,³⁴ the survey recruitment strategy based on landline telephone may have led to lower response rates. Thus, although some studies show little evidence of nonresponse bias among surveys achieving lower response rates,³⁵ the present sample may still not be fully representative of the targeted population.

To conclude, the overall public opinion about the impact of this PBSP was positive and the population was somewhat supportive of public policies to improve active living through transportation. This environmental intervention was associated with positive public perceptions regarding the impact of the program and on public support for policies for active living in transportation. However, the implementation of the PBSP was not associated with a favorable perception of its impact on road safety. Future studies should investigate long-term trends in public perceptions and support for active living policies, alongside trends in different modes of transportation, as well as in response to implementing a PBSP.

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Notes

¹ It is noteworthy that the interaction effect for this outcome was attenuated to nonsignificance ($P = .07$) in analyses performed on the subsample with no missing data (OR = 0.7; 95% CI, 0.4–1.0).

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