Travel Behavior Impacts of Transportation Demand Management Policies: May is the Bike Month in Sacramento, California

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ABSTRACT

Every year, the Sacramento Area Council of Governments (SACOG) organizes the "May is the Bike Month" campaign to promote bicycling as a mode of transportation in the Sacramento region. In 2018, they conducted two online surveys – before the launch of the campaign and after its conclusion - to understand the effectiveness of the campaign in changing travel behaviors. We present the analysis of the information collected in this campaign. In this study, we integrated the before and after dataset through geocoding the residential location of each participant, and matching it with information on the built environment and a *bikeability index* of the home location (bikescore). We evaluate the effectiveness of the campaign through estimating three ordered logit models for the changes in bicycling frequency during three time periods: (1) before vs. during, (2) during vs after, and (3) before vs. after the campaign. In our preliminary analyses participants who were considering bicycling more and usually travelled by modes other than bicycling were found to more often increase their bicycling frequency than individuals who had already been regularly bicycling for more than six months. However, this increase was only temporary and largely disappeared after the end of the campaign.

Keywords: Travel Behavior, Transportation Demand Management, Bicycling, Before-after Study, Ordered Logit Model.

INTRODUCTION

Active modes of transportation like bicycling and walking are extremely beneficial to society. They help reduce the vehicle miles travelled from motorized travel modes, as well as reduce congestion and transportation-related emissions of greenhouse gases and air pollutants. Bicycling also has a very direct and positive health impact on the life of the individuals. A number of steps have been taken to promote active transportation in cities – including awareness campaigns, transportation demand management (TDM) policies, the building of new bicycling infrastructure, and the launch of bike sharing programs, such as the JUMP Bike program in the region of study of this paper: the Sacramento area in California.

In this study, we evaluate one of the TDM campaigns launched by the Sacramento Area Council of Governments (SACOG) to promote bicycling in the region. Every year, SACOG launches a 'May is the bike month' (MIBM) campaign. Throughout the campaign, participants are encouraged to pledge miles, register their bicycle trip miles, and challenge friends and family members to bicycle more often and win prizes. The campaign is promoted through social media, special events, websites and in collaboration with many schools, offices, clubs and teams in the Sacramento region. More details on this annual campaign are available through a detailed report from SACOG (2016).

A number of studies have looked into the factors which affect the frequency of bicycling. Lack of safety and reduced ability to run errands on a commute trip are some of the identified barriers to the adoption of bicycling as a mode of transportation (Akar, Flynn, & Namgung, 2012). On the other hand, proximity to bicycle tracks and shortcuts, safe parking facility, and provision of showers at destination are some of the identified incentives which can increase bicycling frequency (Hunt & Abraham, 2007; Noland & Kunreuther, 1995; Sener, Eluru, & Bhat, 2009; Titze, Stronegger, Janschitz, & Oja, 2008; Wardman, Tight, & Page, 2007). Brezina & Hildebrandt (2016) suggested that improvements in urban intersection design and increment in green light time at signal could improve attractiveness to cycling. On the other hand, a study conducted in elementary schools of Arizona concluded there was no significant relationship between bikeability of the streets and the number of bikes parked in local schools, which was used as a proxy measure of bicycling in the neighborhood (Sisson, Lee, Burns, & Tudor-Locke, 2006).

A number of studies have investigated the impacts of various TDM strategies on bicycling behaviors in various geographic contexts. For example, Fitch, Thigpen, Cruz, & Handy (2016) in a before-after study in San Francisco found an increase in bicycling after the installation of additional bicycling infrastructure. The type and quality of bicycling infrastructure also matters. A recent study from (Clark, Mokhtarian, Circella, & Watkins, 2019) showed higher preference and likelihood to start riding a bicycle when separated bicycle lanes and cycle tracks become available, compared to other types of bicycling infrastructure such as conventional on-street bike lanes. Outside of the US, Titze et al., (2008) found that bicycle lane connectivity is positively associated with cycling in Austria. The Australian Greenhouse Office (2005) tracked bike promotional programs like these in Australia. It was observed that 10 of 11 neighborhood program and 8 of 10 worksite programs were successful in increasing bike trips in Australia. These comprehensive programs included targeted information, events and incentives to promote bicycling.

The objective of this project is to understand the effect of the campaign launched by SACOG on the level of bicycling of the participants in the area of study. In particular, we are interested in addressing the following research questions:

- How does the frequency of bicycling of the campaign participants' change during and after the campaign?
- Which type of people are most receptive to the campaign message and increase their bicycling levels over the period of campaign?
- What other factors affect the decision of changing the frequency of bicycling?
- In particular, what local attributes of the place where participants live affect their likelihood of changing their frequency of bicycling?

DATA AND METHODS

In spring 2018, SACOG conducted a "before and after" survey to evaluate the impact of the 'May is the bike month' campaign. In addition to gauging the frequency of bicycling at three different times (before, during and after the campaign), the two surveys collected information on the perceived barriers and motivations for bicycling, travel habits, among other variables. The first round of data collection was completed at the time participants enrolled in the campaign. A second "after survey" was conducted after the campaign was over, in June 2018. Both surveys were administered online. The "before survey" consisted of only four questions asking about the campaign participants' usual mode of transportation and the frequency of bicycling for recreational and transportation purposes. In addition, participants were also asked to report their "bicycling status" choosing from of the following statements.

- Pre-contemplation: "I do not bike for most of my trips, and I don't intend to make any changes."
- Contemplation: "I do not bike for most of my trips. I am considering bicycling more often, but I'm not sure how to make that change."
- Preparation: "I do not bike for most of my trips, but I intend to bicycle more often. I know how I want to do this, but I haven't yet gotten started."
- Action: "I bike for most of my trips, and have been doing so for less than six months."
- Maintenance: "I bike for most of my trips, and I have been doing so for more than six months."

The "after survey" included other questions about the source of information from where they heard about the campaign, the reason to join the campaign, perceived barriers to bicycling, incentives that were offered to the participant, and a set of socio-demographic questions. Most importantly, this survey asked participants (retrospectively) about levels of bicycling before, during and after the campaign. The dataset that we used for the analysis presented in this paper consisted of 1,970 observations from individuals who participated in both surveys. After data cleaning, the final sample included 1,727 observations.

The dataset contains the addresses of the home locations of participants. After geocoding the data, this information was used to expand the dataset through integrating block-level information on the built environment in the place of residence of the participants. Figure 1 shows the geographic region of the campaign, with the distribution of the home locations of the participants. Table 1 summarizes the list of built environment variables that were imported, and the list of sources from where the information was obtained.

Table 1 Variables from web scrapping

Data used to extract information	Sources	Variables extracted
Address of participants	https://maps.googleapis.com/maps/api	- Latitude, Longitude
Address, latitude, longitude	http://api.walkscore.com/score	- Bikescore: score (0-100) measuring the ease of biking at the block level - Walkscore: score (0-100) measuring the ease of walking at the block level - Transitscore: score (0-100) measuring transit availability at the block level
Address	https://alltransit.cnt.org/metrics	- Overall transit score summarizing connectivity, access to land area and jobs, and frequency of service. - Number of commuters who use transit - Jobs located within 0.5 mile of transit - Workers who live within 0.5 mile of transit and commute by walking - Size of the average block within ½ mile of transit - Households within 0.5 mile of transit - Farmers markets within 0.5 mile of transit - Jobs Accessible in 30-minute trip by transit

To evaluate the effectiveness of the campaign, we fit three ordered logit models to study the changes in the frequency of bicycling of the participants during three time periods: (1) before vs. during; (2) during vs. after; and (3) before vs. after the campaign. To compute the dependent variable in each of these models, the initial bicycling frequency (before the campaign) was retrieved from the before survey; and the bicycling frequencies during and after the campaign were retrieved from the after survey, where participants also (retrospectively) reported their level of bicycling during the campaign in May 2018.

In all frequency questions, respondents were asked to report if they rode a bicycle as a means of transportation less than 1 day per month, 1-3 days per month, 1-2 days per week, 3-4 days per week or 5 days per week in each of these time periods. We used these frequency categories to compute the approximate number of days respondents bicycled as a means of transportation in the various months (April, May and June 2018). We then used the difference in these numbers to calculate the change in the frequency of bicycling, before-during, during-after and before-after the campaign, and generated ordinal variables to measure the magnitude and direction of the changes. The five ordinal levels measure *a strong decrease* (reduction in the frequency of seven bicycling days or more), a decrease (reduction of less than seven bicycling days per month), no change, an increase (increase of less than seven bicycling days per month), and a strong increase (increase in the frequency of seven bicycling days or more) in bicycling. All models include explanatory variables controlling for the impacts of sociodemographics, attitudes about bicycling, travel habits, perceived barriers and information about the built environment.

PRELIMINARY FINDINGS AND NEXT STEPS

We analyze the responses from the surveys conducted in April and June 2018 to understand how bicycling frequency of participants changed during and after the campaign. Certain demographic groups were found to be more likely to participate in the MIBM campaign and participate in this data collection. Consistent with expectations regarding the impact of TDM strategies mainly targeting office workers and students in the California capitol (and somewhat with the distribution of the population of bicyclists in the region), our sample includes a larger proportion of higher-income and better educated adults than in the general population of the region. In particular, individuals living in low-income households are particularly underrepresented: participants with annual income of less $75,000 are barely a quarter of the sample. By comparison, 65% of the population the in the Sacramento County belong to this group. Further, our sample tend to over-represent males – 58% in the sample as opposed to 48% in Sacramento – and (not surprisingly) is skewed towards people who usually use bicycle as a primary mode of transportation (23% in the sample, only 1% in City of Sacramento) (ACS, 2019).

Approximately a third of the participants increased their frequency of bicycling during the campaign (compared to before the campaign). A similar number of participants decreased their bicycling frequency during the same period, possibly due to a combination of concurrent factors including the increase in temperatures (hot weather of summer) and the end of the school year for some schools. Almost 70% of participants reported that their bicycling frequency after the end of the campaign was similar to the frequency during the campaign, suggesting that habits created during the campaign persisted also after the end of the incentives of the TDM policy, in addition to the effects of other confounding factors including both seasonal effects and methodological issues in the data collection.

Figure 1 shows the location of participants from the Sacramento County. The green color indicates an increase in the frequency of bicycling, red shows decrease and yellow means no change in the frequency after the campaign as compared to before. Most of the participants are from the city center. These central city participants more often report to have increased their bicycling frequency after the campaign.

Individuals who usually travel by car, walk or transit as a typical mode of transportation were the ones who more often reported an increase in bicycling during and after the campaign. On the contrary, about 80% of the participants who already bicycle as a regular mode of transportation decreased their bicycling frequency during the time of the campaign (both in the before-after and in the before-during comparisons). In particular, people who decreased their bicycling frequency primarily bike for work. On the other hand, participants who mainly ride a bicycle for recreational purposes increased their bicycling frequencies during the time of the campaign. Further, almost half of the younger participants (below the age of 34) decreased their bicycling frequency in the before-during and before-after phase.

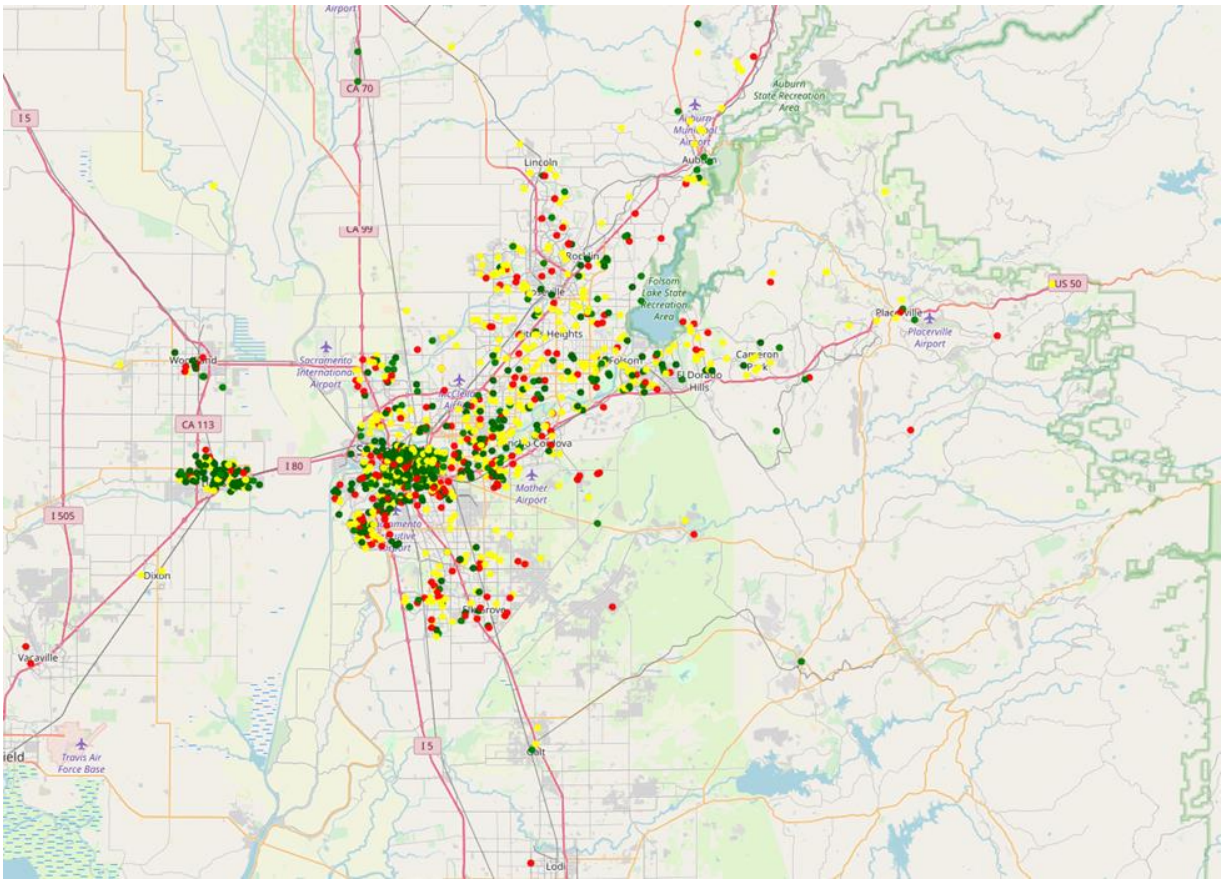

Figure 1: Spatial representation of change in the bicycling frequency (before-after): Green = Increase, Yellow = No change, Red = Decrease

The results of the estimation of the three ordinal models show that individuals in the *action*, *contemplation*, *pre-contemplation* and *preparation* status were more likely to increase their bicycling frequencies in the 'Before-During' phase as compared to individuals in the *maintenance* bike status. This is probably due to the higher "space" for an increase in bicycling for the former groups, and the fact that the campaign mainly motivated them to increase their bicycling only a temporary basis. Consistent with what observed in the descriptive statistics, individuals who use any mode of transportation other than bicycling were more likely to increase their bicycling frequency during and after the campaign than the individuals who usually use bike as their main mode pf transportation. Overall, individuals who stated they joined campaign because "it was fun" were unlikely to increase their bicycling frequency, while individuals who stated that weather is a barrier to bicycling increased their bicycling levels after the campaign (at the beginning of summer, where the weather is warmer).

Individuals who stated that the TDM campaign had a direct impact on their bicycling activity showed a strong likelihood of increasing their bicycling frequency during the campaign as compared to individuals who stated that the campaign did not have an impact. However, the former group did not sustain the increment in bicycling frequency after the end of the campaign.

In future steps of the research, we plan to estimate models by segmenting respondents on whether the campaign had an impact on their bicycling and otherwise. We plan to treat the latter group (who did not

report an impact) as a quasi-control group in the analysis to account for the confounding impacts of seasonal effects and other variables on the reported bicycling frequency. The results of these additional analyses will be ready by the time of the conference. Also, the results from this study are informing the design of the TDM campaign to be deployed in Spring 2019, when a new data collection will be carried out.

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