

Positively Influencing the Perception of Cycling: 'The Club' Case Study

Tess Cummings, Mark Headley, Shabaka Gibson, and Akpo (Tobo) Okoro

University of Maryland Global Campus

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Executive Summary

The purpose of this case study was to perform a systematic review to identify some factors that could positively influence the perception of cycling. These factors would help a local cycling Club (The Club) address problems with Club revenue, the number of new members, and challenges with influencing the community, as well as, local, regional, and national policymakers.

This case study identifies potential guidance for The Club through a systematic review that is a quality appraisal and synthesis of 30 peer-reviewed, scholarly articles. Five primary findings resulted from the systematic review: personal values and beliefs strongly influenced the perception of cycling; individuals who value an active lifestyle have a positive perception of cycling; real/perceived physical safety is influenced by bicycle infrastructure; the decision to bike is multifactorial, involving psychological, socioeconomic, and infrastructure factors; motivational programs for biking work best in the individual's environment.

There were three evidence-based recommendations for The Club. The first was to revise their mission statement to include value-laden statements known to influence riders. The second recommendation was geared towards The Club increasing their virtual and physical presence in the community. The third recommendation was for The Club to actively engage in communicating / advocating with local and county officials. These proposed evidence-based recommendations are coupled with a high-level assessment of risks and suggested implementation plans. A general communication plan accompanies these recommendations.

Overall, it was determined that the case study should contribute to a positive perception of cycling in the local area and other cities/towns.

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Introduction

Problem Statement

The authors received their first project with a local cycling organization we are calling The Club. The Club expressed issues with declining revenue, a need for new members, and a lack of influence on the community, as well as, local, regional, and national policymakers. The organization's focus is influencing key stakeholders by increasing the positive perception of cycling. These stakeholders include policy makers, municipal planning organizations, local businesses, community members, current club members and potential new members, and cycling advocates.

Research Question

The authors reviewed The Club's membership surveys and had an initial conference call with The Club's President of the Board of Directors. The authors also met with The Club's President in person. During the meeting, a review of rapid-evidence assessments conducted by individual team members, along with a consolidated presentation and review of initial findings with the client, led to the selection of the following research question: What factors positively influence the perception of cycling to improve stakeholder advocacy?

This research question was refined using a PICOC (Population, Intervention, Comparison, Outcome, Context) assessment with the results shown below (Barends, Rousseau, & Briner, 2017):

- Population: The individuals affected by the outcome are bike riders
- Intervention: Influence perception/thoughts of stakeholders (policy makers, municipal planning organizations, local businesses, community members, current club members and potential new members, and cycling advocates)

- Comparison: Current stakeholder perception/thoughts
- Outcome: Improved stakeholder perception
- Context: Bicycling Club

Based on the PICOC assessment, a final research question was derived: What can bicycle stakeholders do to positively influence the perception of cycling? This descriptive research question was selected to help The Club gain a broad understanding of actions they might consider taking to positively influence the perception of cycling in the community, thus increasing ridership and safety.

Background

Organizational Overview

The Club is a cycling club that was established in 1981 and consists of road, touring, hybrid, recumbent, and tandem cyclists. The Club strives to provide opportunities for riders of all levels and partners with other clubs and organizations to further safe riding throughout the region (The Club, 2020). The organization is membership-based and generates revenue through membership dues, merchandise sales, and other fundraising events such as 50/50 raffles, dinners, and other activities (The Club Bylaws, 2019). Attributes of The Club include camaraderie, companionship, and the sheer joy of riding bikes (The Club Bylaws, 2019).

The Club operates as a network value (loyalty-based) efficiency model. Essentially, The Club creates repeated interactions with a group of loyal customers (members). The generic value capture logic for a business model that wants to create a network value is to supplement the profit logic of the value-based model with attributes that attract and retain the critical mass of customers while keeping imitators out (Chatterjee, 2013). These attributes at The Club include camaraderie, companionship, and the sheer joy of riding bikes (The Club Bylaws, 2019). The

imitators exist in this scenario as competing bicycle clubs and other comrade building group-based offerings. Figure 1 shows the network-value business model for The Club.

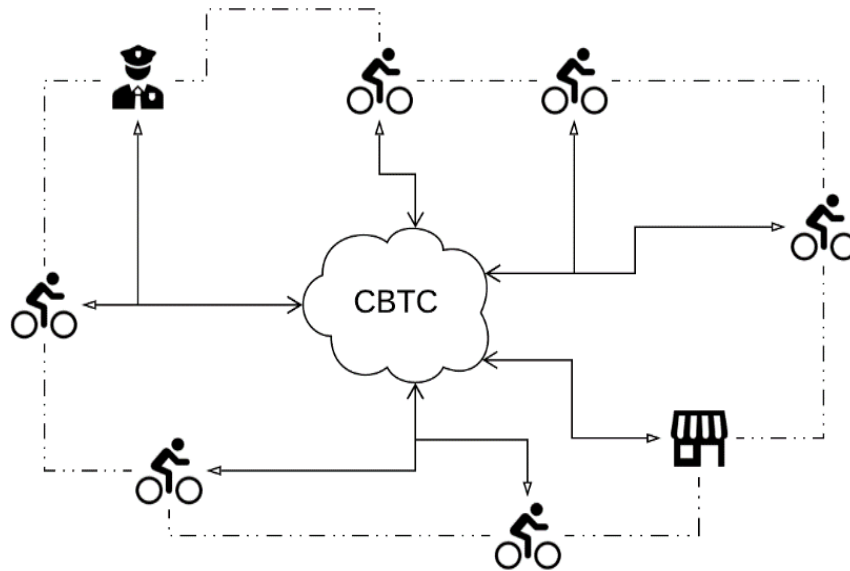


Figure 1: Network-value (loyalty based) business model for The Club.

In this model, the organization creates value for its members and partners through unique attributes. In return, the members and partners generate revenue and influence for the organization by existing as its network (Chatterjee, 2013).

Organizational Assessment

Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was used to assess THE CLUB. Based on discussions with the President of The Club and a review of membership survey results, the SWOT analysis revealed the information provided in Figure 2.

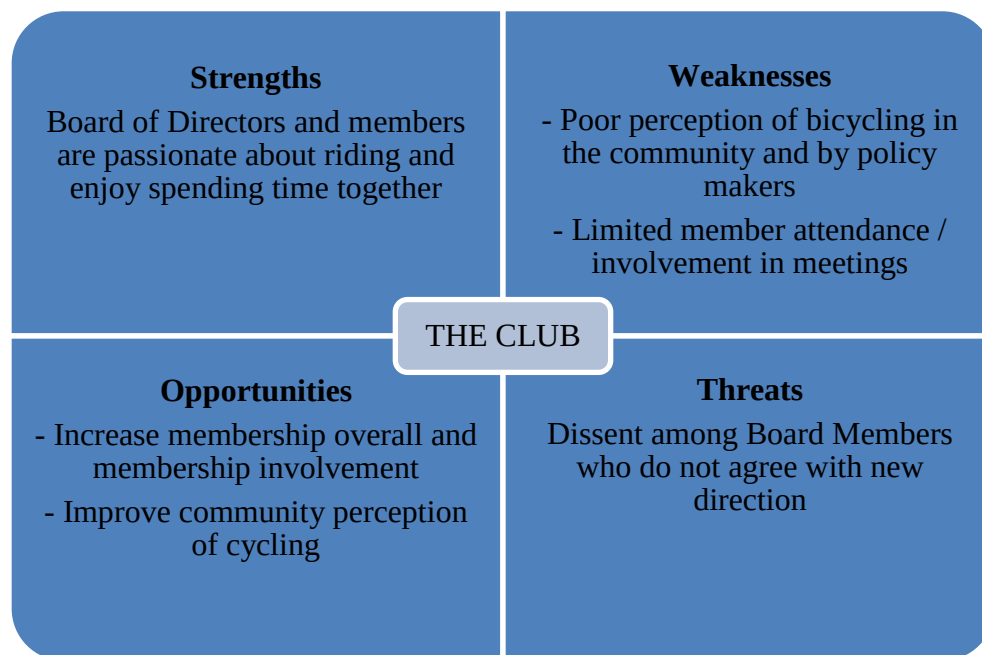


Figure 2: SWOT analysis for The Club.

The strength of The Club is the organization itself. The Board of Directors and members are passionate about riding and enjoy spending time together. However, some weaknesses include a poor perception of bicycling in the community and by policy makers. Additionally, there is limited membership growth and participation in meetings and events.

There are opportunities to increase member involvement and membership overall. Improved membership would include partnerships with local businesses and policy makers. An additional key opportunity is in the potential to improve the community perception of cycling.

A potential threat to The Club would be in the dissent among Board Members who would not agree with a new direction.

Theory

Theoretical Framework

The Sense of Community Theory (McMillan & Chavis, 1986) was selected to serve as the theoretical framework for this Systematic Review. In summary, Sense of Community focuses

on four key components: membership, influence, integration and fulfillment of needs (reinforcement), and shared emotional connection; as illustrated in Figure 3. Membership is inclusive of five distinct domains: boundaries, sense of belonging, common symbol system, personal investment, and emotional safety. Each of these domains is important in creating a sense of membership or belonging.



Figure 3: Sense of Community Theoretical Framework (McMillan & Chavis, 1986)

This theoretical framework was selected to understand the issues faced by The Club because of the common themes seen in the client's description of the problem and the main constructs represented. Also, the Sense of Community framework has been previously used in research performed in the tourism industry (Hahm, Breiter, Severt, Wang, & Fjelstul, 2016), recreation industry (Legg, Wells, & Barile, 2015), and business industry, with a focus on brand loyalty (Djoko, 2016; Swimberghe, Darrat, Beal, & Astakhova, 2018).

Theoretical Lens

Within the theoretical lens, membership is a concern. In discussions with The Club, one of the main problems expressed was a drop-in club membership. The president of The Club expressed that one of the more recent successes was the implementation of a new club jersey to create a more up-to-date common symbol for all members. Some members view The Club as a stepping stone from which they could advance to join other clubs. This condition illustrates a need for a stronger sense of belonging. In a recent survey, less than 10% of the 42 respondents listed “association with a club” as one of the top three reasons for membership, and less than 10% were willing to get involved in building club membership or serving on the Board of Directors.

Influence is a bi-directional concept, where for a member to be attracted to a group, they must have some influence over what the group does. However, group cohesiveness is contingent on a group's ability to influence its members. In the same survey, 28% (12 respondents) indicated that they were not willing to attend club meetings or neglected to answer the question related to attendance at club meetings. Bi-directional influence cannot be achieved if members do not participate in the meetings where club objectives are discussed.

Another bi-directional component entails the influence between community stakeholders and the bike club. In this case, bike club members are attempting to influence community stakeholders for better riding environments while trying to change the community's perception of cycling.

Reinforcement of the individual-group association must be rewarding for the members of the group to maintain a positive sense of togetherness. “Some of the rewards that are effective reinforcers of communities are status of membership, success of the community, and competence

or capabilities of other members” (McMillan & Chavis, 1986, p.13). Creating a stronger and more active membership for The Club would also serve as a reward that reinforces strategic partnerships with civic leaders, bike clubs, and businesses, fostering a stronger sense of community. In the survey, over 40% of respondents indicated that they ride at least three times per week as part of The Club, and that this element of The Club was fulfilling.

The strength of the community is directly influenced by the shared emotional connections, which is represented by interactions of club members in shared events. Organized bike events serve as a positive influence in this community. During the survey, 86% of the respondents indicated that social interaction with other cyclists was one of their top three reasons for club membership.

Conceptual Framework

Integration of the information provided above about The Club with elements of the Sense of Community Theory resulted in the conceptual framework illustrated in Figure 4. The characteristics of the lines signify the strength or weakness of the theoretical construct at The Club, with intervention opportunities in the domains of membership and influence. The more solid the line, the stronger the theoretical construct was assessed to be at The Club.

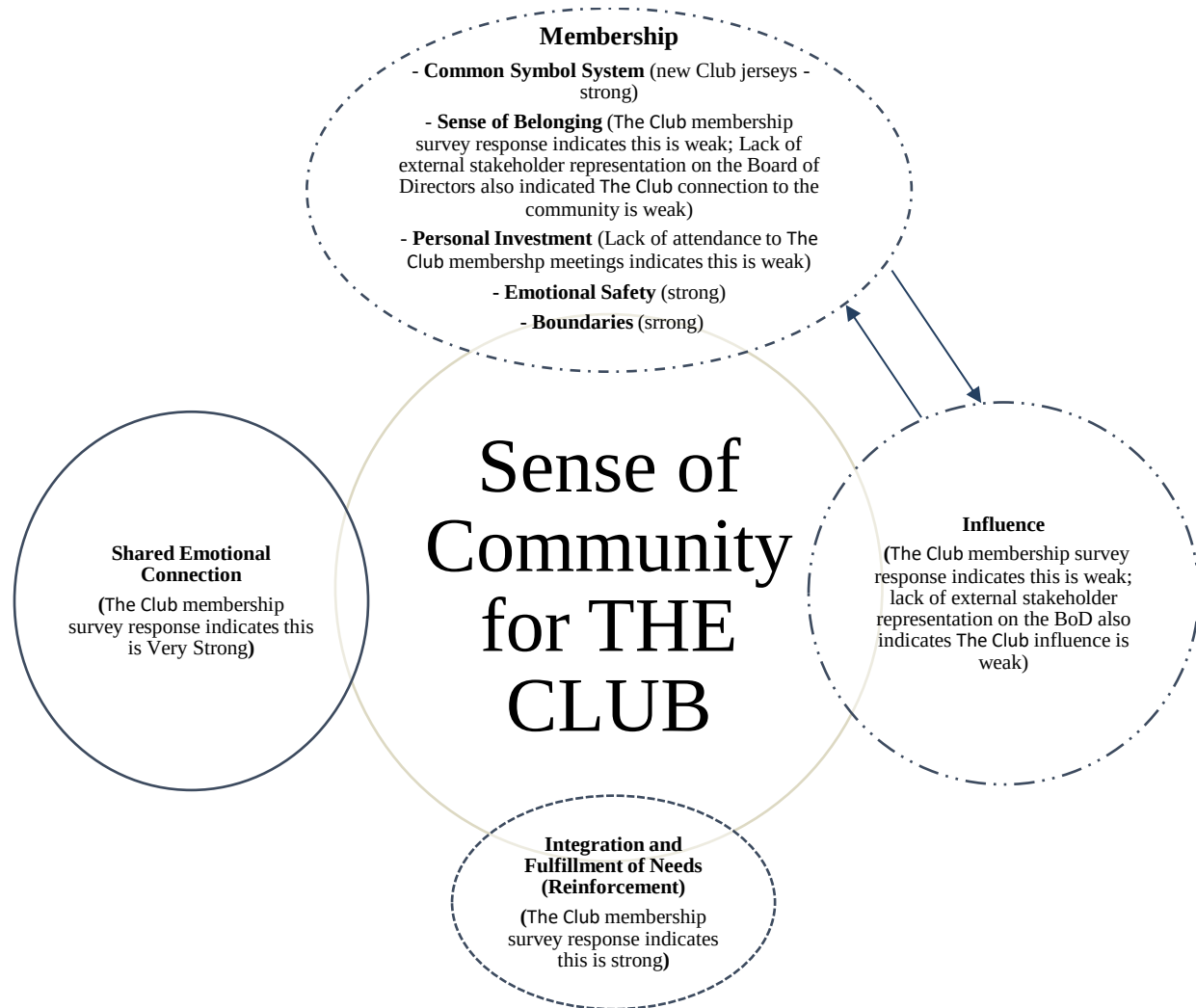


Figure 4: Conceptual Framework for The Club integrated with Sense of Community Theory.

THE AUTHORS assessed the Common Symbol System trait of Membership as strong. For The Club, this would be the physical branding and marketing material including the common riding gear that is used on group rides. Additional strong Membership traits are Emotional Safety and Boundaries. However, weak Membership traits for The Club include Sense of Belonging and Personal Investment.

The second key component of Sense of Community, as applied to The Club, is Shared Emotional Connection. This is a commitment and belief that members have and will share history, common places, time together, and similar experiences. For The Club, this is rated as very strong given the organization's history and shared experiences amongst current members.

Additionally, The Club scores strongly in the third key component - Integration and Fulfillment of Needs. The Club's members' needs can be met by resources received through membership in the group. There may be an opportunity, however, to strengthen needs fulfillment by providing resources for skill development and/or racing support.

Influence (bi-directional) is the final key component. This is a sense of making a difference to the group, and a sense that the group matters to its members. The authors assessed this component as weak. However, it should be understood that this includes potential members and partners as well. The group matters to its members and the members matter to the group, but the size of the group and impact of the group compared to its potential implies that there may be some work to do in this component.

Alternative Views

Stakeholder Theory was considered as an alternative theoretical framework that could be applied to The Club for this systematic review. "Stakeholder Theory conceptualizes the firm as a series of groups with different respective relationships to it. Stakeholders consist of internal organizational members, including employees, managers, and board members; external members, such as owners, customers, suppliers, and competitors; and hybrid members engaged in interorganizational cooperative activity with the firm" (Schneider, 2002, p. 211). The main reason that the authors elected to go with the Sense of Community Theory versus Stakeholder

Theory is that the Sense of Community Theory is geared towards membership, whereas Stakeholder Theory is aimed at organizational management.

Methodology

Evidence-Based Approach

Evidence-based management encourages the use of the best available evidence and helps organizations to identify evidenced information to keep management informed (Aninag, 2014). The “evidence-based approach to management reduces the potential for irrational thinking, bias, or exhaustion” (Price, 2018, para. 5; Rynes, Giluk, & Brown, 2007). Evidence-based management is science and data driven (Price, 2018).

The team first created a search string based on words and associated synonyms from the research question. Inclusion / exclusion criteria were then stipulated, and literature was selected. Critical appraisal was also performed to assess the quality of the articles, with key data then being extracted for review. Coding with Atlas.ti was performed to synthesize the data.

Search Process / Literature Selection

Search strings generated 1420 articles for consideration. Broad preliminary search strings were initially used in the title and abstract searches on the UMGC "OneSearch" internet library database advanced search tool. This first search returned 516 results.

A more specific search using constructs from the original research question on the UMGC "OneSearch" internet library database advanced search tool yielded 402 results using search string (bike or bicycle or bicycling) AND (*influence) AND (perceptions or attitudes) AND factor.

One article by Habib, Mann, Mahmoud, and Weiss (2014) seemed to represent a seminal article in the field. A refined cited-reference search using Google Scholar was then conducted on this article, yielding 24 articles.

Based on the PICOC assessment and refined research question, refined search strings targeting policy makers and cyclists were used in the title, abstract, and all text search fields on the UMGC "OneSearch" internet library database advanced search tool. This search returned 436 results using the following search strings:

- Title search - (policy* OR "policymaker" OR "policy maker" OR "policy-maker" OR policy making)
- Abstract search - (bik* OR bicycle* OR cyclist)
- All text search - (percep* OR influen*)

A "Google Scholar" search was also conducted and yielded three additional articles using the following search strings:

- (bike* OR cyclist OR bicyc*) AND (policy OR regulat*) AND (influence AND advocacy*)
- (bike* OR cyclist OR bicyc*) AND (policy OR policy maker OR policy-maker OR regulation*)

A UMGC librarian assisted search targeted at advocacy on the UMGC "OneSearch" internet library database advanced search tool resulted in 39 additional articles: bicycle* n5 advoca*.

After removing duplicates, there were 632 articles. Screening of titles and abstracts resulted in 577 articles being excluded, and assessing full texts of the remaining articles resulted in 25 additional articles being excluded. As a result, 30 research articles were included in this systematic review. The article selection process is illustrated in Figure 5 (see Appendix A),

which includes a flowchart for article selection using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher, Liberati, Tetzlaff, & Altman, 2010).

Inclusion/Exclusion Criteria

The team intended to include 30 original research articles in the systematic review. Articles had to be published in a scholarly journal within the last 10 years (2010 – 2020), and had to be published in English. Articles that were identified to not include applicable titles and/or abstracts were disqualified. As cycling is an international phenomenon, no constraints were applied related to the location of the research.

Quality Assessment of the Literature

Transparency, Accuracy, Purposivity, Utility, Propriety, Accessibility, and Specificity (TAPUPAS) was selected as the quality appraisal tool for this systematic review. According to Long, Grayson, and Boaz (2006), TAPUPAS appraisal provides a standardized framework to constructively assess the quality of evidence in a body of knowledge. Each of the 30 articles was appraised using TAPUPAS by one team member, and then independently reviewed by a peer team member. A five-point scale was used to rate each article as either 1 – Very Poor, 2 – Poor, 3 – Average, 4 – Good, or 5 – Excellent. The lesser of the two ratings from the team members was selected for each appraisal element. These appraisal element ratings were then totaled and presented as scores for each article. Scores were categorized as Low (0 - 11), Medium (12 - 23), or High (24 - 35). The quality appraisal is illustrated in the Quality Appraisal Chart in Appendix B. The appraisal resulted in the 30 articles being rated as High, within the range of 24 and 35.

Data Extraction

Each article offered useful information. The team extracted sector / population, design and sample size, main findings, effect size, and limitations. Main findings were selected from the findings and discussion section of each article for synthesis, as the main findings could be used to derive themes. The Data Extraction Chart can be viewed in Appendix C.

Coding, Categorization, and Themes

A thematic synthesis was used in this case study based on the research question and the theoretical framework. After completion of the quality assessment, the coding of core themes allowed for thematic analysis and synthesis of the data. According to Bowen (2009), organizing data into central themes is a form of pattern recognition, providing an opportunity for integration. The software Atlas.ti, a qualitative software tool that helps sort, manage, and understand textual data, was used to aid in the first and second cycle coding of the literature. Second cycle coding was completed to remove redundancy, reorganize parent codes, and find common themes across the literature.

Themes across the 30 studies include: infrastructure and physical space for cycling; membership/ridership; cycling advocacy groups include community, policy makers, cycling club members, cyclists; an individual's value/belief system and attitude influences their perceptions of cycling; motivations for cycling - transportation vs. leisure; characteristics of bikers (gender, age); economic influences; environmental influences. In addition, an overarching theme of multifactorial stakeholder involvement in cycling was very apparent. The themes were then reviewed and evolved into five overarching findings and three recommendations. The resulting coding parameters and levels developed for this thematic analysis can be found in Appendix D.

Findings

The Systematic Review resulted in five key findings. This was based on the emerging themes from the coding synthesis. The first finding is that personal values and beliefs were found to strongly influence an individual's perception of cycling (Garcia et al., 2019; Etminani-Ghasrodashtia et al., 2018; Fernandez-Heredia et al., 2016; Thigpen, 2019; Park et al., 2019; Useche et al., 2019; Fernandez-Heredia et al., 2014).

For the second finding, the literature states that individuals who place high value on physical health, fitness, active lifestyle, stimulation, the environment, and openness to change are more likely to perceive cycling in a positive way and thus be more likely to engage in cycling (Garcia et al., 2019; Etminani-Ghasrodashtia et al., 2018; Fernandez-Heredia et al., 2016; Thigpen, 2019; Park et al., 2019; Useche et al., 2019; Fernandez-Heredia et al., 2014).

For the third finding, the literature showed that physical safety (real and perceived) is influenced by the quantity and type of biking infrastructure in place, and in turn, influences an individual's decision to cycle (Sallis et al., 2013; Hoffman et al., 2014; Habib et al., 2014; Ghekiere et al., 2014; Etminani-Ghasrodashtia et al., 2018; Branion-Calles et al., 2019; Park et al., 2019; Handy et al., 2010). As a result, infrastructure impacts the perception of cycling and active engagement.

The fourth key finding is that the decision to bike is a multifactorial decision involving psychological, socioeconomic, and land use / infrastructure factors; and therefore, any campaign to change cycling behavior should involve steps that address these factors (Badland et al., 2013; Tapp, 2016; Habib et al., 2014).

Finally, it was deduced that programs or initiatives to motivate people to ride bicycles work best when customized to an individual's environment (Rastogi, 2011; Braun et al., 2016;

Fernandez-Heredia et al., 2016; Thigpen, 2019). The research shows that customization is highly important when trying to motivate riders. The literature reviewed included information on several employer-driven or city-driven programs aimed at increasing ridership. Each reported a mild uptick in ridership in relation to these general programs, suggesting a potential for higher ridership in more customized programs.

Recommendations, Implementation and Risks, and Communication Plan

Recommendations

Based on these key findings from the systematic review, the following three recommendations are postulated for The Club for implementation:

- The authors recommend that The Club refine the mission statement of The Club to include value laden statements (such as those associated with health, physical fitness, and environmental impact) known to influence riders (Garcia et al., 2019; Etminani-Ghasrodashtia et al., 2018; Fernandez-Heredia et al., 2016; Thigpen, 2019; Park et al., 2019; Useche et al., 2019; Fernandez-Heredia et al., 2014). This recommendation would address one of the perceived weaknesses of The Club identified in the Sense of Community Theory. Namely, it would induce a stronger personal investment into The Club by members and potential members, as well as, articulate its value system to the community. This will help demonstrate to all stakeholders that The Club's values align with theirs.
- The Club should increase its physical and virtual presence in the community (Badland et al., 2013; Tapp, 2016; Habib et al., 2014; Rastogi, 2011; Braun et al., 2016; Fernandez-Heredia, 2016; Thigpen, 2019). This would directly enhance The Club's sense of belonging in the community and exhibit some influence over how the

community perceives cycling. Involvement could be in the form of participating in local fairs, school activities, social events, etc. as a group. Other activities could help to support these activities, whereby The Club's logo would be displayed in prominent positions.

- The Club should actively engage in communicating/advocating with the local and county officials in the local area (Sallis et al., 2013; Hoffman et al., 2014; Habib et al., 2014; Ghekiere et al., 2014; Etminani-Ghasrodashtia et al., 2018; Branion-Calles et al., 2019; Park et al., 2019; Handy et al., 2010). This would include elected officials, the City Manager's office, the Office of Infrastructure and Development, as well as other policy makers in the local area, to exert more influence over infrastructure decisions related to cycling. Being involved in building permits and other infrastructural decision processes would help ensure that safety and other cycling infrastructural development are embedded as part of the city's permit approval process. This recommendation would address the perceived weaknesses of The Club when nested within the Sense of Community Theory. Namely, giving and receiving bi-directional influence over infrastructure decisions during community planning projects, and ensuring cycling infrastructure options are actively considered and adopted (when possible).

Implementation and Risks

To refine The Club mission, as suggested in the first recommendation, it is proposed that there be a discussion at the next Board of Directors meeting regarding this systematic review. Once a consensus is gained on the need to revise the mission statement and focus, a full

membership meeting should be scheduled to obtain all input on the mission statement and focus from all members. During the general meeting, consider language that focuses on:

- Promoting and encouraging cycling as part of a fitness regimen designed to foster health and wellbeing
- The safety and enjoyment associated with cycling, and actively working towards the development of a safe environment for all cyclists
- The development of riding skills for adults and youth

Once agreed upon, the organization's website can be updated to emphasize the new core values of The Club. With a revised purpose statement, The Club could undertake a new marketing strategy to emphasize these core values. There is a risk associated with this recommendation in that the outcome will take time to demonstrate an impact, and the impact will be less tangible. However, the findings indicate that this is a key component in attracting and retaining new members.

To implement the second recommendation of increasing physical and virtual presence in the community, there may need to be an expansion of the existing communications and marketing team, which is currently comprised of a single individual. Dividing the work amongst several individuals mitigates the risk of burnout, as individuals in The Club leadership roles are volunteers. Additionally, this recommendation needs to be viewed in two parts – physical and virtual. From a physical standpoint, The Club would need to make its presence known outside of its group members. This would include riding in branded gear, as well as posting posters in high traffic areas. This may also include exploration of partnerships that allow for co-branding. For example, a Mug Club at the local brewery, or sponsoring high traffic events to allow for The Club logo and website to be communicated to non-members.

Virtually, a social media team would need to be developed and assigned the task of managing the The Club social media presence. Managing the presence could be as simple as giving upload access to a small group of people who find material and upload regularly. Additionally, The Club should consider social media geo-fencing their desired area of influence and doing advertisements to promote club events or cycling in general. Geo-fencing is a marketing tactic that allows users to target recipients within a specified geographic region. Social media advertising would help The Club to get its messages out. The Club could also cascade its messages by sharing messages with its partners, who could then share the messages with their followers. The Club should consider this after it has built its member/partner base.

The risk associated with the second recommendation is that individual burnout can occur from maintaining the social media presence. This risk can be mitigated by expanding members involved in Board of Director level activities, particularly the Communications/Marketing committee.

To implement the third recommendation and become actively engaged in communicating with the local and county government, The Club should regularly invite the following individuals to Board of Directors meetings after The Club updates its mission and focus:

- Elected officials including Mayor, Aldermen, and County Representatives
- City Manager
- Chief Infrastructure and Development Officer
- Director of Planning, Zoning, and Urban Design
- Director of Capital Projects Management

The Club should also consider having representation on some of the planning boards and committees that impact infrastructure planning and funding in the area. The risk associated with

the third recommendation is that advocacy could get political. Additionally, there may be discouragement from inactivity or slow activity.

Communication Plan

The Board of Directors should provide direction and guidance through a revised missions statement. The Communications/Marketing Committee should expand, update communications tools on a regular basis, and monitor impact via data analytics. Members should be encouraged to spread influence via involvement in activities and with partner organizations/businesses. Target audiences to influence should include current and non-members, government officials, partner organizations and businesses, and youth. Key messages should center on health impacts, cycling as a safe mode of transportation, skill development, environmental stewardship, and infrastructure.

Implications for Practice

This paper can inform research on bicycle stakeholder influence in a multinational context. This is due to the study including 30 articles from different parts of the world such as Brazil, Australia, China, India, and the United States. This paper can also help researchers to identify references pertaining to the influence of bicycle stakeholder perception. Practitioners may use this study to gain a more global perspective regarding approaches to influence bicycle stakeholders. The recommendations that were selected for The Club can be used for the advancement of bicycle friendly communities, bicycle club mission statements, bicycle club marketing strategy, and bicycle policy. They can also be leveraged to increase focus on bicycle infrastructure awareness and the diversification of urban economic strategies. All of these have direct implication on how individuals perceive cycling and may directly or indirectly influence an individual's willingness to cycle.

Limitations

This systematic review is limited to the scope of the research question and The Club project objectives. The information contained in this systematic review can be used for research on influencing bicycle stakeholder perception; however, it should be noted that the systematic review is not all encompassing. Although transparency and rigor were focus areas for the paper to ensure understanding of the information, reproducibility of the results, and thoroughness, it should be considered that the assessment was performed over the course of three-weeks. Thirty articles were reviewed, appraised, and synthesized to glean the primary findings.

Also, seasonal impacts such as rain, snow, and extreme heat were not investigated in this study, and additional research would need to be performed to identify the seasonal impacts on stakeholder perception(s) of cycling. Bicycle Club cost analysis was also not researched, as membership cost was not communicated by the President of the Board of Directors as a problem.

Further research would need to be performed regarding the perception of transportation such as scooters and skateboards, as these were not within the scope of this systematic review. Also, while some negative perceptions were identified during the coding process, exploration of these perceptions was not included in the systematic review.

Conclusion

This systematic review will help to positively influence the perception of cycling. The TAPUPAS quality appraisal that was performed included sufficient rigor with peer review for evaluating the 30 articles selected for the systematic review. Quality appraisal resulted in High rated quality articles. Finding extraction and synthesis allowed for the evaluation of key data that could influence the perception of cycling. Synthesis of the articles resulted in the derivation of themes that could be translated into recommendations and implications for practice.

In conclusion, a properly planned implementation of the evidence-based recommendations in this case study should result in a paradigm shift toward positively changing the perception of cycling in The Club's local area and other cities/towns.

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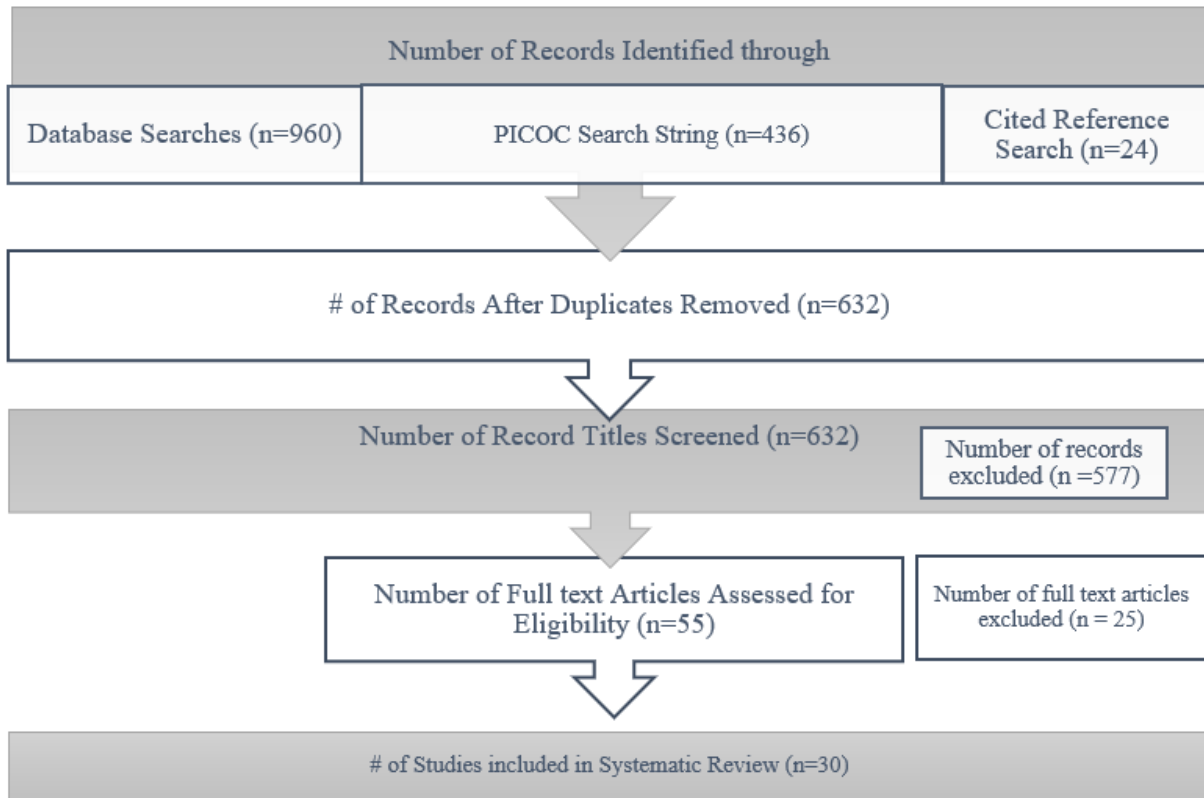
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Appendix A

PRISMA Flowchart

*Figure 5: PRISMA Flowchart for article selection.*

Appendix B

Quality Appraisal Chart

1- Very Poor	2 - Poor	3 - Average	4 - Good	5 - Excellent
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Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Habib, Mann, Mahmoud, and Weiss (2014)	3 Surveys from Toronto, random selection and the size is only 1000	5 Data aligns with the conclusions	5 Methods are typical for social perception questions	5 All aspects of the research are aligned with RQ	4 Survey was done in an ethical manner	3 This report is dense. Readable but not the easiest	5 Does not violate any standards	30 (High)
Garcia, Mars, Arroyo, Casquero, Ciommo, and Ruiz (2019)	4 Online surveys	5 Data aligns with conclusions	3 Not certain if online surveys are a strong method	5 There is utility in the research	5 Survey was done in an ethical manner	4 Most statistical analyses are explained	5 Does not violate any standards	31 (High)
Useche, Montoro, Samartin, and Alonso (2019)	4 Sample size is low given the area	4 Data and claims were aligned	3 Multi-country online survey with only 1064 samples seem weak	3 Answers questions on perceptions in a limited manner	4 Survey was done in an ethical manner	5 This material was easy to understand. Tables were useful	5 Does not violate any standards	28 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Park and Akar (2019)	4 Online survey, but highly targeted	5 Data aligns with the results presented	4 Targeted surveys were good but the sample may be considered unique	3 The research is aligned with the RQ. However, its limited to college campus	4 Not sure why the distribution was limited to just 15% of the campus population	5 Good use of maps and tables	4 Seems to fit within acceptable standards although there is a question about the survey distribution	29 (High)
Handy, Xing, and Buehler (2010)	4 Cross-sectional research design, good sample size, targeted population	4 The findings align with results, but there are not direct connections expressed in the conclusions	3 The methods are aligned with a part of the RQ	4 This research will be useful but not a direct answer to the RQ	5 No concerns with research methodology	5 The article is consumable. Includes limitations section which are helpful	5 Does not violate any standards	30 (High)
Sallis, Conway, Dillon, Frank, Adams, Cain, and Saelens (2013)	4 Review and assessment of third-party survey results	4 Data aligns well with the findings	4 Survey populations only slightly align with RQ population	4 This research will be useful but not a direct answer to the RQ	5 No concerns with research methodology	5 Short article, however easily readable	5 Does not violate any standards	31 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Fernandez-Heredia, Monzon, and Jara-Diaz (2014)	4 Online campus survey	4 Data aligns with the results presented	3 There are concerns with this being non-primary research, there could be confirmation bias from the initial findings	4 Research may be helpful in forming recommendations	4 Research was conducted in an ethical manner	3 The reporting of findings was not well organized	4 Does not appear to break any standards	26 (High)
Thigpen (2019)	4 Review and assessment of annual UCD survey results to make a longitudinal study	4 The methods seemed reasonable and aligned with the findings	4 The research was conducted on students. The RQ is focused on non-academic setting	5 There is utility in the findings that is applicable to the RQ	4 Possible questions with combining annual surveys to make longitudinal observations	5 Report is understandable. However, use of first person is distracting	4 Concerns with the concept of longitudinal study from annual surveys. There needs more assurance that survey did not change yr over yr	30 (High)
Branion-Calles, Nelson, Fuller, Gauvin, and Winters (2019)	4 Cross sectional online survey in six cities	4 Data aligns with the results presented	4 Methods and results are in good alignment	5 The research should add value to the RQ response	5 Research was conducted in an ethical manner	4 Work is written at a scholarly level but should be consumable	5 Does not violate any standards	31 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
						by non-scholars		
Fernandez-Heredia, Jara-Diaz, and Monzon (2016)	4 Online campus survey	4 Data aligns with the results presented	3 There are concerns with this being non-primary research, there could be confirmation bias from the initial findings	4 Research should be useful in developing recommendations	5 Research was conducted in an ethical manner	4 The report is easily consumable. However, the labelling could be clearer.	4 Does not appear to violate any standards	28 (High)
Osborne and Grant-Smith (2017)	4 Method and discussion on the Cycling citizen showed good transparency	4 Analysis methodology was appropriate for the study	4 Method of research resulted in findings that matched the research question for THE CLUB	4 Useful research to answer research questions	4 Ethical research	4 Understandable research report	4 Knowledge lives up to the standards in the research area	28 (High)
Pelechrinis, Zacharias, Kokkodis, and Lappas (2017)	4 Good transparency with research results for each hypothesis	4 Data clearly backs up the research findings	4 Research results answer the research question for THE CLUB	4 Useful research to answer research questions	4 Ethical research	3 Understandable research, but some of the statistical analysis may not be	4 Knowledge lives up to the standards in the research area	27 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
						broadly understood		
Tapp, Davis, Nancarrow, and Jones (2016)	4 Good transparency in tables and associated explanations	4 Data clearly backs up the research findings	4 The research informs on policymaker decisions basis, and how that can potentially be changed through surveys	4 Useful research to answer research questions	4 Ethical research	5 Transparent tables	4 Knowledge lives up to the standards in the research area	29 (High)
Medeiros and Duarte (2013)	4 Good transparency with the comparison of the image of Brazil over recent decades:	4 Data clearly backs up the research findings	3 The paper did not have many recommendations , but there was one insight regarding policymaker promotion of bicycle use	2 The results of the article did not contribute significantly to the research question	4 Ethical research	4 Understandable research report	3 The research was relevant, but did not add any real value besides one insight regarding policymaker promotion	24 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity of bicycle use	Score
Rastogi (2011)	4 Good transparency in the research study	4 The research was broken down into three main focus areas, Sustainable Transportation, Sustainability across modes, Non-modified policies, and Planning Issues.	4 Resulted in two main findings that were applicable to the research question	5 The research is useful, because it provides an alternative perspective that the THE CLUB can pose to policymakers to promote the use of bicycling as a viable means of transportatio n.	4 Ethical research	4 Research is easily understood by the audience	4 good insights	29 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Braun, Rodriguez, Cole-Hunter, Ambros, Donaire-Gonzalez, Jerrett, Mendez, Nieuwenhuijsen, and de Nazelle (2016)	5 Strengths and limitations were discussed	4 Data clearly backs up the research findings	4 Research was relevant to the research question for THE CLUB	5 Resulted in two main findings that were useful	4 Ethical research	4 Understandable research report	5 The research adds a lot of value, as it is informative on policy.	31 (High)
Fleiter and Senserrick (2015)	5 Limitations were discussed throughout the paper. For example: “The full extent of the problem is difficult to determine because of limitations with data sources at the national and provincial levels” (p. 73).	3 The research first presented issues regarding the road trauma burden in China, vulnerable road users, and social disparity of road trauma in China. Then there were discussions on potential solutions.	4 Resulted in main findings that were applicable to the research question	4 Resulted in two main findings that were useful	4 Ethical research	4 Research is easily understood by the audience	3 This study was useful in gaining a perspective on injured bikers, and the associated social policy implications.	27 (High)
Hoffmann and Lugo (2014)	4 Limitations were discussed throughout the paper. For example: “The full extent of the problem is	4 One of the data points, for example, is a World Health Organization (2013) “comparison of	4 The research first presented issues regarding the road trauma burden in China, vulnerable road users, and social disparity of	4 Useful findings	4 Ethical research	4 Simple research report that can be broadly understood	3 Adds value to the extant research based on the perspective	27 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
	difficult to determine because of limitations with data sources at the national and provincial levels” (p. 73).	the proportion of total fatalities according to road-user group in several countries from the Asian region” (p. 73).	road trauma in China. Then there were discussions on potential solutions.				on bicycle infrastructure.	
Caggiani, Camporeale, and Ottomanelli (2017)	4 The data supporting the recommendation was based on extensive analysis and calculations. This demonstrated good rigor. Also, there was a high level of transparency and quantitative analysis to support the points made throughout the paper.	4 A literature Review is performed, and then “both a test network and a real case study application are presented, together with a sensitivity analysis, aiming at assisting the decision maker in his/her strategical decisions, suggesting how to properly carry out a congestion price strategy on the network, fairly redistributing	4 The data supporting the recommendation was based on extensive analysis and calculations. This demonstrated good rigor. Also, there was a high level of transparency and quantitative analysis to support the points made throughout the paper.	3 The research is relevant and useful, as it provides a method to influence policymakers .	4 Ethical research	3 Research method with calculations and graphs may not be easily understood	4 Adds value to the industry	26 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
		the derived revenues among all the users” (p. 2).						
Agarwal, Ziemke, and Nagel (2019)	5 Good level of transparency demonstrated	4 "For the application of a bicycle superhighway, a case study of Patna, India is chosen. Further, this study also proposes an innovative approach to find the optimal number and locations of the connectors between the new infrastructure and the existing network. To estimate the vehicle- and link-specific time-dependent emissions	4 Research methods are a good match for the THE CLUB research question	4 The information provided is relevant to the research paper.	4 Ethical research	3 Well laid out research, but the quantitative analysis may be confusing	4 Adds value to the industry	28 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
		undermixed traffic conditions, an emission modelling tool (EMT; Kickhöferetal.,2013) is extended. Moreover, using the case study, this work provides insights which are useful to encourage policymakers and law enforcement" (p. 3).						
Etminani-Ghasrodashti, Paydar, and Ardeshiri (2018)	4 Surveys	5 Results alignment was clearly demonstrated	4 the methods and RQ are well aligned	5 the research is closely aligned with the RQ	4 All work was done within ethical standards	4 the material is dense in appearance and verbiage but consumable	4 Does not violate any standards	30 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Solbraa, Anderssen, Holme, Kolle, Hansen, and Ashe (2018)	4 Questionnaire along with plus objective measurement	4 Seems to be designed well	4 alignment with physical environment and perceptions	3 helps to gain an understanding of infrastructure and perspectives	4 All work was done within ethical standards	3 methods sections are not too technical but clearly displays process	4 Does not violate any standards	26 (High)
Bourke, Hilland, and Craike (2018)	4 Online questionnaire	4 Alignment is there however; the self-reporting could be problematic	4 Good matches with respect to social norms and perceptions	4 Could be useful in building environmental assets to support cycling	4 All work was done within ethical standards	3 Good discussion section	4 Does not violate any standards	27 (High)
Badland, Knuiman, Hooper, and Giles-Corti (2013)	4 Self-reported longitudinal study	4 The data is from a longitudinal study and can be tracked over time	3 This research provides predictors but not necessarily factors	3 The study will be useful but may not provide direct answers	4 All work was done within ethical standards	3 This material is under stable	4 Does not violate any standards	25 (High)
Kim, Choi, Kim, and Fujii (2017)	4 Surveys	4 Data and findings appear aligned	4 Aligns with the goals of the project may not be specific to complete RQ	4 The research is close the RQ but does not directly answer it	4 All work was done within ethical standards	3 The material was written in a very consumable manner	4 Does not violate any standards	27 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Ghekiere, Van Cauwenberg, de Geus, Clarys, Cardon, Salmon, de Bourdenaudhuij, and Deforche (2014)	5 Very detailed procedure. Survey method, observations, followed by discussion	4 Authors used appropriate software to process the qualitative data	3 The project was focused on youth and environmental factors which only covers part of the RQ	3 This will provide a good but limited response to the RQ	4 All work was done within ethical standards	5 The material was written in a very consumable manner	4 Does not violate any standards	28 (High)
Kang and Fricker (2016)	4 Data collection methods clearly delineated	4 Research claims directly supported with collection results	4 subjects of the data, collection, and aims directly aligned with RQ	4 Findings impact the RQ but may not be generalizable	3 Observations were used without interference	3 The material is heavily quantitative but explained well	4 Does not violate any standards	26 (High)
Geraghty, Seifert, Preston, Holm, Duarte, and Farrar (2009)	3 Hard to determine how they got their information	3 Back up data is not fully demonstrated	3 Methods are not delineated	4 The information provided is useful	4 All work was done within ethical standards	4 The material is understandable and consumable but not complete	4 Does not violate any standards	25 (High)
Willis, Manaugh, and El-Geneidy (2015)	5 This was a systematic review of surveys and questionnaire research papers	5 All claims are backed up with citations	4 the methods and RQ are well aligned	4 The study will be useful	4 All work was done within ethical standards	5 The material was written in a very consumable manner	4 Does not violate any standards	31 (High)

Author(s) & Year	Transparency	Accuracy	Purposivity	Utility	Propriety	Accessibility	Specificity	Score
Cooper and Leahy (2017)	4 Surveys	3 Claims are not backed up by demonstrated survey results	4 The methods and RQ are well aligned	4 The study will be useful, but could use some data for support	3 All work was done within ethical standards	3 This report needed a visual display of survey results to back up the claims	4 Does not violate any standards	25 (High)

Appendix C

Data Extraction Chart

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Habib, Mann, Mahmoud, and Weiss (2014)	Random Sample of Toronto residents	Telephone survey; n=1,000	Perception of bikability (quality of infrastructure, quality of on-street bike lanes, quality of off-street bike lanes, quality of bike parking in city) in the city influences choice to bike or not, but does not differentiate between biking for utilitarian or recreational purposes; Integrated econometric modeling framework used; choice of biking is influenced directly by the latent perception of bikability and safety consciousness, along with other exogenous variables	P-value 0.00 with CI of 95% for all perception of bikability variables; latent variable inclusion justified by Chi square	complex model, many latent variables tested, no details on respondents provided to review for homogeneity of sample; survey details not provided - R/V cannot be assessed; did not self ID limitations
Garcia, Mars, Arroyo, Casquero, Ciommo, and Ruiz (2019)	Residents of Valencia Spain and surrounding areas	Web based issuance of Schwartz Value Survey distributed to Universities, private companies and regional government;	Those surveyed who hold values related to openness to change (universalism and stimulation specifically) are more likely to cycle, have greater intentions to cycle and have a more positive attitude toward cycling. Efforts to enhance these values in the general public should include	Small effect size for Universalism and Stimulation: for those who currently cycle (β .08 and .12 respectively); for the intention to cycle (β 0.12 and 0.15 respectively);	survey respondents skewed toward employed student and those less than 70

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		n=1254 valid responses	dissemination of successful experiences. Also, transmission of these values from one generation to the next should be fostered. Include family activities in bike programs to encourage self-transcendence values across generations.	for attitudes toward cycling (β 0/10 and 0.23 respectively)	
Useche, Montoro, Samartin, and Alonso (2019)	Urban bike users from 20 different countries in Latin America, Europe and North America	Convenience sample of cyclists completed an on-line questionnaire; inter-institutional mailing list used to distribute to universities (students, staff and those in research DB invited); n=1064	Descriptive statistics used to identify the reasons people do (or do not) choose to cycle. Top three reasons that encourage people to cycle: physical health and fitness (29%), environmental sustainability (14%), Economy (13%). Top three reasons that discourage people from cycling: crash risk (17%), weather factors (17%), lack of safety (16%).	N/A - descriptive stats only	polled only cyclists; various countries with different policies in place; weak I/E criteria

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Park and Akar (2019)	Ohio State University students, faculty and staff	stratified random sample of 15,100 OSU received email to on line survey; n=667 evaluable respondents	Descriptive statistics used to characterize bicyclists vs. noncyclists in commuter distance and if bicycling conditions were a factor in choosing where to live. 61% of cyclists indicated biking conditions influenced their choice of residence as opposed to 39% of no cyclists. Five neighborhood clusters surrounding OSU were identified and respondents were allocated to their respective cluster. Evaluation of differences between clusters revealed that those living in high-density mixed-use cluster (closest to campus) cycled with the highest frequency of all clusters. Cyclists were more likely to agree that there are perceived additional benefits of cycling, cycling reduces environmental impacts and cycling leads to enjoyed health benefits. Cyclists also indicated they would ride more frequently if bike-related facilities are to be improved	Differences between groups (cyclists vs. non cyclists) measured using Mann-Whitney U test; P value <0.05 @ CI of 95%; strongest differences on attitudes of willingness to use bicycles and perceived additional benefits of cycling;	small sample size limited the ability to evaluate frequency of cycling as a variable; data derived from a survey conducted during a one-month window that represented habits over a one-year period in a single university; limited generalizability

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Handy, Xing, and Buehler (2010)	3 bike friendly cities (Davis CA, Boulder CO, Eugene OR) compared to 3 comparison cities (Woodland CA, Chico CA, Turlock CA)	cross-sectional design; 1500 resident information purchased from Martin Worldwide for each city; on line survey details mailed to residents; n=965	Bicycle ownership appears to be dependent solely on individual attitudes toward bicycling; the perception that "most cyclists look like they are too poor to own a car" positively correlates with non-regular cycling; negative perceptions of cyclists are a deterrent to regular cycling; bicycling infrastructure (off-street bike paths) positively correlates to more frequent biking for transportation;	Effect size seen for those owning bikes was strong on the perception of the truth of the statement "the city has a network of off-street bike paths" (coeff. 0.65) and the portion of truth of the statement "I am in good health" (coeff. 0.521)	cross-sectional design is a snapshot of time and not necessarily representative; low response rates in some cities and high response rate in others may have skewed findings
Sallis, Conway, Dillon, Frank, Adams, Cain, and Saelens (2013)	Residents of two regions (Seattle WA and Baltimore/Wash DC) were characterized into 8 study quadrants based on walkability and income.	Neighborhood Quality of Life Study survey was mailed to residents at baseline and at six months; n=1745 respondents	Majority of bike owners reported never riding (60%) or riding less than once per week (28%), even though 71% of respondents report owning a bike. Multivariate regression revealed that environmental correlates (having bike/pedestrian trails easy to get to, greater safety for riding in the neighborhood and greater land use mix-access) were associated with higher rider frequency. Projections were made based on respondents indicating "How often would you bike if you	Effect size is small with partial eta ² reported as .005, 0.15 and .006 for bike trails easy to get to, safe to ride in neighborhood and land use mix access respectively. However, reported p value of each is <.015 @ CI of 95%	survey did not differentiate between biking for recreation vs biking for transportation; self-reported biking frequency; survey did not include any assessment of bike facilities or policies in place; cross sectional design

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			thought it was safe from cars?". They predicted that the percent never riding would drop from 71% to 34% and the percent riding at least once per week would rise from 9% to 39%.		
Fernandez-Heredia, Monzon, and Jara-Diaz (2014)	Students and faculty at Ciudad University (Spain)	Focus group of cycle users to detect significant variables; questionnaire prepared tested using face to face pilot survey; once validated, questionnaire distributed to n=3908 with final n=3048 faculty and staff	concept of intention derived from four latent variables (convenience, pro-bike, external restrictions, physical determination) and actual behavior; pro-bike latent variable explains 76% of variance seen in economic indicator, 70% of ecologic aspect, 62% of health aspect and 60% of the fun aspect; convenience latent variable explains 85% efficiency and 88% of flexibility. Clear difference between the perceptions of users that have cycling experience and those not in the habit of riding; factors which encourage bike use are seen a positive by users.	goodness of fit of the structural equation model = chi square of 379 with p value of <0.01; R2 >0.50 for both convenience (efficiency and flexibility) and pro bike (economic and ecological). R2>.33 for pro bike (healthy and fun).	Not discussed; limited to a single collection point - cross sectional; limited to single university - limited generalizability; recommendations do not tie back to findings directly

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Thigpen (2019)	Students faculty and Staff at UC Davis	longitudinal study extracting results from existing campus travel survey over 7 years, linking subject id via email addresses for prospective data; additional questions asked via survey related to previous two-three-year experiences for retrospective data; n=1648 members with 3498 observations	Those surveyed who had exposure to bicycling as an elementary school child were associated with increased probability of being in the skilled enthusiast or expert category (not the novice bike phoebe). The number of years of regular riding in jr high and high school was strongly associated with being in the expert class. Individuals are more likely to stay in their existing motility class than they are to change to a higher or lower class. Exposure to UCD bike friendly campus alone did not influence those in the novice class to move into the skilled or expert class. Regular bike use in childhood and young adult hood is associated with increased pro-bike attitudes and skills, while exposure to high levels of bicycling at a bike friendly university has little to no effect on skills or attitudes.	Elementary/Jr high/High biking had strong neg effect (-0.3 @ 95% CI) for those in the novice class; Jr high/high had strong pos effect (0.1 @95% CI) for those in expert class)	selection bias; latent Markov model used to explore relationships between variables, but structural equation might have shed more light on relative strength of relationship; single (bike friendly) campus limits generalizability even to other college students

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Branion-Calles, Nelson, Fuller, Gauvin, and Winters (2019)	Bicyclists living in Boston, Chicago, NY, Toronto, Montreal and Vancouver; n=3,446	three repeats cross sectional timepoints of data (fall 2012, 2013 and 2014) extracted from the International Bikeshare Impacts on Cycling Collision and Safety Study (IBICCS) from each city to measure perceived safety and individual characteristics and Bike Lane Score for each city derived from Bike Score Index.	Bicycling infrastructure availability was significantly associated with the perceived safety of bicycling in each city. For every 10 unit increase in bike lane score the odds of rating bicycling as safe compared to neutral increased by 6%. With larger bike lane score values, there is an increase in the predicted probability that the average bicyclist perceives cycling as safe.	regression analysis used to reveal strong + effect (1.06 @95% CI) between perception of safety and availability of bike infrastructure	traffic volume data in each city not obtained/control led for in safety perception; city boundaries & population size vary widely between selected cities;

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Fernandez-Heredia, Jara-Diaz, and Monzon (2016)	Students and faculty at Ciudad University (Spain)	Focus group of cycle users to detect significant variables; questionnaire prepared tested using face to face pilot survey; once validated, questionnaire distributed to n=3908 with final n=3048 faculty and staff	Building on previous data collected in 2014 survey, the authors employed a framework of hybrid models (including use choice model) and found that on the perception questions, factors that negatively influence choice to ride include lack of adequate facilities and sense of danger. Positive factors marked as very important include efficiency and consideration of biking as an ecological mode of transport. Rather important factors include flexibility, health and cheap. Bike users take into account a large number of factors than those considered by users of other transportation modes. Cheap access and supporting measures make the use of bike in campus friendlier.	Structural equation model revealed $R^2 > 0.70$ for both convenience (efficiency and flexibility) and pro bike (economic and ecological). $R^2 > .56$ for pro bike (healthy and fun).	additional modeling completed on previously studies data set; Not discussed; limited to a single collection point - cross sectional; limited to single university - limited generalizability; recommendations do not tie back to findings directly

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Osborne and Grant-Smith (2017)	Five contemporary policy documents centered on cycling	Five contemporary policy documents centered on cycling	The South East Queensland Principal Cycle Network Plan (QT, 2007) asserts that “residents of cycle friendly communities are more likely to explore their neighborhood and befriend their neighbors, and in so doing create a culture that deters crime and anti-social behavior” (Osborne and Grant-Smith, 2017, p. 49).	1 cyclist, 2 cycling infrastructure - Brisbane Vision 6 cyclists, 1 cycling infrastructure - Transport Plan for Brisbane 15 cyclists, 3 cycling infrastructure - Brisbane Active Transport Strategy 31 cyclists, 2 cycling infrastructure - SEQ Principal Cycle Network Plan 35 cyclists, 18 cycling infrastructure - Queensland Cycle Strategy	Limitations are not discussed.
Pelechrinis, Zacharias, Kokkodis, and Lappas (2017)	"The real estate market in the city of Pittsburgh to analyze the effect on dwellers' properties of the shared bike system	Two hypotheses were posed: - Hypothesis 1 [Impact on Dwelling Units Values]: The presence of	"The positive impact on the housing values is consequently translated to increased income for the local government due to increased property taxes...From this perspective, local governments can view	"Even though not as strong as the effect on the actual property values, on average, i.e., over all the treated zip codes, the	Limitations are adequately identified and discussed. It is emphasized that “conclusions are based on the

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
	installed in the city in June 2015" (p. 1)	shared bike transportation infrastructure impacts positively the housing values of nearby properties. - Hypothesis 2 [Impact on Rental Price]: The presence of shared bike transportation infrastructure leads to an increase in the prices of nearby rental properties. In order to support or reject Hypotheses 1 and 2, the authors relied on the Zillow Home Value Index and Zillow Rent Index data from Zillow respectively, utilizing the difference-in-	similar shared transportation systems as investments that can be paid off fairly quickly through the increased property taxes" (Pelechrinis, Zacharias, Kokkodis, and Lappas, 2017, p. 17).	difference-in-differences is \$26.5 (p-value < 0.05). This means that the additional increase in the rent price due to the presence of the shared bike system is \$26.5" (p. 14).	analysis from the real estate market in the city of Pittsburgh. These conclusions are not necessarily transferable to other metropolitan areas. For instance, while our conclusions might hold for cities with the same population, demographics and geography, the installation of a similar system in a megacity—e.g., NYC, Los Angeles etc.—might have much less impact on the real estate value, if at all.

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		differences method. They, further, examine the presence of an impact on different spatial scale "Zillow provides the Zillow Home Value Index (ZHVI) calculated using both public and user-submitted data through a proprietary formula. Similarly, Zillow provides information about the rental properties, through the Zillow Rent Index (ZRI). For our study we collect the following information: • Time-series data for the ZHVI for all homes in 10			However, we expect our study to stimulate further and deeper examination of similar interventions" (p. 3).

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		selected metro areas (including Pittsburgh) the choice of which is described in Section 3. • Time-series data for the ZHVI and ZRI in the zip codes within Pittsburgh metro" (p. 6). The authors "collect different time-series for all homes as well as, 1, 2, 3, 4 and more than 5 bedroom dwelling units separately" (p. 6).			

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Tapp, Davis, Nancarrow, and Jones (2016)	“The authors undertook two large-scale surveys of opinions and claimed behaviors with respect to cycling in Great Britain in 2010 and 2013.” (p. 15)	"The primary focus was to survey general opinions relating to cycling within British society – how is it regarded? A series of questions were asked about the public’s opinions of cycling, the role of the car in their lives, motor travel in terms of its convenience and expediency, cycling and health, wider environmental issues, respondents’ cultural readiness for possible increases in cycling, and so on.” (p. 15) Opinions were sought relating to:“(a) GB adults’	“The links between cycling and its underlying values are directly addressed: both progressive and conservative values may be targeted, with conservatives attracted by the ‘economic growth’ and ‘congestion relief’ attributes of urban everyday cycling, and its economic potential for reducing costly health bills” (Tapp, Davis, Nancarrow, and Jones, 2016, p. 26).	"Great Britain totals from the 2010 and 2013 surveys" with indications of "statistical significance between columns at 95% level of confidence" (p. 18). "Great Britain totals split by 'cyclists' (who cycle frequently or quite often), occasional cyclists (whose cycling may be very infrequent, in many cases a small handful of occasions annually), and non-cyclists (probably have not cycled as adult in any meaningful way).."(p. 18). "Bristol data for 2013" (p. 18).	N/A

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		opinions regarding cycling in terms of societal and personal contributions(b) The degree to which cycling is viewed as ‘normal’ in Great Britain(c) Influencers of cycling such as role models, media, and opinion leaders(d) Attitudes to the possible future growth of cycling” (p. 17) Sample demographics included 50% male and 50 % female for the 2010 and 2013 surveys in Great Britain and the Bristol survey in 2013 included 51 % male and			

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		49 % female. Good spread of inclusion of upper socio-economic group and lower socio-economic group, and the age range was broken down into two groups of 16-39 and 49 – 64. The online survey included a sample size of 3885 in 2010 and 4022 in 2013 for Great Britain, and 507 in 2013 for Bristol.			
Medeiros and Duarte (2013)	The image of the bicycle in Brazil	In the article, the authors compare the image of Brazil over recent decades: The paper discusses “exactly how the imagery constructed around a certain technology influences its use	“Even when city officials act to promote the bicycle their projects still link this vehicle to sports and leisure activities, even regarding them as a by-product of other political interests – and not really as a mode of transport that should be promoted for its environmental, economic and social contributions to cities”	N/A - Statistical analysis was not used	N/A

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		and its social appropriation, and how meanings stabilized through history may indicate obduracy in incorporating the bicycle into contemporary urban mobility" (p. 31). The authors "take Brazil as an example of how the image of the bicycle has been changing in recent decades and is still poorly related to a comprehensive urban transportation policy" (p. 31).	(Medeiros and Duarte, 2013, p. 36).		

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Rastogi (2011)	Multinational pedestrians and cyclists (for example, pedestrians and cyclists in places such as China, Thailand, UK, and USA)	The research was broken down into three main focus areas, Sustainable Transportation, Sustainability across modes, Non-modified policies, and Planning Issues. “This article discusses issues that make non-motorized transportation sustainable not only within but also across travel modes. It further discusses policies and options that can make a city, walk- or bicycle-friendly. Finally, design issues that are found important for better planning of facilities are presented.” (p. 1340).	“A policy marked as a most probable solution should be evaluated for its acceptability. A user-preference survey can be conducted for this purpose. A study conducted in the Central Business District area of Shanghai, China indicated higher preference for more bicycle lanes and bicycle parking spaces” In a Mumbai, India study, “almost equal preference is given to bicycle paths between dwelling units in dense settlement areas, whereas in open areas marked/painted lanes are preferred. It is highlighted that compacted land use and provision of pedestrian or bicycle facilities would promote use of these modes” (Rastogi, 2011, p. 1345). “Bike on transit: Bicycle access expands the potential market area of high-speed public transport services at low cost. Integration of bicycles with public transport can help in sustaining their shares in	N/A - Statistical analysis was not used	N/A

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			rapidly motorizing cities with mixed traffic systems; in reintegrating them; and in dealing with network capacity saturation. Adequate supporting infrastructure, including secure parking at station entrances and safe access routes, is essential to this intermodal integration. Various such systems are bike-and-ride system, bike-on-bus system, bike-on-rail system, folding bikes system, bike-on-ferries, bike-on-vanpool, park and ride system, etc. The bike-on-bus system in USA resulted in an increase in the number of cyclists between 17% and 68% in different transportation districts” (Rastogi, 2011, p. 1344).		

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Braun, Rodriguez, Cole-Hunter, Ambros, Donaire-Gonzalez, Jerrett, Mendez, Nieuwenhuijsen, and de Nazelle (2016)	"765 commuters who live and work within the municipality of Barcelona," Spain (p. 164).	The authors used data from a travel behavior survey developed as part of the Transportation, Air Pollution, and Physical Activities (TAPAS) project, which aimed to comprehensively investigate the risks and benefits of cycling in Barcelona. The TAPAS survey was designed to assess the potential for built environment, policy, and programmatic interventions to increase active transportation in the city" (p. 168). "Descriptive statistics for study sample (n = 765)" (p. 171).	"Although topography is beyond the direct control of planners and policy makers, understanding its influence can inform policies and infrastructure investments related to cycling; for instance, public transport integration strategies and the placement and design of cycling infrastructure may lessen the impacts of hilly terrain" (Braun, Rodriguez, Cole-Hunter, Ambros, Donaire-Gonzalez, Jerrett, Mendez, Nieuwenhuijsen, and de Nazelle, 2016, pp. 167 – 168). "Education campaigns designed to promote awareness of cycling infrastructure may be important complements to infrastructure investments. Given the relatively low costs associated with this type of strategy, interventions that target awareness and perceptions may be particularly viable as short-term solutions to promote cycling, and as methods to	"While both self-reported and objective measures of access to cycling infrastructure were associated with bicycle commuting, self-reported measures had stronger associations. Bicycle commuting had positive associations with access to bike share stations but inverse associations with access to public transport stops. Point elasticities suggested that bicycle commuting has mild negative correlation with public transport availability (-0.136), bike share availability is more	Limitations were considered in the research study, and the authors were, recognizably, very critical (p. 129).

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		"Between June 2011 and May 2012, 18,469 commuters were approached across the 40 sampling points displayed...Of these commuters, 6,701 agreed to answer initial screening questions, 1,406 met the eligibility criteria, and 809 completed the travel survey. Among these 809 individuals, 23 were excluded from the final sample because they did not select cycling as either their actual or their hypothetical commute mode and 21 were excluded because they did not	increase the feasibility and success of larger infrastructure projects" (Braun et al., 2016, p. 180).	important at the work location (0.077) than at home (0.034), and bicycle lane presence has a relatively small association with bicycle commuting (0.039). Marginal effects suggested that provision of an employer-based incentive not to commute by private vehicle would be associated with an 11.3% decrease in the probability of commuting by bicycle, likely reflecting the typical emphasis of such incentives on public transport" (p. 164) (used abstract summary due to the size of the	

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		provide home or work addresses that could be accurately geocoded. This led to a final sample of n = 765" (p. 172).		study results section)	
Fleiter and Senserrick (2015)	Road users in China	The research first presented issues regarding the road trauma burden in China, vulnerable road users, and social disparity of road trauma in China. Then there were discussions on data reporting and management systems, challenges relating to the inequity of the road trauma burden, and vulnerable road users.	"It is critical that policy attention is devoted to protecting those most at risk on the road. As noted frequently above, vulnerable road users in China face their greatest risk when negotiating the road system. Countermeasures to protect pedestrians are needed and could include: improved public education about the risks of crossing roads; creation and enforcement of designated safe road-crossing facilities; pedestrian priority at unsignalized intersections (especially relevant to rural areas); physical separation from vehicles where possible; reductions in vehicle speeds, especially in high pedestrian	"70% of all road-related fatalities in China in 2010 were pedestrians, bicyclists, and riders of motorized two- and three wheelers, compared with only 32% in a highly motorized, high-income country; Australia" (p. 72)."China shoulders the weight of approximately 15% of all global road fatalities, yet its citizens own only	Limitations were discussed throughout the paper. For example: "The full extent of the problem is difficult to determine because of limitations with data sources at the national and provincial levels" (p. 73).

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			environments; improving public transport services; and increasing the visibility and conspicuity of pedestrians” (Fleiter and Senserrick, 2015, p. 75).“Ongoing policy development is required in the areas of emergency response and treatment, rehabilitation, and lifelong support services to sustain those who suffer the consequences of permanent disability from road crashes. For instance, improved injury surveillance in rural and remote areas is needed to assist in identifying areas where strategies such as satellite support systems could be established and linked to key rural cities” (Fleiter and Senserrick, 2015, p. 76).	approximately 2% of the world's vehicles" (p. 72).	
Hoffmann and Lugo (2014)	Bicycle advocates and policymakers in Los Angeles (L.A.) and Minneapolis	A literature review was performed, and “this article consists of two case studies that draw on the findings of ethnographic	“Research findings in both L.A. and Minneapolis suggest that city politicians and bicycle advocates increasingly see eye to eye on bicycle infrastructure. At first glance, this relationship does not challenge the promise of bicycle mobility; working	N/A - Statistical analysis was not used	N/A

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		research about bicycle advocacy undertaken in two very different U.S. cities, L.A. and Minneapolis, to analyse the shifting meanings of bicycling and its infrastructure in a country where the bicycle has long been a toy for the privileged but a burden for the poor” (p.47).	through public infrastructure to expand bicycling to more people would seem ideal. However, in Minneapolis we saw how politicians have turned their support for bicycle advocacy into a strategy to recruit the creative class” (Hoffmann and Lugo, 2014, p. 57).		
Caggiani, Camporeale, and Ottomanelli (2017)	Free-floating bike-sharing system based on spatial and social equity principles (with a Sioux Falls City test network)	A literature Review is performed, and then “both a test network and a real case study application are presented, together with a sensitivity analysis, aiming at assisting the decision maker in his/her strategical	Consider “the proposal of an equity-based optimization model to plan and design a free-floating bike-sharing system that could provide a sustainable modal alternative to every individual/group of people, taking into account both their spatial and their social needs. In this way, the outcome of congestion pricing is an effective policy that promotes a greater sustainability” (Caggiani,	"The Sioux Falls City network consists of 24 nodes, 76 links, and 552 origin-destination pairs; it has been divided into 24 zones, each one having a node as centroid (origin and destination of every trip)" (p. 8).	N/A

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		decisions, suggesting how to properly carry out a congestion price strategy on the network, fairly redistributing the derived revenues among all the users” (p. 2).	Camporeale, and Ottomanelli, 2017, p. 2).		
Agarwal, Ziemke, and Nagel (2019)	Physically segregated bicycle superhighway for urban areas (Patna, India is selected for application of the bicycle superhighway in this study)	"For the application of a bicycle superhighway, a case study of Patna, India is chosen. Further, this study also proposes an innovative approach to find the optimal number and locations of the connectors between the new infrastructure and the existing network. To	"A computation of accessibilities, a policy assessment tool that is oriented on the actual needs of individuals, showed positive effects of the proposed bicycle superhighway on the accessibility of education facilities. While areas that are located in the direct vicinity of the new bicycle superhighway experience the highest accessibility increase, areas away from the new infrastructure also benefit from it in terms of increased accessibility. These positive effects are reduced if motorbikes are allowed to	"A total of 13,278 plans are recorded, which constitutes approximately a 1% sample of the full population of Patna. In order to obtain a 10% sample, each record is cloned by randomizing the origins, destinations and departure times of the trips. Travel modes for urban trips are bicycle, car, motorbike, public transport	Limitations were considered but were not explicitly discussed. A good level of transparency was demonstrated.

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
		estimate the vehicle- and link-specific time-dependent emissions undermixed traffic conditions, an emission modelling tool (EMT; Kickhöferetal.,2013) is extended" (p. 3).	travel on the bicycle superhighway. This demonstrates that it is very important that an infrastructure is not only constructed appropriately, but also its use must be defined in areas on able way. Otherwise, the benefits it provides may be compromised" (Agarwal, Ziemke, and Nagel, 2019, p. 20).	(PT) and walk. The modal share for these modes is 33%, 2%, 14%, 22% and 29%, respectively" (p. 7).	
Etminani-Ghasrodashti, Paydar, and Ardeshiri (2018)	Kish Island, Iran; survey of two neighborhoods	Survey; n= 426	Individual decision making concerning recreational cycling is associated with subjective as well as objective factors; Network connectivity is not related to the frequency of recreational cycling; Individual attitudes toward landscape design is cycling paths have the strongest positive impact on cycling frequency; Lifestyle factors and geography contribute to attitudes toward cycling; age is significantly related to frequency of cycling	All of the four lifestyle factors are statistically significant for the entire sample in the ordered logit model ($p < 0.001$);	
Solbraa, Anderssen,	Sample of mail recipients from 13	cross sectional study using	Physical activity and time spent in moderate to vigorous	Built environment correlates: sex	Cross sectional design prevents

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Holme, Kolle, Hansen, and Ashe (2018)	of 19 counties in Norway who were born between 1954-1956 and 1967-1969	questionnaire; n=1032	activity are positively associated with higher perceived walkability scores and active transport for commuting; Higher community scores were negatively associated with PA among men but not women; Geographic differences in PA correlations occurred	specific associations for the community perception scores and perceived walkability both $p < .001$ for both; accounts for 14.8% of variance in time spent in PA / 15.7% of variance in time spent in MVPA	causal relationship determinations; low response rate; errors with self-reporting; limitations associated with measuring PA by accelerometry
Bourke, Hilland, and Craike (2018)	Adult office workers aged between 22 and 70 from Metropolitan Melbourne, Australia	Cross-sectional data for self-administered online questionnaire; n=228	There was a significant interactive effect between the workplace-built environment and perceived group norm on transport cycling ($p = 0.06$). There were no other significant interactive effects observed between components of the built environment and perceived social norms on transport or recreational cycling.	Built environment and social norm: Perceived group norm and perceived workplace-built environment was significant - $p = .06$	Walk score remains a novel method for measuring the built environment and does not measure cycling specific components of the built environment; Measures used in this study did not capture the objective built environment between the

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
					neighborhoods that the participants lived and worked; Cross-sectional study design means that conclusions from this study can only infer association rather than causation; Study relied upon self-reported measures of cycling, which may be influenced by recall bias and social desirability; The relatively small sample size may have increased the likelihood of type II errors; Participants in this study were

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
					recruited from a convenience sample, which may beget selection bias and limit the generalizability of the results; No adjustments were made for multiple hypothesis test
Badland, Knuiman, Hooper, and Giles-Corti (2013)	Residents of a new housing development in Perth, Australia	Longitudinal study, self-reporting during 2005-2006 (T2) and 2007-2008 (T3); n=909	There were few significant neighborhood predictors of uptake of cycling for recreation or transport. Those who perceived living near busy streets were half as likely to start cycling for recreation than those living on (perceived) quieter roads. Respondents living in higher walkable neighborhoods (recreation) or with higher street connectivity (as measured by GIS) were more likely to start cycling for recreation when compared with their reference groups. There were no significant relationships between	Of 909 sample: 5.9% took up cycling for recreation; 4.8% for transport; 2.3% for both. Mean time spent on recreation was 50.7 min, 109.7min for transport;	Findings are drawn from a small sample size; this study had inadequate power to detect effect sizes represented by odds ratios less than 2.0; differences in the amount of cycling accumulated were unable to be explored; residential self-selection may

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			objective measures of the neighborhood and uptake of cycling for transport. Low to moderate correlations were shown for personal and built environment characteristics.		have impacted on cycling behaviors
Kim, Choi, Kim, and Fujii (2017)	Residents of Suwon, Korea - a suburb of Seoul	Random survey via interviews; n=1,465	Perception of public bike sharing (PBS) value is influenced by scheme-specific determinants related to environmental concerns. Having awareness of consequences belief determines the perception of PBS value with willingness to pay (WTP).	759 of 1,465 willing to pay taxes for public bike sharing - with half of those willing to pay 1.0 - 2.9 dollars per year; Statistical significance between those willing to pay and those not willing to pay with reference to psychological variables - environmental concerns, high travel personal norms, and high positive beliefs in cycling	None listed (revisit)

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
Ghekiere, Van Cauwenberg, de Geus, Clarys, Cardon, Salmon, de Bourdenaudhuij, and Deforche (2014)	Children aged 10-12 years old and one of their parents (each) residing in different municipalities across Flanders, Belgium	In person questionnaire, Cycling trip observation, semi-structured interview; n=35	Factors influencing cycling for children: Traffic - density, speed, visibility; Urban Design - connectivity, distance to destination; Cycling Facilities - degree of separation (cycling facilities separated from the road), width, type of surface, legibility of road situations (road markings), crossings, continuity of cycling facilities; Road Design - obstacles, intersections, traffic signs; Facilities at Destination; Aesthetics; Topography; Weather - amount of daylight, amount of precipitation; Social Control; Stranger Danger; and Familiar Environment.	Descriptive Stats Only	Possible survey bias - most participating parents had a high socio-economic status and were female. There was no distinction between urban versus suburban and regular versus non-regular riders. Furthermore, the findings are only generalizable for (semi-)urban areas of Flanders, which limits generalization to rural areas and to other countries. Further consideration needs to be

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
					given to child cycling skills.
Kang and Fricker (2016)	General population from 4 cities in China: Shanghai, Beijing, Hangzhou, and Hefei	Survey after watching 15 60 second videos; n=114	The effects of direct interactions with bicycles were found to be negative, because pedestrians would always tend to maximize their own comfort and safety by avoiding such direct interactions and they are more likely to disapprove of bicycle riding on the sidewalk. However, indirect interactions with bicycles were found to cause a positive impact on a pedestrian's attitude towards sharing. Those indirect interactions basically refer to attributes associated with bicycle riding conditions. The	Positive parameter = an increase in the variable gives a higher probability that extremely acceptable will be perceived. Negative parameter = an increase in the variable gives a higher probability that extremely unacceptable will be perceived.	Data is limited geographically to China and student populations. Video clips were used instead of real-world observations or interactions. There was no physical discomfort to confirm preferences identified in the

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			no bicycle lane situation and a greater number of roadway lanes would make a bicyclist's riding condition more dangerous if riding in the street. In this situation, pedestrian attitudes towards bicyclists on the sidewalk tend to be more tolerant. Experience-based desired safe distance from bicyclists on the sidewalk captures one's walking experiences. Walking habits and other personal characteristics like age, sex, marital status, and household size also contribute to pedestrian attitudes.	Positive parameters: Male - 79.3%, Sidewalk width - 99.2%, No bike lane - 98.0% Negative parameters: Married - 96.5%, Less than 1.5m distance from cyclist - 84.6%, Rain - 99.7%, Bicycle lane present - 60.4%	surveys. The survey did not discuss the purpose of the trip which could have impacted perceptions.
Geraghty, Seifert, Preston, Holm, Duarte, and Farrar (2009)	Sacramento City, CA	Survey of impact of walkability and bikability programs; city population 420,000	Walk- and bike-to-school programs grew; community-design workshops helped leverage more than \$12 million in additional support; partnership delivered more than 150 project reviews to city planners, architects, and developers with recommendations for improved pedestrian and bicycle infrastructure; Complete Streets is now	Descriptive Stats Only	Study was programmatic descriptions only

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			included as a policy in local and regional community planning processes		
Willis, Manaugh, and El-Geneidy (2015)	24 studies of various sector/populations	Systematic Review	Perception that influence cycling: benefits, barriers, ability to commute by bike, safety, cycling routes, perception of cyclists, lack of alternatives, parental perceptions; Attitudes that influence cycling: concern for environment, attitudes toward cycling, attitudes toward other modes; Habits that influence cycling; Social environment: Subjective norm, descriptive norm, parental influence, societal acceptance, work environment	Descriptive Stats Only	This study was limited to quantitative studies using questionnaires and surveys; Some studies with larger sizes would provide a different perspective; More studies on behavioral norms and environment were needed
Cooper and Leahy (2017)	New South Wales, Australia	two-year study of cycling advocates; n=18	There are five conflicting themes of bicycle advocacy: Economic arguments; separation of cyclists from or	Descriptive Stats Only	This study did not show any of the data for examination.

Author(s) & Year	Sector / Population	Design and Sample Size	Main Findings	Effect Size	Limitations
			integration of cyclists with motored vehicles; the morality of cycling as good or bad versus motored travel; identity as a cyclist has an impact on influence that can be conflicting; emotional responses to cycling		

Appendix D

Coding, Categorization, and Themes

Codes	Coding Categories	Coding Themes	Recommendations
Economics	Financial factors		1. The Club should get actively engaged in communicating / advocating with the local and County officials in the community. 2. The Club should increase its physical and virtual presence in the community. 3. The Club should refine the mission and focus of The Club to include value laden statements known to influence ridership
Policy/policy maker/campaigns	Public awareness campaigns Public policy and advocacy	Advocacy to influence public policy that will promote biking in the community	
Advocate/advocacy			
Programs/attitudes/values that +/- influence riding			
Promotional Campaigns - public awareness, mass media, partnership, incentives			
Policy - protection for the handicapped			
Community / Family / Parent / Child	Community and family participation	Customization of programs to the community environment are most impactful at motivating riders in the community	
Clubs/socialization			
Membership/new members/new users			

Codes	Coding Categories	Coding Themes	Recommendations
Inclusivity and sustainability		Real and Perceived physical safety influence an individual's decision to bike	
Cycling with family – early exposure			
Characteristics of bikers	Factors that make people bike	Personal Values and Beliefs strongly influence an individual’s perception of cycling	
Cycling factors			
Gender - Male / Female			
Motives for riding - convenience / cost / health			
Negative public perception	Perception by potential bikers and public		
Positive public perception			
Disproportionate Infrastructure	Public Infrastructure	Infrastructure to provide safety to bikers and the public	
Bike lending/sharing			

*Different colors used for grouping of the codes.

END