A Comparison of Bicyclist Attitudes in Two Urban Areas in USA and Italy

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Abstract. Over the past 40 years, the number of people using bicycles as their primary means of transportation has increased significantly. Transportation agencies around the world now promote bicycling as a way to reduce pollution and traffic congestion. However, the lack of bicycling infrastructure in many cities could significantly impede the future growth of bicycle usage. This paper used a web survey to evaluate the attitudes and preferences of bicyclists in two cities: Lexington, Kentucky, USA and Catania, Sicily, Italy. The goal of the survey was to document impediments to bicycling in both cities, determine how infrastructure could be improved. Descriptive statistics and test of hypothesis were applied to the survey data to analyze participant responses and their level of agreement. Confirming previous research, respondents in both cities overwhelmingly cited lack of infrastructure as a major obstacle to bicycling more often. Respondents indicated that improving bicycle infrastructure and pavement conditions would result in an increased number of bicycle trips. While the survey findings lend support to the idea that bicyclists around the world harbor similar attitudes about what improvements are needed to increase cycling and enhance their experiences, local conditions and practices also influence perceptions about the relevance of specific issue.

Keywords: Bicyclist mobility · Bicyclist preferences · Infrastructure

1 Introduction

Throughout the world, bicycling as a transport mode has seen a significant increase over the past decades. In the USA, the number of walking and biking trips were approximately 11.9% of the total number of trips in 2009; more than a 25% increase from 2001 [1]. Studies have also shown an increase in ridership with over 40% reporting that they have used a bicycle more often than in the past [2]. What is of interest too is that most of the trips are now utilitarian (i.e., they do not have a recreational purpose) [3]. Similar trends have been noted in the European Union (EU), where the number of bicycles per 1,000 inhabitants ranges from 52 in the Czech Republic to 1,000 in the Netherlands [4]. The most noticeable difference among EU countries is the level of bicycle usage—in some countries individuals rely on bicycles every day as a primary means of transport (such as the Netherlands and Scandinavia), while in others do so only occasionally.

Throughout the world, transportation agencies promote bicycling as an alternative transportation option, since it provides health benefits, reduces carbon emissions, and alleviates congestion. It is imperative then that transportation agencies develop and support an appropriate infrastructure to encourage the continued growth of bicycling.

The availability of bicycle-friendly infrastructure is considered one of the factors that stimulates cycling [3]. Infrastructure qualifies as bicycle-friendly if it allows comfortable cycling in a safe and attractive traffic environment. For agencies to provide appropriate bicycle infrastructure and increase the share of bicycle as a travel mode, they must be aware of the obstacles to bicycling perceived by the active and potential bicyclists and address them accordingly. Agencies have utilized surveys to understand bicyclists' attitudes and identify required improvements.

This paper evaluates attitudes and preferences of bicyclists in Lexington, Kentucky, USA, and Catania, Sicily, Italy, using a web-based survey aimed to identify impediments to bicycling in both cities. A comparison of the two survey results could reveal whether the bicycling population expresses similar concerns and preferences across the world and illuminate how attitudes are influenced by living in a city with (Lexington) or without (Catania) bicycle infrastructure. Understanding these issues will facilitate development a plan of action for how to better address bicycling needs.

2 Background

The number of people using bicycles as a primary mode of transport has increased over the past 40 years. Much of this growth in the USA and Canada has been concentrated in large cities, where the growth rate was twice what was observed for the entire country between 1990 and 2010 [3]. Higher growth has been attributed to infrastructure improvements and the introduction of programs that advocate bicycling. These efforts have included the addition and expansion of bicycle facilities (lanes and paths), implementation of traffic calming measures, improved bicycle-transit integration, establishment of bike sharing programs, and promotional events. Another study that reviewed current installations in 14 cities found significant increases in bicycling mobility after they adopted comprehensive packages of interventions [5]. The study concluded that public policy plays a critical role in encouraging bicycling; to increase bicycle usage, a comprehensive package of several complementary interventions is required.

Bicyclists select routes based on criteria such as length of trip, frequency of left turns, intersection traffic volumes, and slopes [6]. These findings suggest that bicyclists select routes based on specific preferences, avoiding perceived high-hazard locations and opting for cycle paths, if available. However, it is not clear whether they are always aware of hazardous situations or alternative routes. Moreover, the route selection for commuter bicyclists is more sensitive to route length than other route characteristics. Bicyclists generally prefer separate facilities or at least bicycle lanes [7, 8]. Commuter bicyclists prefer on-street bike lanes over paths because lanes follow the road network and provide more direct routes [9]. Previous studies have indicated a positive correlation between cycling levels and the supply of bike paths and lanes [10, 11].

The National Documentation Project (NDP) is an annual bicycle and pedestrian count and survey effort that documents usage and demand of facilities for bicyclists and pedestrians [12]. The NDP uses a combination of traffic count and surveys to estimate non-motorized transportation needs and provides local agencies with hard-to-collect data so they can make better-informed decisions when planning infrastructure improvements. A similar survey has been administered in Europe to understand the issues people face traveling in urban areas and determine policies to achieve the goals set forth in Urban Mobility plan [13], which phase out conventionally fueled cars by 2050. The survey focused on defining transport habits, problems in cities, and ideas on improving travel. Fifty percent of the survey's respondents indicated they never use a bike as an alternative to cars; just 12% said they opt for bicycles as an alternative daily [14].

Although surveys are used routinely to understand bicycle usage in the USA and Europe, no comparative studies have been performed that systematically compare the preferences and attitudes of bicyclists. This study fills this gap and provides much-needed insights into how bicyclist attitudes vary between countries.

3   Methodology

A web-based survey was developed to solicit responses about bicyclist attitudes, opinions about bicycle infrastructure. The survey targeted audiences in two cities: Lexington, Kentucky, in the USA and Catania, Sicily, in Italy. While both cities are home to approximately 250,000 residents, their respective bicycle infrastructures differ significantly. Lexington has over 40 miles (64 km) of bicycle facilities (paths, lanes, and shared facilities), while Catania has a network of less than 5 miles (8 km). Originally developed for Catania as part of a research effort to identify infrastructure deficiencies and obstacles to mobility that discourage widespread bicycle use, the survey was also administered in Lexington to compare the responses of US and Italian bicyclists and determine the potential impact of infrastructure extent on their views.

The length of the survey was short to maximize completion rate and contained five parts: demographic questions, questions about bicycle usage and impediments to bicycling, a list of items that would help increase the use of bicycle as a transport mode. Participants had the option as well to add responses not included in the lists. Preferences were recorded using a 6-point Likert scale without ties to force a decision. The survey web-link was disseminated through email lists, social media and bicycle events. A total of 329 people took the survey; 195 in the USA and 134 in Italy.

A statistical analysis was undertaken to determine whether there was a consensus in the rankings of each group of participants and compare responses from the two cities. Kendall's coefficient of concordance (W) was used to estimate consensus on the rankings within each group of participants, and the U Mann-Whitney test was selected to detect differences in the rankings between the survey participants from each country. These tests were considered appropriate given the type of available data (i.e., ordinal data with rank orders and different sample sizes) [14].

4 Survey Results

4.1 Demographics

The questions on participant demographics showed similar levels of gender participation between counties, with males making up approximately 65% of respondents in both surveys. The age distribution was slightly different: the mean age in Catania was 33.9 with 41.8% of participants in the 25–34 age group, while in Lexington the average age was 43.5 with 31.1% in the 35–44 age group. The final demographic question asked about income to understand the relationship between it and bicycling preferences and attitudes. This question was not answered by 36.2% of the participants in Catania, while just 9% in Lexington did not respond. Overall, gender and age distributions of the participants were similar in both cities.

4.2 Frequency of Use

Frequency of bicycle use differs to some extent between Lexington and Catania. In Lexington, 45.9% of respondents use a bicycle as their primary mode of transportation each day, while just 19.6% in Catania do. The percentage of respondents who use their bike every day or more than four days per week as a primary transport mode widens this difference—64.4% in Lexington do so, while 28.3% in Catania do. These trends were similar for specific trip purposes as well, when combining the categories of daily and more than four days per week usage. In Lexington, 74.5% of respondents use bicycles to go to school or work compared to 33.3% in Catania. Furthermore, 47.2% of respondents said they bicycle to exercise, while only 8.2% in Catania do. The only area in which this trend reversed was shopping trips. A larger percentage of respondents in Catania use bikes for shopping trips (33.3%) than in Lexington (24.1%).

A question about weekly trip length also revealed differences in the behavior of the cities' bicyclists. Nearly half of the Lexington participants (48.6%) said they travel more than 15 miles (24 km) per week—an average of approximately 13.9 miles (22.4 km). Catania bicyclists noted an average distance of 5.4 miles (8.7 km) per week and the majority (54.4%) travel less than 1.25 miles (2.0 km) per week. A comparison for weekly trip distance by trip purpose did not yield additional findings, repeating the patterns observed previously. An overwhelming majority of Catania participants (85.8%) said that they travel less than 5 miles (8 km) weekly on a bicycle as a primary means of travel while almost an even percentage in Lexington noted that they use bike as a main mode for transport for short (less than 5 miles: 45.3%) and long distances (more than 10 miles: 38.8%).

4.3 Impediments to Bicycling

The next set questions attempted to identify potential impediments to bicycling. There were two questions: one focused on infrastructure issues and a second examined aspects of the roadway environment that could discourage bicycling.

For both cities, a key reason respondents gave for not cycling is the absence of bicycle infrastructure (Table 1). For Lexington, this was noted as the most important reason 36.7% of the time and for Catania 42.5%. If the presence of narrow travel lanes is counted as an infrastructure deficiency impeding bicycle use, these figures climb to 67.2% for Lexington and 47.7% for Catania. The second most cited impediment (total of both: 62.1% for Lexington and 37.3% for Catania) was lack of bicycle infrastructure. Pavement condition was the third highest ranked justification respondents gave for not bicycling, with 18.6% of participants in Lexington citing this and 29.1% in Catania. Many respondents marked this as their second choice as well. The mean rank order for the impediments shows, overall, a different ranking between the participants of the two cities. The top two choices in roadway environmental impediments are for both cities high volumes of vehicles and aggressive driver behavior. The top three choices for roadway infrastructure impediments are the same for both cities, however they are ordered differently.

Table 1. Mean scores for impediments to bicycling.

City	Roadway infrastructure impediments					
	No bike parking	No bike lane	Narrow travel lane	Poor pavement	No street light	Many intersections
Lexington	4.52	**2.44**	**2.18**	**3.01**	4.72	4.15
Catania	4.25	**2.34**	**3.67**	**2.79**	4.04	3.90
	Roadway environmental impediments					
	High volumes	Aggressive drivers	Modal connectivity	Weather	Pollution	Destination distances
Lexington	**2.41**	**1.94**	3.65	**3.20**	4.72	4.08
Catania	**2.45**	**2.34**	3.72	4.80	4.08	**3.61**

Note: 6-point Likert scale 1: most relevant; 6: least relevant. Bold figures denote top choices

The Kendall's W values were 0.345 (p = 0.000) for Lexington and 0.165 (p = 0.000) for Catania, indicating overall agreement among participants on the ranking of each impediment. This agreement was weak for Catania and moderate for Lexington. Results of the Mann-Whitney U-tests showed that Ho (i.e., there is no agreement between the participants from the two cities) cannot be rejected for the rankings related to no bike lanes (p = 0.357), many intersections (p = 0.129), poor pavement (p = 0.090) and no bike parking (p = 0.188). However, it was rejected for the narrow travel lanes and no street lights (p = 0.000). This may indicate the importance that each of these impediments have within the specific population and reflect overall perceptions.

The survey also investigated which roadway environmental factors influenced respondents' bicycling tendencies. In both cities, a primary obstacle to bicycling is aggressive drivers (Table 1). In Lexington, 47.5% of respondents identified this as the most important reason, while 40.3% of Catania participants ranked it as such. High traffic volumes were the second most frequently cited reason, with 25.4% of Lexington

participants and 24.6% of Catania respondents ranking this at the top of their lists. These reasons were often noted as the second most important as well. The Kendall's W values were 0.44 (p = 0.000) for Lexington and 0.26 (p = 0.000) for Catania, which indicates that participants' rankings agreed overall. However, this agreement was weak for Catania and moderate for Lexington.

The mean rank order of environmental impediments reveals participants in Lexington and Catania had different overall rankings. The Mann-Whitney U-tests showed a significant difference in the rankings assigned by participants for weather, pollution, aggressive drivers, and modal connectivity (i.e., p < 0.05). Catania residents expressed greater worry about pollution and modal connectivity, while Lexington bicyclists were more apprehensive about weather conditions and aggressive drivers. Weather was not highly important for the Catania participants since the climate is more temperate and winters are not severe. Comparatively, Lexington experiences more severe weather and has a greater number of days with inclement weather (e.g., rain, snow, and ice). It was not possible to reject the hypothesis of equal rank for high traffic volumes (p = 0.665) and destination distances (p = 0.592). The results show that universally high traffic volumes could impede bicycling, while the other variables could be of greater importance based on the local experiences and conditions.

A question was also included aiming to identify potential interventions to reduce or eliminate bicycling impediments. Respondents in Lexington (81.4%) and Catania (85.1%) overwhelmingly favored the addition of new bicycle infrastructure, citing it as the most important intervention. Improving pavement conditions was ranked as the section option by respondents in both cities (39% in Lexington; 65.7% in Catania). Based on these responses, clearly respondents believe that correcting or improving infrastructure will encourage significant increases in bicycling.

The Kendall's W values for Lexington were 0.35 (p = 0.000) and 0.19 (p = 0.000) for Catania, indicating that participants exhibited overall agreement in their rankings of each impediment. This agreement was weak for Catania and moderate for Lexington. The mean rank order for the interventions shows, overall, a similar ranking by participants in both cities. The Mann-Whitney U-tests indicated that it is not possible to reject the null hypothesis of equal rank between the participants from the two cities for bike lanes (p = 0.324) and bike parking (p = 0.151). The null hypothesis (Ho) was accepted (i.e., p < 0.05) for the other items, with only slight differences between the ranks except for modal connectivity, which was classified as more important in Catania than in Lexington. This may be attributed to Catania lacking public transportation provisions to accommodate bicyclists; this is an issue of lesser importance in Lexington, since all public buses are equipped with bicycle transport equipment.

5   Conclusions and Discussion

This paper described the findings of a survey conducted to identify attitudes and opinions of bicyclists is two cities in Lexington, Kentucky, USA and Catania, Sicily, Italy. Survey respondents ranked impediments to bicycling as well as the potential efficacy of different interventions for removing obstacles to safe bicycling trips.

Survey results could reflect the presence or absence of bicycle infrastructure. Respondents in Lexington tend to bike more miles per week than those from Catania, possibly due to a more robust bicycle network, which accommodates longer trips and greater commute frequency. This was also reflected in statistics of the number of respondents using their bicycles either daily or more than four days per week. Another item that indicates the infrastructure effects is modal connectivity. This was not a concern for respondents in Lexington, where public transportation facilities accommodate bicycling, while the lack of modal connectivity made this a much more salient issue for bicyclists in Catania.

Survey participants in both cities overwhelmingly said that lack of quality infrastructure is a major impediment to bicycle usage; this finding mirrors the results of previous research. Factors such as presence of bicycle infrastructure, in the form of bicycle lanes, paths, or cycle tracks, and pavement conditions, have been identified as features that could encourage bicycling. Respondents' identification of interventions to improve bicycling conditions and increase the number and frequency of bicycle trips underscored this fact.

Statistical analysis indicated weak to moderate agreement among respondents. This may be the result of having small samples. Additional surveys may provide more robust statistical findings. A deeper investigation of how demographic characteristics (e.g., gender, income level, frequency of cycling, cycling distances) influence bicyclist attitudes and perceptions could be beneficial as well. The limited dataset used for the analysis described in this paper does is not sufficient to conduct a more thorough examination of demographic influences. Additional surveys should be administered to collect these data [15]. Another approach that can be used to further examine the effects of local context, is a multi-round survey (Delphi technique) where after each round the results of the previous round are given to the participants as feedback to influence their opinion [16].

Overall, the survey's findings demonstrate that bicyclists around the world hold similar opinions on what improvements are required to promote cycling and enhance their experiences. Agencies wanting to increase bicycling in their jurisdictions must improve infrastructure. However, in the current economic environment there is less money to fund infrastructure, and transportation agencies with shrinking budgets are challenged to justify all investments, especially those designed to increase bicycling as transportation mode.

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