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IMPORTANT FACTORS RELATED TO INCREASING CYCLING IN CITIES

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Abstract: Cities around the world are looking for ways to increase the share of travellers who use active transportation modes. Active transport is more cost effective than traditional vehicular infrastructure and also offers significant health benefits. Despite these benefits, the relative newness and unfamiliarity of cycling as a mode of transportation means that cities must find ways to optimize investment to most efficiently increase ridership. It is important for city planners to know what types of infrastructure potential cyclists are interested in. They should also be aware of the barriers to cycling that people perceive as being most important so that these can be mitigated. The objective of this study is to determine what factors are related to increased ridership of bicycles. To this end, an intercept survey was completed to collect the opinions of 189 people in Calgary. In addition to basic demographic information, the survey collected data about respondents' current cycling habits and their opinions on various items related to increasing or decreasing their propensity to ride. Using inferential statistics, respondents' opinions were correlated to the various demographic and baseline cycling characteristics to find patterns. The correlations make suggestions about where cycling infrastructure dollars could be best spent to achieve the goal of increased cycling ridership. The findings of this study can be used by transportation planners to more efficiently allocate transportation spending. This in turn could lead to increased ridership, lower costs to taxpayers, and greater health benefits for users.

1 INTRODUCTION

Cycling as a means of transportation has gained increased attention in recent years as cities have begun to recognize its benefits in terms of cost efficiency, health outcomes and equity (City of Calgary 2011; Handy, van Wee, and Kroesen 2014). Calgary's 2009 Transportation Plan recognizes the growing desire to provide transportation options such as cycling within its system (The City of Calgary 2009). To this end the city created its Cycling Strategy to guide the development of cycling within the city (City of Calgary 2011). Edmonton, Vancouver and the province of Ontario have created similar cycling strategy documents that seek to increase the amount cycling is used for transportation in their respective geographical areas (Stantec 2009; Translink 2011; Ontario Ministry of Transportation 2013).

This emphasis on cycling for transportation differs from previous policies that viewed cycling as primarily a means of recreation or physical fitness. Cycling for transportation thus expands on the benefits of recreational cycling (such as enjoyment or physical fitness) to also include cost effectiveness for the individual or municipality as well as environmental benefits (Macmillan et al. 2014; Handy, van Wee, and Kroesen 2014). Cities have recognized that taking cars off the road is a cheaper and more effective alternative for reducing congestion than building more roads, a process criticized for inducing rather than alleviating demand (Duranton and Turner 2011). Facilitating cycling for transport also has many social benefits as this form of transportation is more accessible to those with low or no income (Lee, Sener, and Jones 2017).

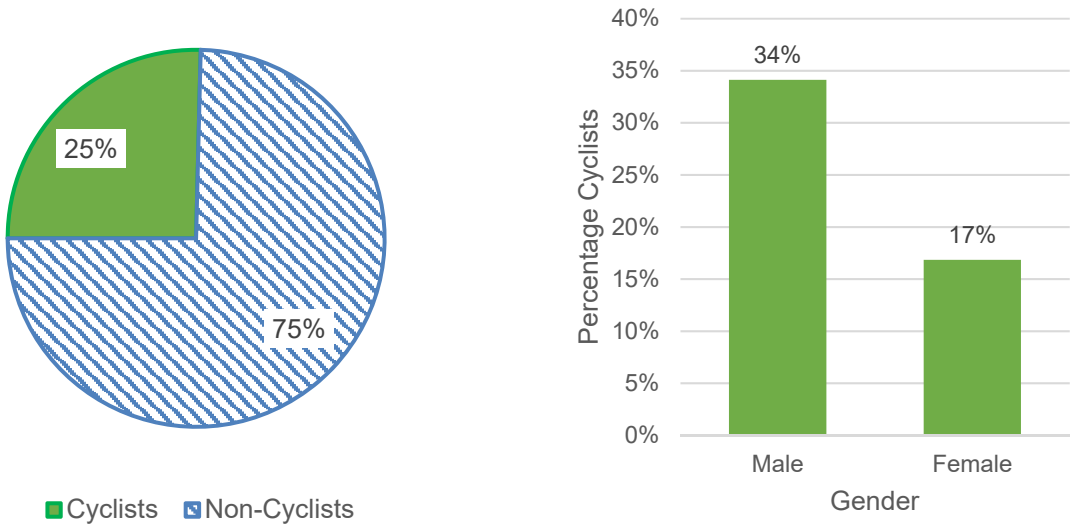
However, despite its benefits, cycling for transportation is still subject to budget considerations and wavering public and political support. There is a distinct need to justify and prioritize government budget expenditures to make the best use of limited funding. Strategies such as Calgary's Cycling Strategy mention many possible avenues to pursue that could encourage the use of cycling for transport, but do little to prioritize or mandate what types of improvements could be made in pursuit of this goal (City of Calgary 2011). Strategies that do set goals or prioritize expenditures do so without much basis in theory.

For this reason, this study has the objective of determining what factors are currently preventing non-cyclists from using cycling as transportation. The study interviewed 189 cyclists and non-cyclists in Calgary on issues such as what would cause them to ride their bike more, and what infrastructure elements they would be comfortable riding a bike in. Results compare the responses of non-cyclists to those of cyclists to better understand what differentiates the two groups. It is anticipated that this information could help municipalities in determining what policy remedies should be sought to encourage cycling among current non-cyclists. These municipalities can gain insight from seeing the relative increase in ridership available with each potential type of proposed infrastructure upgrade. This efficient allocation of resources should help lead to more cycling for transport in Canadian cities.

2 METHODOLOGY

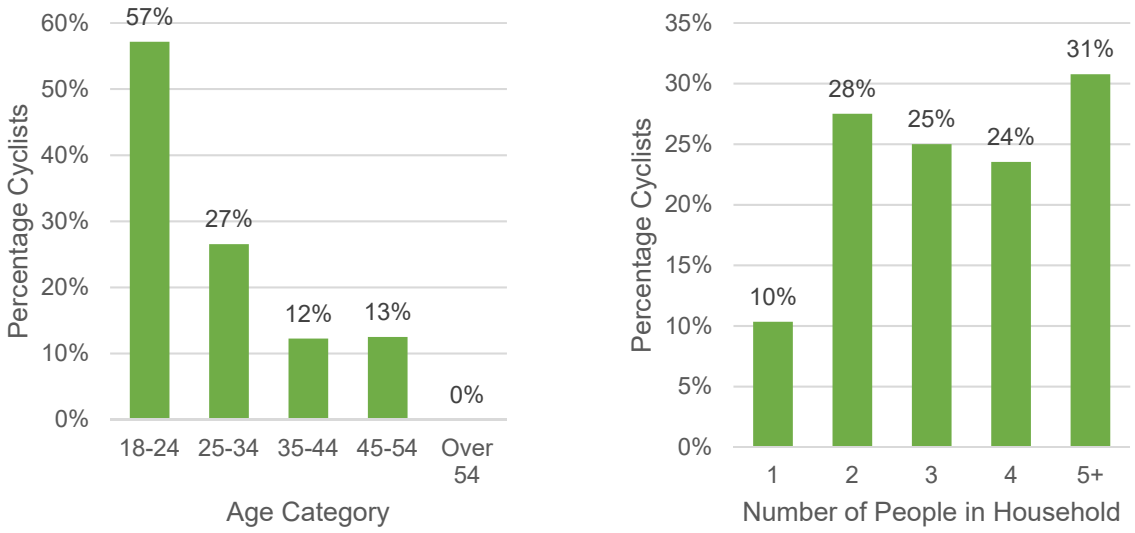
This study conducted an intercept survey on 189 individuals who live in Calgary. Researchers asked respondents opinion-based questions about their perceptions of cycling as a mode of transportation. These questions were followed up with a series of demographic questions. The survey was conducted in areas that would lead to high levels of responses from people who do not identify as a "cyclist". In this way, the survey could meet the project's aims of determining non-cyclist's opinions on what would increase their propensity to cycle.

Overall, 75% of respondents did not cycle at all. This was in line with the study's objective of determining the opinions of non-cyclists. Approximately equal numbers of men and women were surveyed, though men identified as cyclists at twice the rate of women as shown in Figure 1. The number of people surveyed skewed slightly younger but was relatively evenly distributed from 18 to over 54. As expected, younger respondents were more likely to be cyclists. Respondents also reported whether they lived alone, or with more people (parents, siblings, children, roommates etc.). Those living alone were the least likely to be cyclists while larger households had roughly equal numbers of cyclists as shown in Figure 2.



(a) (b)

Figure 1: Breakdown of cyclists and non-cyclists surveyed
(a) Overall rate of cycling, (b) Percentage cyclists by gender



(a) (b)

Figure 2: Age and household size of cyclists surveyed
(a) Percentage cyclists by age category, (b) Percentage cyclists by number of people in household

In addition to this demographic information, respondents were also asked a series of questions in three separate categories which are presented in the results section. Respondents were asked “yes” or “no” questions about what would encourage them to cycle more. They were also asked “yes” or “no” questions about what they see as barriers to cycling. Lastly, they were asked about whether or not they would feel comfortable in a variety of different cycling infrastructure types. Any respondent who identified as a bike courier was removed from the survey pool.

The responses to these opinion-based questions were separated between cyclists and non-cyclists. The means of these responses were compared between the two groups using an independent samples T-test. This test determines the probability that the difference in the two groups’ means is due to random chance. A small value ($p < 0.05$) suggests the presence of a non-random effect and implies a difference in the population (Adams and Lawrence 2015). Significant differences in the means are important because they can be seen as very important factors that are preventing non-cyclists from becoming cyclists. For instance, many cyclists and non-cyclists agree that better bike storage would encourage them to cycle more, but since there is not a significant difference between non-cyclists and cyclists in this opinion it can be concluded that better bike storage is not a factor that prevents people from becoming cyclists at all. Thus, it is the responses which differ significantly between non-cyclists and cyclists that will be this study’s focus as an answer to its objective.

3 RESULTS

3.1 Cycling Wish List

The survey asked cyclists and non-cyclists yes or no questions about what would encourage them to cycle more. Respondents could answer “yes” to as many questions as they would like. The results from this analysis are shown in Figure 2. It is useful to consider the relative importance of these different options for improving the cycling experience. While being able to forgo a bike helmet would appear to not have much of an impact on encouraging cycling, more and better cycle infrastructure appears to be very important as it could be considered the underlying factor behind the top three most desired factor, “Improved network facilities”, “Access to separated lanes” and “Nearby bike routes”.

It is useful to consider the difference in means between the proportion of “yes” responses for cyclists and non-cyclists on each of the available factors. Though cyclists and non-cyclists share many of the same

desires for increasing their usage of cycling, the response of “enforcement of traffic rules” was much more important to people not currently cycling. The question specifically mentioned better enforcement of traffic rules with regards to car-cyclist interaction. Interestingly 39% more non-cyclists cited this issue as being important to them than cyclists which is a statistically significant difference ($p = 0.009$).

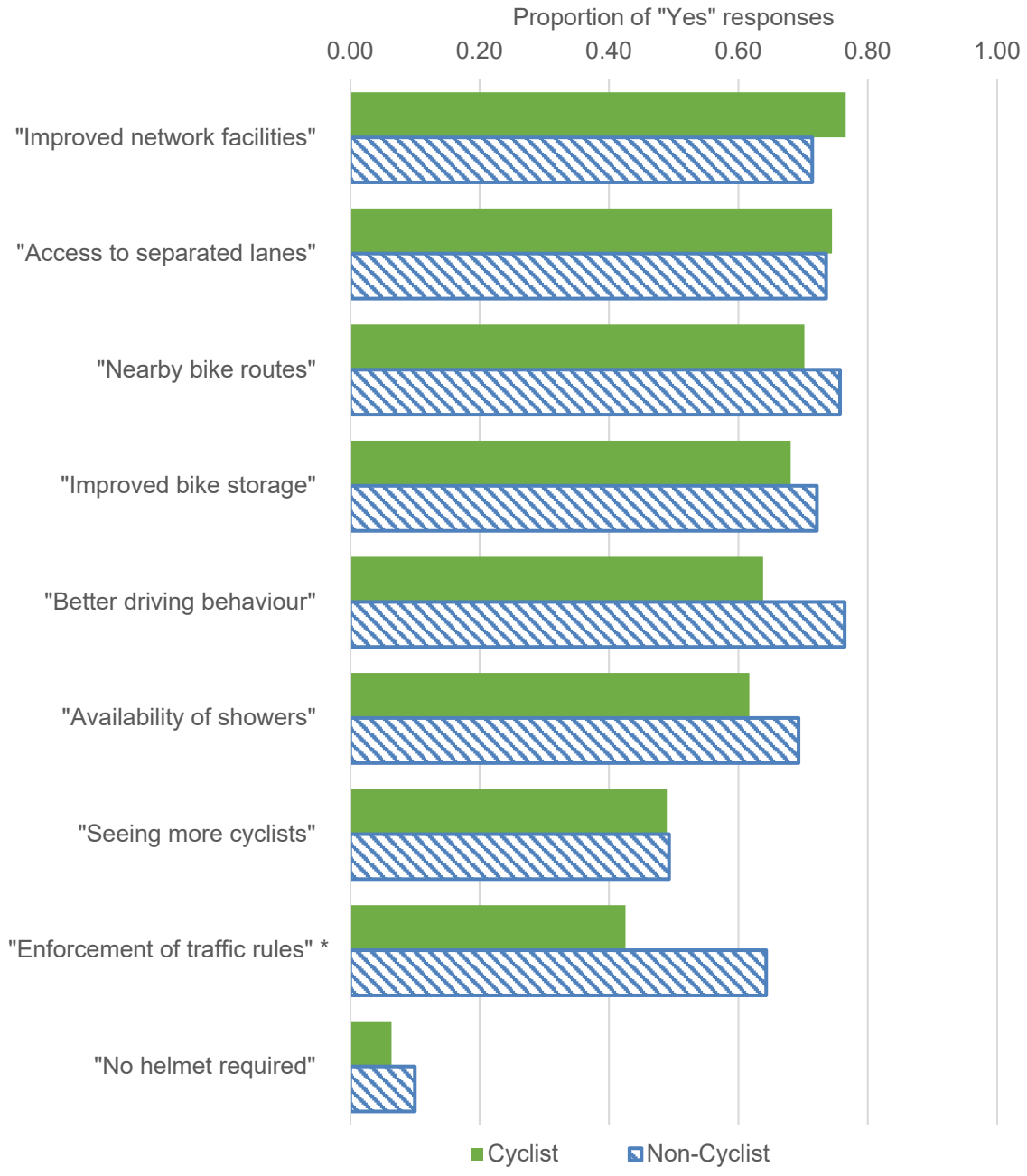


Figure 2: What would encourage people to cycle more
*$p < 0.05$, can infer difference in population between cyclists and non-cyclists

3.2 Barriers to Cycling

Respondents were also asked a similar question about what would encourage them to cycle more and given the option of unlimited “yes” or “no” responses to various alternatives. These responses were separated into responses from cyclists and non-cyclists and are presented in Figure 3. Again, the means of these two groups were checked for difference using an independent samples T-test. There are wide variations in levels of relative importance for why people would cycle more. Cold weather is an important restricting factor for nearly all respondents, but very few respondents are worried about messy hair or the inability to carry children.

In considering the differences in means between cyclists and non-cyclists there are several significant differences. Of interest is the “I’m uncomfortable next to cars” option which shows a very wide difference in means in which non-cyclists identified this issue as “important” at a rate 5.6 times higher than cyclists. This difference is significant at the $p < 0.001$ level. Being uncomfortable next to cars appears to be the leading factor in determining whether a respondent identifies as a cyclist or not. Special attention should be paid to this response especially when considered in concert with non-cyclists’ strong belief in the importance of the enforcement of traffic rules

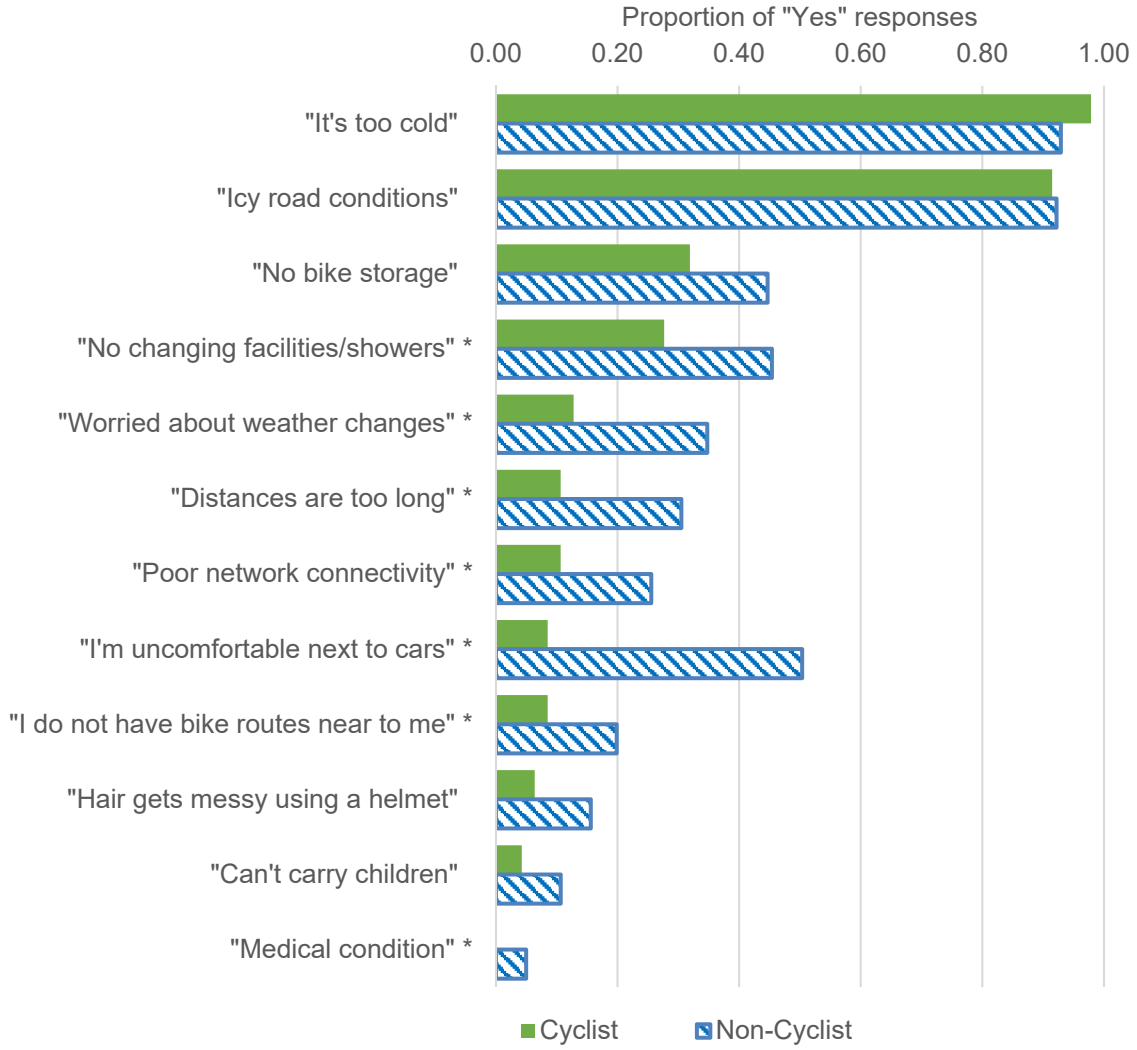


Figure 3: Reasons for not cycling or not cycling more
*$p < 0.05$, can infer difference in population between cyclists and non-cyclists

3.3 Comfort in Cycling Infrastructure

Lastly, respondents were asked about their comfort in a variety of common types of cycling infrastructure. Their responses were separated between cyclists and non-cyclists and compared for mean differences using an independent samples T-test. A further analysis was done to better clarify the impact that improved cycling infrastructure would have on the comfort of cyclists and non-cyclists. The proportion of cyclists and non-cyclists who reported being comfortable in each type of infrastructure was divided by the portion of cyclists and non-cyclists who reported being comfortable riding in a regular lane. This provides the proportion increase in comfort provided by each type of cycling infrastructure when compared with a regular lane.

The proportion increase in comfort over regular lanes is calculated based on the 7% of non-cyclists (or 9 respondents) who said they would be comfortable riding in a regular lane as well as the 30% of cyclists (or 14 respondents) who said they would be comfortable riding in a regular lane. The results of this comparative analysis are presented in Figure 5. Detailed descriptions of cycling infrastructure types are listed in Table 1 which is similar to the descriptions available to respondents during the survey.

Overall, it can be seen in Figure 5 that increasing quality of cycling infrastructure is very important to both cyclists and non-cyclists. This figure represents the proportion increase in “yes” responses to the question of comfort in that type of cycling infrastructure over the “yes” responses to comfort in a regular lane. It can be seen that almost any added provisions for safety over a regular lane (such as painted sharrows) makes current cyclists three times more likely to be comfortable in that area. The difference is even more pronounced for non-cyclists, who are ten times more likely to be comfortable in a physically separated cycle track lane than they are in a regular lane. The types of cycling infrastructure were ordered based on the increasing proportion of non-cyclists who would be comfortable in that infrastructure. Interestingly, this increasing preference held by non-cyclists corresponded perfectly with decreasing frequency of car-cyclist interactions. This relationship is represented by the arrow on Figure 5.

Table 1: Types of cycling infrastructure

Infrastructure Type	Definition used
Regular Lane	A regular traffic lane on a moderate capacity road such as a collector road
Shared Lane	A lane on a collector or smaller road with signage to indicate the lane is to be shared with bikes (such as sharrows)
Bike Lane	A lane adjacent to regular traffic lanes demarcated by a painted line, but without any physical barrier
Cycle Track Lane	A lane adjacent to regular traffic lanes exclusively for bicycle use, separated with physical barriers with enhanced intersection treatments
Sidewalk	A concrete pathway for foot traffic between traffic and buildings (currently only legal for children under the age of 14 to use these facilities in Calgary)
Back Alley	A low volume road behind buildings not generally used by vehicles for travel
Neighbourhood Street	A quiet residential street with low traffic volumes
Bike path	A physically and grade separated bike-only pathway that may or may not include very low pedestrian volumes that are usually in parks

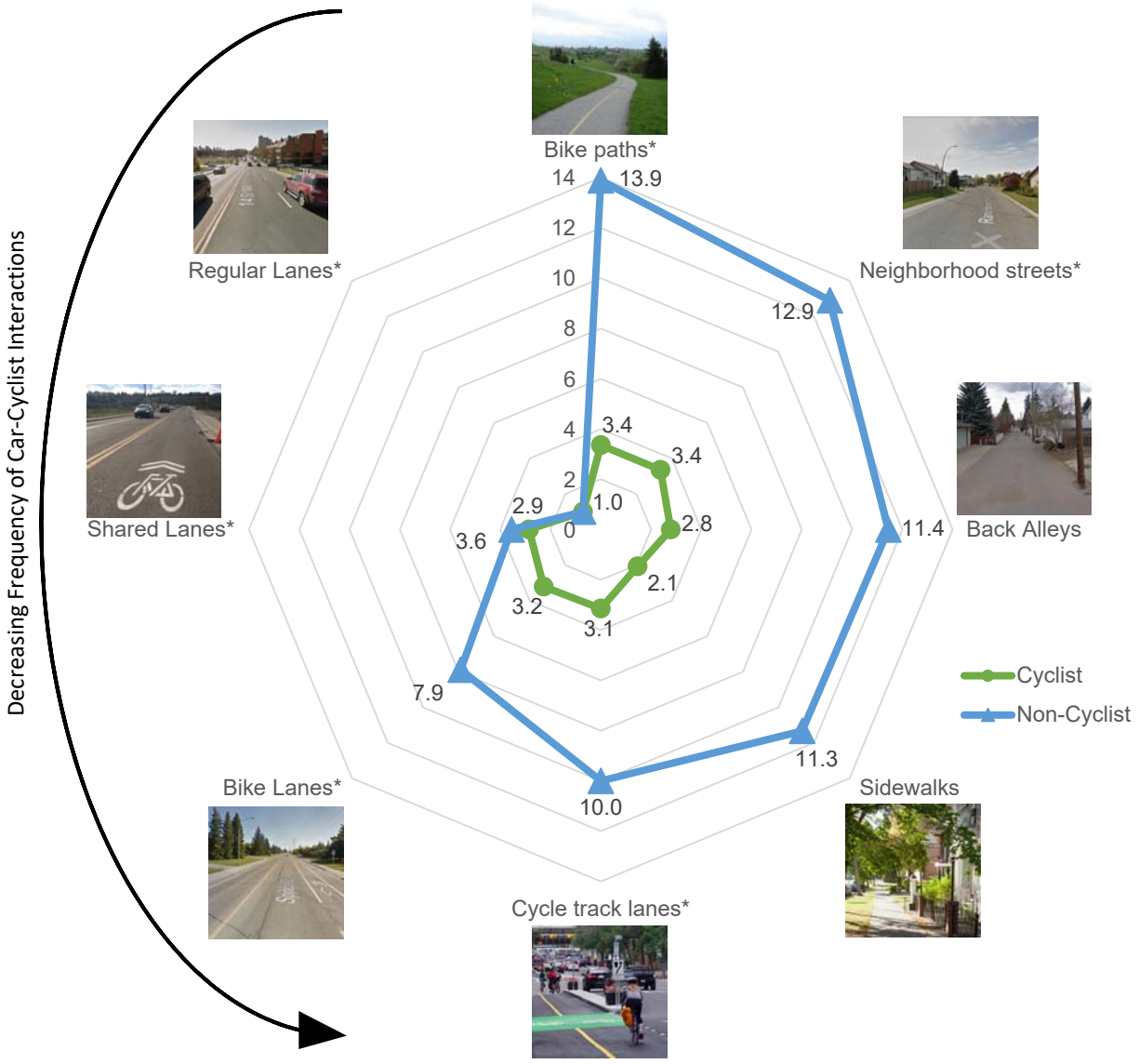


Figure 5: Proportion increase in comfort over a regular lane
*p < 0.05, can infer difference in population between cyclists and non-cyclists

4 DISCUSSION AND CONCLUSION

In determining what factors are currently preventing non-cyclists from using cycling as transportation, this study investigated three questions: what would encourage people to cycle more, what is stopping people from cycling more and what types of infrastructure they are comfortable cycling in. Results from all three questions confirm that increased investment in cycling infrastructure would encourage more people to take up cycling.

The only significant difference between cyclists and non-cyclists in terms of what would encourage them to cycle more is that non-cyclists are looking for better enforcement of traffic rules. The reason for this difference can be traced back to the underlying factor of the fear of cars common amongst non-cyclists. For this reason, increased enforcement is certainly an option that could be pursued by policy-makers in Canada but could alternatively be solved by separating bicycle traffic from car traffic through improved infrastructure so that the impact of law-breaking does not endanger cyclists.

In looking at the responses for reasons people are not cycling at all or not cycling more, the most important factor is certainly the weather. While it is not feasible to alter the weather conditions of cities, partial solutions to this issue do exist in the form of improved snow and ice control (i.e. winter maintenance). However, it should be noted that since current cyclists also share this view so strongly, perhaps this concern does not actually readily prevent people from becoming cyclists.

The mean difference between cyclists and non-cyclists for reasons why they are not cycling more are extremely disparate for the factor of "uncomfortable next to cars". Non-cyclists are 5.6 times more likely to be uncomfortable next to cars than cyclists. Certainly, it is not reasonable to attempt to change people's fears (whether unsubstantiated or justified) and so this issue can again be solved by improving safety through improved infrastructure. The strong effect size here (50% of cyclists being comfortable vs. 10% of non-cyclists being comfortable) demonstrates the importance of this factor.

Lastly, in an effort to improve the feeling of comfort for non-cyclists, this research looked at which types of infrastructure non-cyclists feel would make them more comfortable and thus more likely to cycle. Shared lanes increase the likelihood of a non-cyclist feeling comfortable by 360% over a regular lane. However, painted bike lanes and physically separated cycle tracks improve their comfort over regular lanes by 790% and 1000% respectively. Because these types of infrastructure integrate well with existing road networks, the use of these types of infrastructure should be encouraged in cities that are wanting to increase the comfort of non-cyclists and therefore increase their likelihood of riding.

Thus, all three sections of the survey confirm the conclusion that the greatest concern amongst non-cyclists is a fear of cycling next to vehicles. Non-cyclists disproportionately want to see greater enforcement of traffic rules around car-cyclist interactions. Non-cyclists are disproportionately uncomfortable next to cars. And lastly, non-cyclists disproportionately gain comfort in cycling infrastructure that separates them from vehicular traffic. Certainly, the conclusion is clear that non-cyclists would like to see increased separation from traffic to allow them to begin cycling. Improved infrastructure can increase non-cyclists' level of comfort by considerable amounts and should thus be leveraged extensively by cities wishing to get more non-cyclists riding their bikes.

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