UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Factors Affecting Potential Cyclists in the UBC Community

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Executive Summary

Cycling is a form of active transportation that represents a cost-effective, healthy, and environmentally friendly form of commuting (Bungum, Lounsberry, Moonie & Gast, 2008; Haapala, 2013; Gilderbloom, Grooms, Mog, and Meares, 2015; Hopkins & Mandic, 2016). The University of British Columbia (UBC) has engaged in research and initiatives to encourage individuals to partake in cycling through the Cycling in Cities Research Group, and Campus Community + Planning. However, about 75% of the UBC community have still never engaged in this beneficial form of active transportation and there are likely many different reasons why (Mathewson & Cheyne, 2017). Distance and topography stood out as significantly salient to potential cyclists, and given the geographical positioning of UBC, it is important to determine whether these factors influence the large proportion of community members that have never cycled (Winters & Cooper, 2008). Therefore, through collaboration with SEEDS partners, we were interested in analyzing what deterrents prevented these potential cyclists from biking to campus despite the benefits cycling may have.

Potential cyclists were the main population of interest in the study. A quantitative research study was conducted through evaluating a diverse population of UBC community members including students, staff and faculty members. Based on findings from past studies conducted in Vancouver, a survey was designed to analyze the trends of demographics, biking history, the relative weight of deterrents, and incentives or resources that would motivate them to bike to campus. Open-response questions were also included to identify cycling deterrents that may not have been considered. All UBC community members were invited to participate regardless of cycling history, and we specifically compared results of those with a history of cycling (cyclists) to those with no experience cycling to campus (potential cyclists).

Over four weeks, data was collected from 84 undergraduate and graduate students between the ages of 18 to 36 years of age. As expected, the results indicated that a large proportion of the sample had never biked to campus and, surprisingly, about half of these potential cyclists would not consider biking to campus. While the major deterrents for cyclists with a previous history were weather, lack of facilities, and safety, the major deterrents identified for potential cyclists were weather, distance, and challenging topography. These differences could be attributed to differences in experience, and also may be related to the general location of residence, as potential cyclists were much more likely to live 15-20+ km from campus, which was also a major trend in open-responses. Despite these varied deterrents, many respondents indicated that incentives such as more protected bike lanes, incentive programs, bike storage, and resources on campus would increase their likelihood to cycle to campus.

With consideration of our findings, we have provided five recommendations for UBC Campus + Community Planning to consider implementing at UBC in order to encourage more people to bike to campus. Such recommendations include advocating for protected bike lanes, poster campaigns to change biking attitudes, creating more bike facilities on campus, education workshop series to inform and teach practical skills to potential cyclists, and incentive services.

Introduction & Literature Review

Cycling has the potential to provide individuals with a variety of benefits ranging from physical, mental, economic and environmental (Bungum, Lounsberry, Moonie & Gast, 2008; Haapala, 2013; Gilderbloom, Grooms, Mog, and Meares, 2015; Hopkins & Mandic, 2016). It has been demonstrated that small intervals of biking may decrease diseases often correlated with sedentary behaviour (Bungum et al., 2008). Additionally, students are a population that should consider biking solely due to increases in memory and, as a result, better test performances associated with consistent physical exercise (Haapala, 2013). According to Gilderbloom et al. (2015), biking to campus could also aid in financial savings, as purchasing a bike can be much cheaper than vehicular alternatives. Furthermore, bicycling does not require gas payments, insurance installments, high maintenance costs, and parking fees (Gilderbloom et al., 2015). In other words, the money saved from biking as a student's main method of transportation could be put towards tuition or other enticing alternatives. In addition to the physical, mental, and financial benefits, biking is also very environmentally friendly (Hopkins & Mandic, 2016). In order to assist in maintaining a sustainable environment, shifting from gas powered vehicles to biking can reduce greenhouse gas emissions from car exhaust (Hopkins & Mandic, 2016). Individuals are also encouraged to bike as it would help minimize traffic congestion, further reducing idle time on the road and more emissions (Hopkins & Mandic, 2016). Individuals expressed concerns of biking in busy, congested traffic and were more inclined to bike on quieter roads, thus, they seemed to prefer biking when destinations were close and away from high volumes of traffic (Hopkins & Mandic, 2016). People are also attracted to biking because of convenience and ability to minimize commute times instead of walking (Hopkins & Mandic,

2016). Overall, biking has the ability to be a viable option for individual transport while providing a range of benefits at both individual and community levels.

UBC Biking Statistics

Due to its numerous benefits, many institutions support cycling as a primary mode of transportation. In an effort to meet its sustainability goals, The University of British Columbia (UBC) strives to encourage non-automobile modes of transportation such as cycling to and from campus. Some ways in which UBC has promoted cycling include implementing several bicycle lanes, such as the ones on University Boulevard and SW Marine Drive and ensuring either covered or uncovered bicycle racks are provided at each building on campus, as well as bike lockers, cages and numerous end of trip facilities (University of British Columbia, 2019). The 2018 UBC Transportation Status Report revealed that although there was a significant decrease in trips by bike after the U-Pass program was introduced in 2003, the overall number of bicycle trips since 2010 has increased (University of British Columbia, 2019). This is likely due to the continued improvements to the bike infrastructure at UBC. Furthermore, a 2017 Vancouver Transportation Survey studied 2,502 UBC staff, faculty, and students and discovered that 9% of participants used biking as a primary mode of transportation (Mathewson & Cheyne, 2017). The survey also found that 55% of respondents owned a bike, 42% of bike owners brought their bikes to campus, and 45% of those used bike racks on campus (Mathewson & Cheyne, 2017). Despite data indicating that many individuals who bike to campus were able to successfully access the bike services provided by UBC (e.g. showers, lockers, and safe bike storage), the survey revealed that 75% of respondents had never travelled to campus by bike (Mathewson, & Cheyne, 2017). Therefore, it is important to analyze the factors that are preventing these individuals from choosing cycling as their main method of transportation to and from campus.

Biking Risks/Deterrents

There are many risks inherent to road cycling that prospective cyclists may come across, ultimately preventing them from using a bicycle as their primary means of transportation. One of the most notable deterrents involved in cycling is the risk of injury, with significantly higher risks of fatality and injury compared to driving (Teschke, Reynolds, Ries, Gouge, & Winters, 2012b). Risk of injury is often closely related to route infrastructure and proximity of cyclists to the cars when sharing the road. For example, Teschke et al. (2012a) identified that cycling lanes on busy streets were associated with the highest risk, however, bike lanes on busy streets and bike paths away from the street corresponded with half the risk of injury. However, Teshke et al. (2012b) found that, in Canada, cycling fatalities and injuries have steadily declined over the last two decades, with growing popularity of bike share services increasing the level of safety on the roads as more individuals utilize these services. Another hazard that often deters individuals from cycling are the risks associated with exposure to air pollutants. This is often correlated to travelling longer distances by bicycle as respiratory ventilation increases with physical exertion (Teschke et al., 2012b). This results in increased amounts of air pollutant uptake, which is further enhanced when cycling on busy, car-filled roads (Teschke et al., 2012b). However, with more bike lanes being created and bike routes being redirected onto quieter streets, these risks can be mitigated, with the benefits far outweighing the risks.

UBC Demographic

As previously detailed, there are many motivators and deterrents that influence cycling behaviours, and among the most prominent is the biking environment. The 2017 Vancouver Transportation Survey identified factors that specifically impede university community members from biking to campus, such as concern for theft, pedestrians, and the need for increased road

space allocated for bikes (Mathewson & Cheyne, 2017). The UBC Vancouver Transportation Status Report also showed a correlation between increase in bicycle trips, improved bike infrastructure, and increasing popularity of bicycles with electric motors for assisted propulsion and therefore increased speed and reduced effort, commonly known as e-bikes (University of British Columbia, 2019).

A 2008 report by Winters and Cooper details what makes a neighbourhood "bikeable", according to an index created based on factors identified in interviews with frequent, occasional, and non-cyclists. While UBC has a high mean bikeability index, this seems to be due to the ease of biking within the university, rather than access (Mapping Bikeability, 2017). When analyzing the topography of major access routes to UBC, the bikeability index was reduced to low. This factor of topography, in addition to longer distances (> 5km) and traffic, all have a strong negative influence on biking, particularly among potential cyclists (Winters & Cooper, 2008). These findings are complemented by the results of a general population survey that found regular and potential cyclists shared similar deterrents and motivators, but potential cyclists were more likely to be impacted by nearby traffic, distance, weather, and routes along major roads (Winters, Davidson, Kao, & Teschke, 2011). Therefore, although deterrents for regular cyclists also affect potential cyclists, it is important to determine specific factors that may impede potential cyclists from biking to campus. These findings also identify UBC as a uniquely challenging environment to encourage new cyclists to travel to, as most routes to the campus are lengthy, topographically challenging and heavily trafficked.

The "4 E's" of cycling, as identified by the USDT Federal Highway Administration, highlight important considerations from studies on biking behaviour determinants (Winters et al., 2011). These involve commonly considered issues of engineering (safety, signage),

encouragement (safe bike storage, facilities), and enforcement (cycling laws) that should all be investigated and weighed in terms of relevance to community members that have never cycled to UBC. An interesting consideration is the 4th “E”, education, which refers to information and incentives for cyclists. Educational resources and incentives such as mobile apps, information on safe biking routes and practices, and incentives with point systems should also be explored to determine if their existence would impact the biking behaviour of new cyclists.

Research Aim

As part of UBC’s effort to encourage active living and sustainability goals, various surveys and studies have been conducted in order to capture a statistical demographic of daily, non-, and potential cyclists. Further studies conducted by the Cycling in Cities research group have created a qualitative understanding of motivators and deterrents of cycling behaviour in Vancouver. Our current research knowledge involves benefits of bicycling, transportation statistics at UBC, major risks, deterrents, and motivators of cycling, and some factors unique to UBC. Our research will involve the UBC demographic and will specifically focus on community members that have not biked to campus in the past, or potential cyclists. It is expected that this demographic will include a diverse group of faculty, staff, and students at UBC. Previous studies of the broader Vancouver population have identified distance and time as significant deterrents. It is anticipated that community members that are new to Vancouver, live further from campus, and/or have busier family and work schedules will comprise this demographic of potential cyclists. Given the unique challenges presented by the environment at UBC, it is important to identify which deterrents specifically affect the large population of community members that have never biked to campus, the relative impact of each of these factors, and possible solutions to address them including education and incentives.

Methods

Inclusion & Exclusion Criteria

A quantitative research study was conducted in order to determine barriers that prevent potential cyclists from cycling to campus. For the purposes of the study, potential cyclists were defined as UBC community members that have never biked to campus. The study aimed to evaluate a diverse study population, as many UBC community members including students, faculty, and staff have been identified as potential cyclists.

Inclusion criteria for the survey was any UBC community members interested in participating, regardless of cycling experience or ability. In order to gain insight into deterrents specifically impacting potential cyclists, regular and occasional cyclists were also invited to participate in the survey and differences between the groups were compared. Therefore, exclusion criteria for the study was simply individuals not identified as members of the UBC community of faculty, staff, and students.

Survey

The circulated survey can be referenced in Appendix A. The survey was conducted using Qualtrics software obtained through UBC (Qualtrics, Provo, UT). The use of a survey allowed inexpensive, fast, and widespread access to the broad study population (Kelley et al., 2003). 84 surveys were analyzed for quantitative trends and correlations across categories of data. Open-ended responses and categories labelled “other” were included to obtain insight into subjective experiences of survey respondents, as well as identification of any unique deterrents and

incentives that may not have been considered (see Appendix A for open-ended questions; see Appendix C for responses).

The first section of the survey collected data on respondent demographics, biking history, and access to biking resources. This data was collected in order to identify useful information about the large percentage of individuals that have not biked to campus and identify any possible correlations with deterrents, as well as inform targeted solutions. The second section of the survey required participants to identify and rank deterrents preventing them from biking to campus. The deterrents identified in the survey include route infrastructure, risks, pollution, distance, and weather. This list of deterrents was extracted from those identified in past studies (Teschke et al., 2012a; Teschke, Reynolds, Ries, Gouge, & Winters, 2012b; Mathewson & Cheyne, 2017; Winters & Cooper, 2008). To ensure consideration of deterrents unique to Vancouver and UBC particularly, deterrents such as weather and topography were included, and participants were asked to identify the region of Vancouver they commute from. Additionally, open-ended response options were included in this portion of the survey to collect subjective responses not addressed in the questions. Respondents were asked to indicate the extent to which each of these factors affect them (i.e. does not affect me, affects me a little, somewhat affects me, affects me greatly), and subsequently indicate which factor has the largest impact on their desire to bike to campus. The final section of the survey investigated respondent interest in possible resources and incentives, to identify if they may have an effect on cycling behaviour. By including these questions, the researchers were able to identify and suggest practical solutions with evidence of the expected impact of implementation. The surveyed incentives and resources included tracking and prizes, information about cycling, separated bike routes, and increased on-

campus biking facilities. Overall, the survey was able to collect a broad range of information to identify individuals that have not biked to campus, the relative weight of deterrents that are preventing them from cycling, and identify possible solutions that would encourage this population to begin biking to campus.

Survey Distribution Methods

The survey was distributed in the beginning of March and circulated for four weeks in order to allow for sufficient time to gather responses and analyze data. The survey was advertised primarily through word of mouth using the anonymous link, with emphasis of having individuals send it to other individuals and so forth. The survey was also sent to UBC community and faculty members in an attempt to broaden the demographics and collect responses more representative of the whole campus. Despite this effort, no staff or faculty responses were completed. The survey was designed to only take around two minutes to complete and be easy to forward to others in order to gather a larger number of responses that best represent the population of UBC and the challenges of biking on campus. The research team planned to work on the ground to distribute survey links utilizing a QR code to individuals at the UBC Bus Loop and within parking garages in order to diversify the sample population and gain perspective from frequent transit and car users. However, due to the sudden closure of the university campus on Monday March 16th, 2020, the research team was unable to employ these methods.

Ethical Considerations

The principal investigator (PI) for this study was Dr. Andrea Bundon (Assistant Professor, School of Kinesiology, Faculty of Education). The study was submitted by the PI and

approved by the Research Ethics Board prior to commencing the study. Study purpose, procedures, outcomes, benefits, confidentiality, risks, and contact information were outlined for study participants at the beginning of the online survey. By continuing with the survey, respondents indicated that they provided their consent for participation. In order to maintain confidentiality, secure Qualtrics software was used to collect responses and no participant names were included in collection. Upon completion of the study report, all data was kept in Dr. Andrea Bundon's research lab (1924 West Mall) at the University of British Columbia. All data and consent forms will be destroyed 1 year after completion. There are minimal risks to study participation, including no known physical, economic, or social risks associated with participation in this study. Study participants were made aware of their right to withdraw without consequence at any point within the survey.

Survey Analysis

The responses were converted into a spreadsheet and made into visual graphs for analysis and communication of results and trends. Initially, the responses were separated into two groups based on participant experience biking to campus. These groups were labelled "cyclists" and "potential cyclists" and responses were compared in order to determine similarities and differences between the target population and general population. The results were analyzed using descriptive statistics to determine the demographics of the survey respondents, highest to lowest ranked barriers, and the relative importance of barriers to survey respondents. The percentage of respondents that were affected by each deterrent was also calculated and reported for contextual understanding of the barrier's impact within the survey population. Open response questions were used to enable respondents to add other possible deterrents not presented in the

survey, as well as indicate the most salient barriers they faced. These open-ended responses were assessed with descriptive analysis to allow researchers to summarize responses and determine common perspectives among participants. Responses to proposed resources and incentives were also analyzed with descriptive statistics in order to estimate future engagement with and impact of these solutions.

Results & Findings

Survey Responses

In total, the survey had an impressive response total of 88, with a sample of 84 fully completed responses. 4 responses were excluded from analysis due to incomplete responses. Detailed tables of respondent count and percentage can be found in Appendix B.

About 30% of respondents indicated living on campus, and most of these respondents were indicated as potential cyclists that have never biked to campus. This is likely due to the fact that they already live on campus and are not necessarily the population that UBC is concerned with as they do not represent transit or vehicle commuters. However, many of these respondents still had valuable input about what would deter them from considering biking to campus in the future, and thus were included in the analysis.

Respondent Demographics

The initial portion of the survey examined demographics of the respondents in order to get a sense of UBC community members that are and are not engaged in cycling. 53 respondents

were female (63.1%), making up the majority of respondents, while 30 were male (35.7%) and 1 was gender neutral (1.2%). The age range of respondents was 18 to 36 years of age, with a mean respondent age of 22 (Appendix A). 90.5% of the respondents were undergraduate students and the remaining 9.5% were graduate students, meaning no staff or faculty participated in the survey (Appendix A). Of those students, exactly 50% of respondents were from the faculty of Kinesiology, and the remaining respondents represented many faculties across the university including Art, Science, Engineering, Commerce, Medicine, Land & Food Systems, Education, Forestry, Dentistry, Pharmacy and Nursing. Analysis from the survey responses also showed that the majority of respondents lived off-campus (64.3%), while the remaining 35.7% of respondents lived on campus. In order to determine how far respondents living off campus needed to commute, questions analyzing their distance from campus were included. These responses were analyzed and the percentages reported refer to the respondents that indicated living off-campus only (n = 54). Only 3 respondents indicated living within 5km of campus (5.5%), while 18 indicated living within 10km (33.3%), 11 indicated living within 15km (20.4%), and 22 indicated living 20km or greater from campus (40.7%). Open responses about the area of Vancouver indicate a majority of UBC student commuters are either living in neighbourhoods close to the university (Kerrisdale, Kitsilano, South Vancouver), or travelling far distances from suburbs of Metro Vancouver (Richmond, Burnaby, Delta, New Westminster, Surrey, Coquitlam, and North Vancouver).

In order to obtain a general sense of accessibility, respondents were asked to indicate whether or not they had access to a bike. 27 respondents reported not having access to a bike (32%), and when only considering potential cyclists that have never biked to campus (n = 68), this percentage grows to 39.7%. It is an important consideration that nearly 40% of potential

cyclists may not have access to a bike for a number of reasons. Of the remaining 57 respondents that indicated having access to a bike, 41 had never biked to campus (71.9%). When considering respondents both with and without access to a bike, this means 81% of the study population had never biked to campus. It is also important to understand attitudes toward biking to campus, with survey results indicating 52.4% would never consider biking to campus, while 47.6% would consider it (Figure 1). This means there are likely many potential deterrents causing about half of potential cyclists to not consider biking to campus as a viable option and demonstrates the importance of acting on these deterrents with practical solutions.

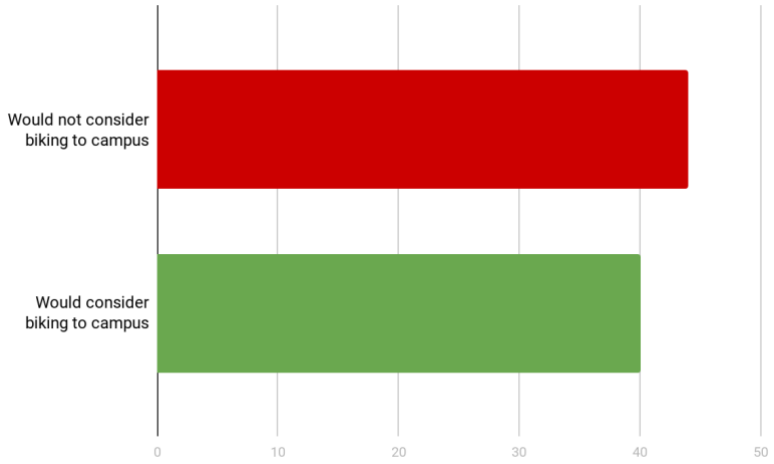

Figure 1. Biking Attitudes of Survey Respondents

Cyclist & Potential Cyclist Demographics

The 68 respondents that indicated that they had never biked to campus represented the "potential cyclist" cohort that the study aimed to identify. The remaining 16 respondents indicated a history of biking to campus. The cyclist demographic was composed of 9 males and 10 females, which was a nearly even gender split. This stands in contrast to the potential cyclist

demographic, which was composed of 67.6% females. This could indicate gender as a potential indicator of cycling habits. Additionally, the distance from campus varied greatly between these two groups (Figure 2). 50% of cyclists indicated living within 5-10km of campus, in comparison to only 19.1% of potential cyclists. 42.6% of potential cyclists and 25% of cyclists lived 15-20+ km away from campus, which implies that distance to the university is another important indicator of cycling behaviour. Further, 61.5% of potential cyclists living within 5-10km of UBC indicated that they would consider biking to campus, while only 20.7% of potential cyclists living 15-20+ km from UBC indicated they would consider biking.

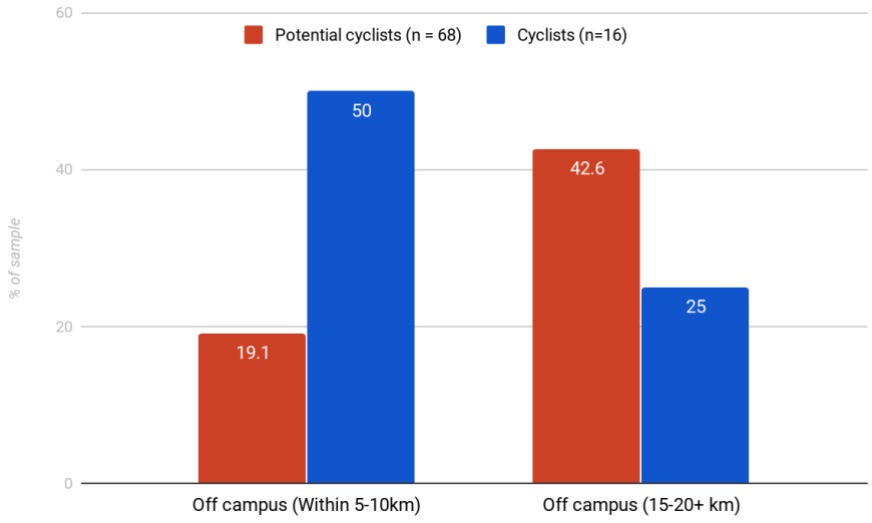

Figure 2. Distance to UBC Campus - Cyclists vs Potential Cyclists

Deterrents

An important outcome of this survey was the deterrents of cycling behaviour for potential cyclists. A deterrent to cycling was classified as “important” if the respondent indicated that the deterrent “affected them a little” or “affected them greatly”. The most important deterrents

identified by the entire survey population are seen in Figure 3. Table 1 in Appendix B contains the count and percentage of respondents that found each deterrent to be important, and how this relates to cyclists and potential cyclists.

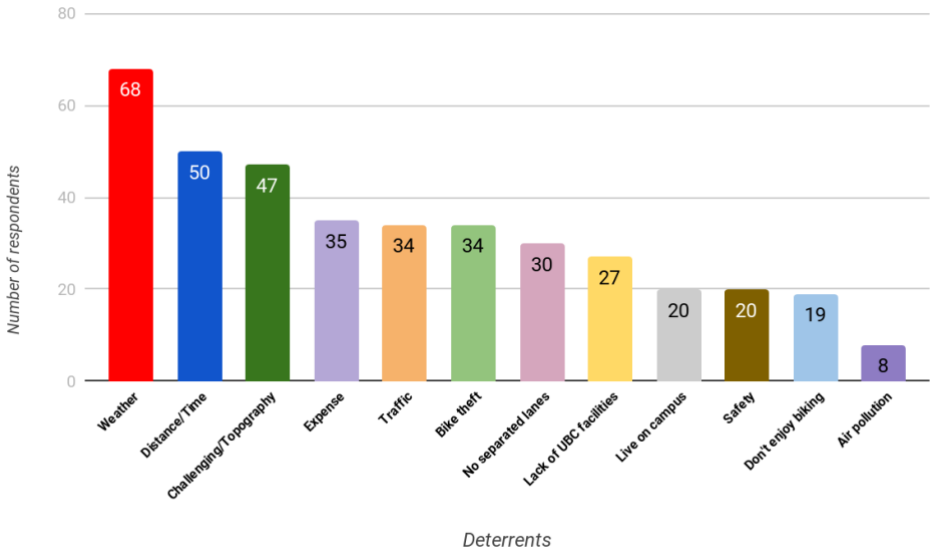

Figure 3. Important Deterrents

Overall, the top three deterrents affecting cyclists were weather (68.8%), lack of facilities at UBC (50%), and lack of separated bike lanes/traffic/bike theft (37.5%). The top three deterrents affecting potential cyclists, on the other hand, were weather (83.8%), distance/amount of time (66.2%), and the challenge/topography (61.8%). These differences in salient deterrents between cyclists and potential cyclists are demonstrated in Figures 4 and 5.

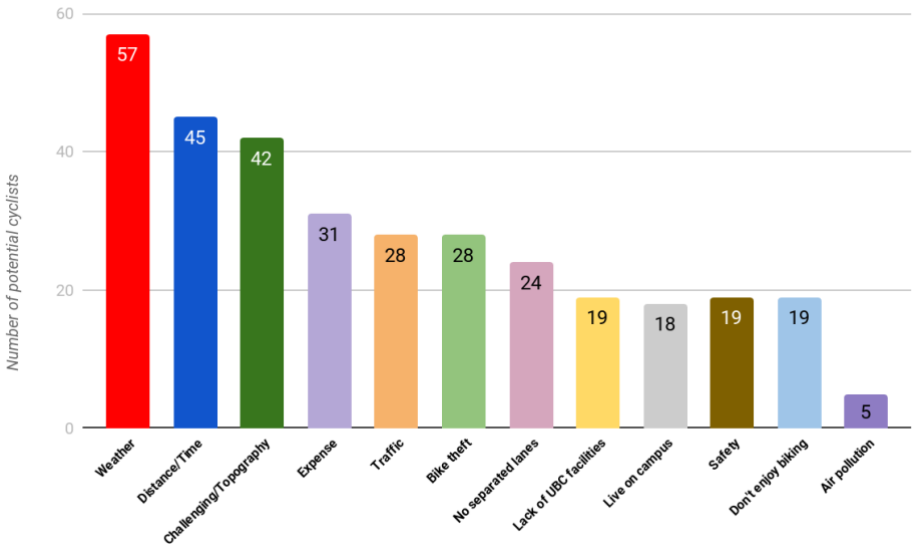

Figure 4. Top deterrents - Potential Cyclists (n = 68)

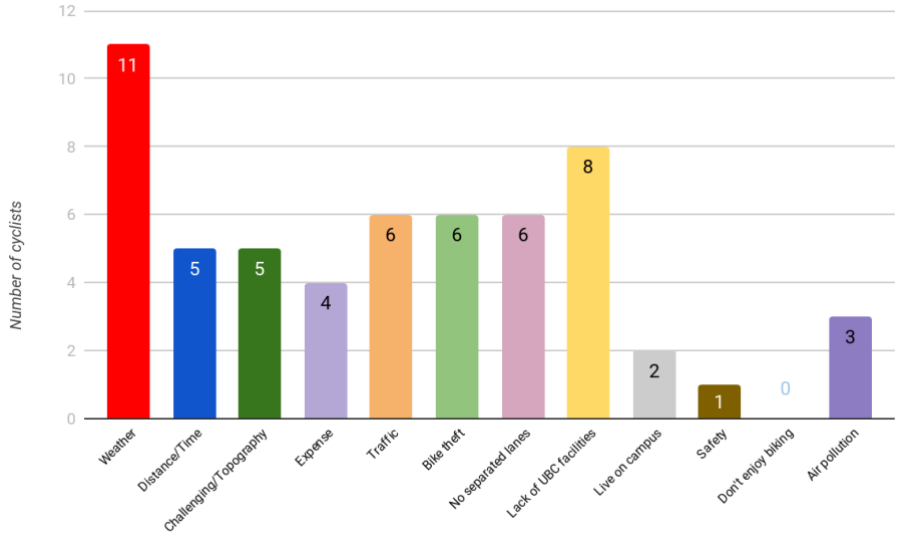

Figure 5. Top deterrents - Cyclists (n = 16)

These findings could indicate that external and generally unchangeable factors are more salient to potential cyclists, while cyclists are more concerned about modifiable issues such as facilities and safety. However, while they were not the top deterrents to cycling, potential

cyclists were also largely impacted by the same factors as cyclists, almost to the same degree. For example, lack of separated bike lanes, traffic, and theft had nearly identical response rates between cyclists and potential cyclists. Another significant deterrent to potential cyclists was expense or lack of proper gear (45.6%), which was also referred to in the biking deterrent open responses. The least important indicator was air pollution (9.5%), however significantly more cyclists (18.8%) reported being impacted by air pollution than potential cyclists (7.4%), likely due to their experience with it.

Of the 84 responses, 10 respondents indicated “other” deterrents prevented them from biking to campus and were then given the opportunity to elaborate on their experiences with an open-ended response. These open-ended responses suggested that potential cyclists experience barriers such as personal preference/laziness, schedule conflicts, and hygiene (Appendix C). Schedule conflicts were coded as reflections of participants' inabilities to accommodate biking around their current timetable and included comments stating it was “too late to bike back” or “hard to get showered before classes/meetings”. The theme of hygiene encompassed several domains, including concerns with sweating, difficulty finding shower facilities, and hair cleanliness.

Incentives

In order to inform suggestions/recommendations to partners, a section of the survey was dedicated to determining how impactful different types of incentives may be on biking behaviour of respondents (Figure 6). The incentive that generated the most interest among survey respondents was separated/protected bike lanes (18.9%), followed closely by more bike storage (16.5%), further highlighting the importance of safety and security for commuting cyclists

(Appendix B, Table 2). Furthermore, increased university resources for cyclists such as showers and lockers (15.6%) was a popular incentive along with incentive programs in which logged trips could win prizes (16.9%). This indicates that potential cyclists may be willing to rethink their environmental deterrents if access to resources and rewards were increased.

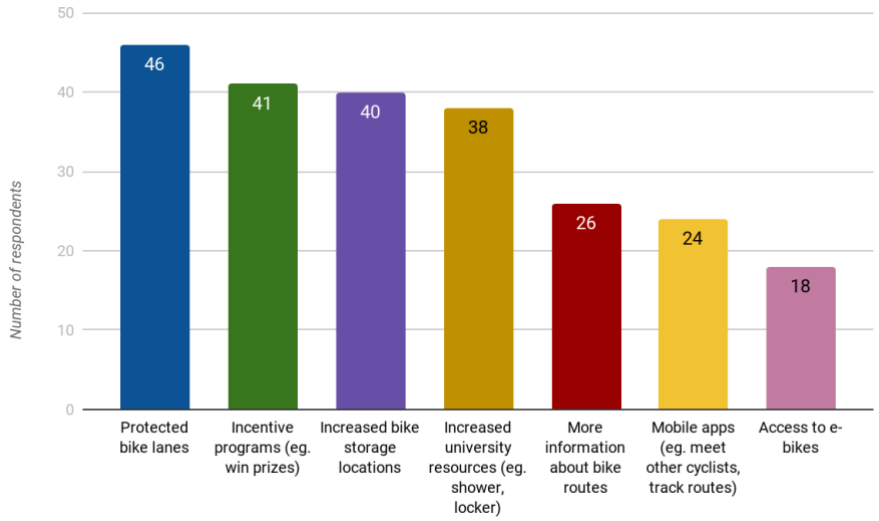

Figure 6. Interest in Incentives

In order to gain a deeper understanding of the incentives that would encourage biking behavior, respondents were provided with an "other" option, in which they were able to suggest incentives not considered in the survey. Of the 15 respondents that answered this open-ended question, seven indicated that they would be more motivated to bike to school if they lived closer to campus. This reinforces the importance of distance in the consideration of engaging in cycling behavior and aligns with survey results that determined distance/amount of time as the second most important deterrent affecting potential cyclists. Another incentive illustrated in the open-ended responses was having access to more bike racks. Finally, less expensive bike options and monetary incentives were also introduced by participants as factors that would encourage them to consider cycling to campus.

Discussion

Overall, our findings showed that only a small handful of individuals have biked to campus in the past, with the majority of individuals having never biked to campus. These individuals represented the "potential cyclists" that our study aimed to investigate. These results closely resemble findings from the 2017 Vancouver Transport Report that found 75% of the UBC community had never cycled to campus (Mathewson & Cheyne, 2017). Furthermore, the results of our survey demonstrated that the main issues deterring potential cyclists from biking to campus are weather, distance/travel time, and difficulty. These findings were echoed in the demographic data that revealed potential cyclists were much more likely to live 15-20+km away from campus than those that indicated a history of cycling. In addition, concerns centered around bike theft, expense, and traffic also seemed to be salient. Similar findings were reported by the UBC Transportation Survey, indicating that 45% of respondents were concerned with bike theft on campus, and 47% were concerned about the lack of road space designated for cyclists (Mathewson & Cheyne, 2017). However, a significant number of respondents indicated they would consider biking to campus if these deterrents were addressed. Many were motivated by having greater access to bike storage and university resources on campus such as showers, lockers, and more protected or separated bike lanes. An interesting finding was that almost 17% of participants would cycle to campus with the implementation of incentive programs. In other words, individuals expressed willingness to bike if the conditions to bike to campus were easier.

Social-Ecological Perspective

It is important to consider health-related behaviours such as active transportation from a multi-level perspective. The social-ecological model is one such framework that can be adapted

and applied to identify multiple levels of influences on active transportation behaviour (Bopp, Kaczynski, & Campbell, 2013). This model suggests that changing one level is unlikely to be effective. Our findings indicated that there are multi-level factors affecting the commuting behaviour of the UBC community, including individual, social, built and natural environment levels, and these factors are similar to those found to affect commuting adults in previous investigations (Bopp, Kaczynski, & Campbell, 2013). Natural environment factors were encompassed by the top three deterrents affecting potential cyclists, which were weather, distance/amount of time, and the challenge/topography. Individual-level factors included gender, as 67.6% of potential cyclists were female, and biking attitudes, as 27.9% of potential cyclists indicated that they do not enjoy biking. The social and interpersonal environment is another important influence to consider, especially in the context of the UBC community. 75% of the community have never biked to campus, indicating that active transport is not a social norm, which can have a large influence on active commuting behaviour (Bopp, Kaczynski, & Campbell, 2013). Concern regarding bike theft also falls within the social level, and was voiced as an important barrier for 41% of potential cyclists, with 16.5% indicating that more secure bike storage would change their active commuting habits. The built environment was indicated as a very important consideration for survey respondents, as 41% and 35% of potential cyclists expressed traffic and the lack of separated bike lanes to be important deterrents respectively (Appendix B). These built environment factors also emerged in the investigation of incentives as the most influential incentive was the addition of bike lanes (Figure 6). Our findings indicate that it is necessary to take into consideration many levels that affect biking behaviour and solutions should move beyond addressing the individual.

Weather, Distance & Challenging Topography

The main purpose of this project was to identify and analyze deterrents that prevent UBC community members, and in particular potential cyclists, from biking to campus. By targeting those specifically that have never biked to campus, we have identified three main deterrents that have the largest influence on cycling attitudes for potential cyclists. First, weather was the top deterrent to those that have never biked to campus, and the rainfall experienced in Vancouver particularly was highlighted in open-ended responses as a hassle and a hazard. Another deterrent that was indicated to affect this population was distance, as a large percentage of potential cyclists live 15-20km away, and/or outside of the Metro Vancouver area. Topographical challenges were another barrier identified, as the difficulty of the bike ride to campus itself seems to prevent community members from cycling to campus. Many respondents stated that there were too many hills to get to UBC which makes the ride to campus more difficult, a finding which is strengthened by evidence of UBC's low commuter bikeability index (Winters et al., 2010). As a result, some individuals indicated that sweating and either needing to carry extra clothes or utilize the limited resources and facilities currently at UBC created extra work that would otherwise be eliminated by not cycling altogether.

These results resembled findings displayed within other literature. According to the study by Winters et al. (2010), weather conditions and perceived difficulty of the task were contributing factors on an individual's decision to bike. They also found that these deterrents impacted potential cyclists more than cyclists, which was echoed by our findings upon separation of barriers between cyclists and potential cyclists (Figures 4 and 5). Winters et al. (2010) also conducted their study within the Metro Vancouver area, which may explain why participants of our study express similar views. Another study illustrated that long distances and routes

requiring turns are associated with increased car usage over bikes (Bungum et al., 2008). UBC can be accessed from a variety of different routes and many of these routes require turns, along with long distances. These geographical deterrents are very specific to UBC and clearly have an impact on the cycling attitudes and behaviours of the community, so it is important that university-specific initiatives are employed.

Expense & Bike Theft

The lack of access to biking equipment is also a factor in cycling behaviour amongst the UBC community. In fact, 31 of 68 potential cyclists noted that they were unable to access the required resources (Appendix B, Table 1). This lack of access to resources could be due to financial or logistical reasons. As noted in a KIN 464 lecture by Professor Bundon on January 22nd, 2020, those facing large financial constraints are less likely to spend money on non-necessities, such as equipment to bike to campus. Those lacking access to resources may also be living in lower socioeconomic neighbourhoods, potentially with higher crime rates. Thus, there may be an added worry of bike theft. Interestingly, participants placed almost equal importance to expenses and bike theft: 41.7% and 40.5% respectively (Appendix B, Table 1). In fact, many of the same participants that indicated expense as a major deterrent also indicated bike theft. This could imply that students are less likely to spend their limited resources on cycling gear due to the potential for it to be stolen. Students are also required to pay for a U-Pass card as part of their tuition for unlimited transit services, so those with low income may be less likely to purchase extra cycling equipment instead of using the U-Pass granted to them (University of British Columbia, 2019). In fact, one respondent noted “unlimited transit” as an important deterrent to biking, which was not included in the initial list of deterrents (Appendix C). This is further

supported by data from the University of British Columbia (2019), which presented a decline in bicycle usage from 1997 to 2018, with a significant increase in transit usage.

In order to alleviate the lack of access to resources, more low-cost bike share programs could be implemented around greater Vancouver and on the UBC campus. Considering that nearly half of potential cyclists do not even have access to the resources needed to begin cycling, further research is imperative to understand and address underlying causes for the lack of access. As explained by Cole et al. (2017), it is important for health promotion strategies to be aware of inequalities and be certain not to further them. Providing an abundant amount of low-cost resources may promote individuals to engage in active transportation, like cycling to campus. Simply put, ensuring that all individuals have equitable and safe access to different health resource options can increase engagement in health activities, such as cycling to campus.

Bike Storage

A portion of respondents indicated increased bike storage would prompt them to consider biking. Gilderbloom et al. (2015) also found that more bike storage and facilities on campus could encourage individuals to bike and encouraging members to cycle to campus would result in future savings with biking storage costing significantly less than parking garages. Additionally, one participant in the open-ended response portion of our survey noted that improving bike racks on public transportation would be a source of encouragement. This brings attention to the value in implementing bike racks not only around campus, but in other locations that could be part of an individuals' commute, such as bus and skytrain stations.

Facilities and Resources

A key finding of our research revealed the need for more facilities such as shower areas and lockers for commuting students. Approximately one third of respondents (32.1%) reported that the lack of shower and storage facilities available at UBC were a deterrent for biking to campus. This included half of the cyclists and 27.9% of the potential cyclists in the sample (Appendix B, Table 1), indicating that this is a pervasive deterrent for most UBC community members. Cycling to campus is a potentially moderate to vigorous form of exercise, and in order to feel comfortable for the rest of the day, shower facilities and lockers are a necessity for those that are travelling long distances on a bike. In order to truly promote active transport amongst the UBC community, it is immensely important to recognize the areas of improvement and listen to feedback provided by the community. Some of the current facilities at UBC include the Aquatic Centre and the gyms such as the ARC. Although these facilities are accessible and affordable, they may not have enough lockers and more shower space for commuters, so cycling to campus can be considered a viable option. Additionally, open-ended responses indicated that all of these resources are grouped to one end of campus, which takes a significant amount of time to travel to. Therefore these facilities need to be spread to different parts of campus to be truly useful to commuters.

Traffic, Safety & Air Pollution

The main risks associated with cycling are accidents, air pollution, and safety (Teschke et al., 2012a; 2012b). Overall, only 9.5% of respondents indicated air pollution as a deterrent. When analyzed further, while air pollution only affected 7.4% of potential cyclists, it was much more salient for cyclists, with 18.8% indicating it as an important deterrent. These findings

indicate that those already involved in cycling are much more concerned with air pollution, likely because of their first-hand experience with it. Meanwhile, around 40% participants indicated traffic as a barrier, which was equally important to cyclists and potential cyclists (Appendix B, Table 1). Although large traffic volumes do pose a risk for possible collisions, fatality rates for cyclists have been on the decline (Teschke et al., 2012a). Overall safety, on the other hand, seemed to be much more of a consideration for potential cyclists (27.9%) compared to cyclists (6.3%). This was also indicated in an open-ended response, as one potential cyclist noted that they "don't feel experienced enough [as a] rider" and another emphasized the "danger hazard" of biking in the rain (Appendix C). Therefore, the lack of experience of potential cyclists compared to cyclists likely explains the large difference in salience of safety hazards. Overall, although these are valid concerns for cycling to campus, existing research has illustrated that the health benefits of cycling far outweigh the fatal crash or pollution risks (Giles & Koehle, 2014; Teschke et al., 2012a).

Ottawa Charter for Health Promotion

The Ottawa Charter for Health Promotion defined health promotion as the process of enabling people to increase control over, and to improve, their health (World Health Organization, 1986). This definition emphasizes that health promotion centers around the idea of empowering individuals to have control over their own health. The Charter details that for individuals to have full control over their health, three strategies need to be implemented; enable, mediate, and advocate. The ability for a community to enable its citizens entails equal opportunities and access to resources. Regarding increasing potential cyclists to campus, ensuring that all members have the same access to biking equipment will provide individuals with the freedom to choose when or whether they bike. In order to meet these equity needs,

mediation is required for the coordination of multiple sectors. Hence, to improve the number of cyclists to campus, multiple municipalities need the common goal of increasing cyclists within their communities. The organization of multiple municipalities, working towards a common goal could allow for those living further from campus to have similar opportunities to bike to campus. In this respect, the stakeholders in the project can expand to leadership from multiple municipalities, the UBC board, and its partners, such as the SEEDS program. Furthermore, advocacy is needed to begin to make changes to the multi-level factors influencing active commuting behaviour. Together, these strategies can make the healthiest choice the easiest choice (World Health Organization, 1986). It is clear that cycling is environmentally, financially, and physically healthy (Bungum et al., 2008; Haapala, 2013; Gilderbloom et al., 2015; Hopkins & Mandic, 2016), yet for people to exchange steering wheels for bike handles, cycling needs to become the easiest choice. UBC community members have expressed that factors such as difficult terrain, far distances, and long travel times deter their desire to bike to campus. Yet, greater interest was observed when the conditions were considered easier through strategies and incentives.

Challenges/Limitations

Most respondents in our survey were females, undergraduates, and Kinesiology students. Since our results did not have an equal distribution among other students and staff, our results are not entirely representative of the entire UBC community. The abundance of Kinesiology students reporting in our survey may have inflated the results received regarding willingness to consider biking to campus. As Kinesiology is a health subject, individuals studying within this domain may be more internally motivated to partake in active transport relative to offered external incentives. In addition, the large flux of undergraduate responses could pose another

potential set of inaccuracies to our results. Undergraduates range in age, but the majority of respondents were in their mid-twenties. With this in mind, these young individuals may be more inclined to bike to campus due to the costs associated with owning a vehicle. Therefore, having more graduate students and staff responses in our survey could have generated different results.

A large proportion of the sample for this study were female (63.1%), which could present another limitation of our results. Notably, Winters et al. (2010) and Bungum et al. (2008) illustrate that men were more likely to bike than females. Gender is one of the social determinants of health, and women may have lower cycling rates due to the traditional sexual division of labour and differing household responsibilities (Prati, 2018). Bungum et al. (2008) also speculated that women may be less inclined to cycle because it can alter their physical appearance, like helmet hair for example. Our findings indicate that females make up the majority of the population that have never cycled to campus, which would support these past findings that females are less likely to cycle. However, our findings may have been simply due to more females participating in the survey. A further study with a balanced sample of males and females could be beneficial to find the correlation between gender and cycling.

The rapidly changing situation around COVID-19 impacted the number and variety of responses gathered for our survey. Initially many of our respondents were collected through word of mouth and social media. To further expand the variety of participants, we had anticipated advertising in parking garages, bus loops, and across campus using in-person approaches. However, the transition to online classes, closure of the university, and social distancing measures were announced March 16th 2020, thus cancelling our plans to begin across-campus approaches. Since we were not able to directly approach and advertise within

parking garages and bus loops, a significant part of the potential cyclist population was not directly addressed within our study.

Accessibility Considerations

As mentioned previously, it is important to consider current health and accessibility inequalities, and whether health promotion strategies are including these individuals, or widening the inequality divide (Cole et al., 2017). Individuals with physical and cognitive disabilities may not have the same opportunities to bike to campus. E-bikes equipped with sensors have been shown to allow individuals with cerebral palsy the ability to bike safely within their environments (Blumenstein, Zeitlmann, Alves-Pinto, Turova, & Lampe, 2014). The addition of adapted E-bikes, or other readily available modified cycling options around Vancouver could also aid in increasing potential cyclists to campus. While these individuals were not excluded from participation, our survey did not directly address these different populations of potential cyclists and the unique challenges that may impact their participation in active commuting. Therefore, prior to implementing initiatives to address cycling within the UBC community, further research should investigate these groups through qualitative approaches and ensure strategies will not be widening or re-establishing existing inequalities.

Recommendations

Our report features five recommendations that we believe SEEDS Sustainability and UBC Campus + Community Planning along with other university partners should consider in order to make the most of our research.

Recommendation 1: Advocate for Protected Bike Lanes

While not indicated as a "top 3" deterrent, safety, traffic, and protected bike lanes were still indicated as important deterrents for both cyclists and potential cyclists. This indicates that these issues of safety are pervasive to a large proportion of the UBC community. Additionally, when asked about options for incentives, implementation of protected bike lanes was the most supported initiative to change biking attitudes and behaviours. While the goal of protected bike lanes and increased safety for active commuters is a very complex and long-term goal, we believe it should not be ignored. Although UBC Campus & Community Planning is not involved in implementing bike lanes or traffic-calming, they do represent a large proportion of the population of the City of Vancouver. Therefore, we recommend that UBC Campus & Community Planning partners with UBC and other interested groups to advocate for active commuters to organizations and councils responsible for policy and city planning. The voices of the UBC community can be supported through letters, emails, attending meetings, and forming partnerships with city planning teams for the University Endowment Lands and the City of Vancouver.

Recommendation 2: Educational Workshops

While strategies to impact safety for commuters are generally long-term and multifaceted, UBC Campus & Community Planning can employ more attainable and short-term initiatives such as educational workshops. It is apparent that deterrents such as weather, distance, time, and fear of bike theft are not within individual control, however they can be addressed through an educational approach. Poor weather conditions such as rain have been reported to hinder members of the UBC community from considering biking to campus. However, educational topics such as how to bike in the rain, what gear to use, and what precautions to take in order to prevent injury in the rain can be covered in workshop series or online infographics. Fear of bike theft was another common deterrent that also emerged in participant written responses. One participant wrote “Compared to public transit, [public transit] is quicker without the worry of my bike getting stolen”. While bike theft can not be directly stopped, education about innovative and safe methods of bike locking and bike storage on campus may be useful in changing cycling attitudes and behaviours. We recommend the information is delivered as free in-person educational workshops and online videos infographics in order to equitably reach many community members. It is important to empower potential cyclists to feel that they have the autonomy to bike to campus without having to worry about bike theft as developing confidence is crucial for developing healthy habits in individuals.

Recommendation 3: Poster Campaign

As identified throughout the report, the major deterrents that prevent potential cyclists from cycling to campus were natural environment-related issues such as distance, weather, and challenge/topography. Therefore, altering potential cyclists’ attitudes and perceptions of these

deterrents may be an effective method to increase cycling behaviours. This perception of the distance to campus may be associated with experiences of commuting to campus in traffic. In short, the greater amount of traffic there is, the further away the distance to campus feels because trips will take significantly longer. Thus, we would recommend a poster campaign that focuses on putting into perspective how far away campus really is, as many would benefit from learning that it does not take much longer than the time spent using public transit. For example, a bus ride from Kerrisdale during rush hour takes approximately 35 minutes, compared to 20 minutes by bike. Specifically within the Vancouver area, by pointing out the comparisons between the time spent travelling by bike versus vehicle, it can encourage and hopefully alter people's attitudes into how much faster cycling really is. Additionally, other deterrents that cannot be directly changed were the weather and the challenge of biking. This poster campaign could include positive messages about taking advantage of the sunny days to cycle, and framing active commuting as an exercise opportunity that fits into the daily schedule.

We recommend that UBC Campus & Community planning consider working with the UBC Wellbeing team that designed the Healthy Beverage Initiative on this poster campaign. This is a cost-effective, efficient, and relatively attainable short-term goal. The UBC Drinks Tap Water campaign was very successful, therefore this partnership can be effective in changing the attitudes of potential cyclists around these natural environment deterrents.

Recommendation 4: More Facilities & Resources for Active Commuters

Based on our findings regarding the lack of resources on campus, we recommend that more facilities and resources be introduced on UBC campus for cyclists and active commuters, including more storage and locker options, showers, and change rooms for commuters. In

relation to the 4 “E’s” of cycling mentioned earlier in the report, this strategy would fall under “Encouragement” as it provides more facilities and resources for UBC community members, which are very important considerations for the determinants of cycling (Winters et al., 2011). As indicated by our findings, there is an apparent demand for these facilities due to the current lack of available options. A significant proportion of the cyclist population indicated this as a deterrent to regular cycling behaviour, while potential cyclists indicated that increased facilities/resources would incentivize them to begin biking. We believe increasing facilities and storage across campus can help alleviate the concerns expressed by the participants and continue to support the cycling behaviour of current cyclists, while encouraging potential cyclists to try.

Recommendation 5: Incentive Programs

As indicated in the “Education” aspect of the 4 “E’s” (Winters et al., 2011), our results found that incentive programs are an important motivating factor for cycling behaviour of the UBC community. This can be done through creating incentivizing programs or apps that rewards users who opt to use cycling as their main mode of transport. Therefore, one long term goal the SEEDS partners could implement is the creation of a rewards based program such as one that allows UBC community members to track their cycling habits to and from campus. We believe that this could be an effective way to encourage potential cyclists to cycle more regularly.

In the meantime, we recommend that the SEEDS partners collaborate with Move UBC to create group bike rides or challenges across campus to promote cycling behaviours within the UBC community. Small prize draws such as gift cards could be given out to participants which we believe will hopefully alter individuals’ attitudes towards cycling on campus through offering these small rewards.

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Appendix A

Survey Questions

Demographics:
These first questions are to get an idea of the demographics of survey respondents.

What is your gender?

- ○ Male
- ○ Female
- ○ Prefer not to say

Please enter your age

Please select your affiliation with UBC Vancouver

- ○ Student
- ○ Faculty member
- ○ Staff
- ○ Other

If applicable, please select your degree program/faculty

- ○ Science
- ○ Arts
- ○ LFS
- ○ Kinesiology
- ○ Education
- ○ Forestry

- ○ Engineering
- ○ Dentistry
- ○ Other

Where are you currently living?

- ○ On campus
- ○ Off campus (within 5km)
- ○ Off campus (within 10km)
- ○ Off campus (within 15km)
- ○ Off campus (greater than 20km)

If you identified yourself as living off campus, which area of Metro Vancouver do you live in?

Do you own a bike or have access to a bike?

- ○ Yes
- ○ No

Have you ever biked TO campus?

- ○ Yes
- ○ No

Have you ever biked ON campus?

- ○ Yes
- ○ No

Would you ever consider biking to campus?

- ○ Yes
- ○ No

Biking Deterrants:

These next questions will assess the factors that are currently deterring you from biking.

What is currently deterring you from biking to campus?

Please select how important each factor is to you

	Please select how important each factor is to you			
	Does not affect me	Somewhat affects me	Affects me a little	Affects me greatly
I already live on campus	O	O	O	O
It doesn't feel safe	O	O	O	O
Lack of separated bike lanes	O	O	O	O
Too much traffic	O	O	O	O
Air pollution	O	O	O	O
Lack of facilities at UBC (showers, lockers etc)	O	O	O	O
Expense (eg. don't own a bike or gear)	O	O	O	O
It takes too long	O	O	O	O
Distance	O	O	O	O
Weather	O	O	O	O
I worry about bike theft	O	O	O	O
It's too hard (eg. hills)	O	O	O	O
I don't enjoy biking	O	O	O	O
Other (fill in below)	O	O	O	O

If you answered other, please enter the reason(s) below

Overall, which deterrent affects you the most? (eg. the main reason you choose not to bike)

Which (if any) resources would increase your interest in biking to campus?

- ☐ Incentive programs (eg. log your biking trips and win prizes)
- ☐ Mobile apps (eg. meet other bikers, track your trips, etc)
- ☐ More information about bike routes
- ☐ Increased university resources (eg. showers, lockers)
- ☐ More bike storage locations
- ☐ Separated (protected) bike lanes to campus
- ☐ Access to e-bikes

- ☐ Other

If other, what other incentives would increase your interest in biking to campus?

Appendix B

Deterrent & Incentive Responses

Table 1

Important Deterrents to Cycling - Number of Cyclists and Potential Cyclists

Deterrent	Total (n=84) Count (%)	Cyclists (n=16) Count (%)	Potential Cyclists (n=68) Count (%)
Already live on campus	20 (23.8%)	2 (12.5%)	18 (23.5%)
It doesn't feel safe	20 (23.8%)	1 (6.3%)	19 (27.9%)
Lack of separated bike lanes	30 (35.7%)	6 (37.5%)	24 (35.3%)
Too much traffic	34 (40.4%)	6 (37.5%)	28 (41.1%)
Air pollution	8 (9.5%)	3 (18.8%)	5 (7.4%)
Lack of facilities at UBC (showers, lockers etc)	27 (32.1%)	8 (50%)	19 (27.9%)
Expense (eg. don't own a bike or gear)	35 (41.7%)	4 (25%)	31 (45.6%)
It takes too long	50 (59.5%)	5 (31.3%)	45 (66.2%)
Distance	50 (59.5%)	5 (31.3%)	45 (66.2%)
Weather	68 (81%)	11 (68.8%)	57 (83.8%)
I worry about bike theft	34 (40.5%)	6 (37.5%)	28 (41.2%)
It's too hard (eg. hills)	47 (56%)	5 (31.3%)	42 (61.8%)
I don't enjoy biking	19 (22.6%)	0 (0%)	19 (27.9%)

Table 2

Important Incentives

Incentive	**Count (%)**
Incentive program (eg. log your trips and win prizes)	41 (16.9%)
Mobile apps (eg. meet other bikers, track your trips)	24 (9.9%)
More information about bike routes	26 (10.7%)
Increased university resources (eg. showers, lockers)	38 (15.6%)
More bike storage locations	40 (16.5%)
Separated/protected bike lanes to campus	46 (18.9%)
Access to e-bikes	18 (7.4%)

Appendix C

Open-ended responses

Other Deterrents:

Intensity-related:

- Biking to school would be an intense workout. I do not like exercising before class, I get lethargic after intense workout especially outside.
- Hate being sweaty.
- I find it hard to get changed and showered etc before classes/meetings.
- My hair will get messy, and I would need to wear exercise clothing because I will break a sweat if I bike from 49th southwest marine all the way up the hill to UBC.

Time/schedule-related:

- Schedule: bike to campus, it's either too late to bike back or too tired.

Lack of equipment/gear:

- Oftentimes it is to do with the functionality of my bike; I have not purchased the appropriate bag to attach to my bike cage, which can make it difficult to cycle with a large backpack.

Other:

- My dad won't let me buy a bike even if our apartment building has a storage room. He fears that I won't ever use my bike other than summer, and that it might get stolen as our apartment has increasing rates of break in each year from intruders/thieves.
- Unlimited transit.

Would any other incentives increase your interest in biking to campus?

Distance-related:

- Nothing would. It's too far.
- If I had a nice bike route to campus. Like if I lived closer and could bike along the beaches.
- If I lived closer then maybe I would be more interested.
- None, it's way too far
- Subsidized housing near campus
- Moving closer to school.
- Honestly I would just have to live closer to campus

Cost-related

- Being afford to live on or close to campus. Not everyone has the privilege to afford expensive rent living on or close to campus. It is not practical for me to bike for up to 30-40 mins to campus in the rain to campus. Additionally, biking is just not my preferred mode of transport nor physical activity.
- Cheaper bike options

Resource availability:

- Bike racks
- MOBI Stations
- Transit having more accessible bike equipment holder things. Also, better bike lanes (for example, the bike lane on SW marine to north campus is pretty dangerous). People also

are always crowded on campus, so it is difficult to bike around people without fear of hitting into them.

Financial incentives:

- Monetary
- Financial incentives.

Personal preference:

- None, I don’t like biking