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An Analysis of the Evolution of Transportation Use at UBC: Impacts of the COVID-19 Pandemic

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**An Analysis of the Evolution of Transportation Use at UBC: Impacts of the COVID-19
Pandemic**

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Executive Summary

The decrease in physical activity amongst Canadians has resulted in an increasing number of Canadians being unable to meet physical activity guidelines and an increase in obesity-related comorbidities (Tremblay et al., 2011). According to Youngkin et al. (2021), the increase in gasoline vehicles for single-occupancy transportation on a daily, or near-daily basis has significantly contributed to the decrease in physical activity in urbanized settings. Therefore, this shows that there is an increased need to emphasize the importance of active transportation (AT) amongst the general population. AT can be defined as “any self-propelled human-powered mode of transportation” (Zwald et al. 2018).

Currently, more research is required on the transportation patterns of university students and how it has been impacted by the COVID-19 pandemic. Therefore, the purpose of our study was to examine the transportation patterns of students at the University of British Columbia (UBC) with respect to before, during, and after the COVID-19 pandemic. In turn, we aimed to provide recommendations for promoting the use of AT amongst UBC students based on our data. We collected students’ transportation data through an online survey via Qualtrics. Quantitative data was collected by tallying up the number of students that used certain modes of transportation. Moreover, qualitative data was collected by having students complete an open-ended question about how the COVID-19 pandemic had changed their transportation patterns as well as their perceptions of different barriers to AT use.

Results show that there was an increase in the number of students that drove/carpooled to class on campus during the 2021/2022 Winter Session compared to the 2019/2020 Winter Session. Furthermore, it was also surmised that there was a discernible drop in AT use in the 2020/2021 Winter Session. “Geography” (weather and climate) was the most commonly cited barrier by students, for all three Winter Sessions. Moreover, time and distance were also factors that were consistently cited by students as being major barriers to engaging in AT. Lastly, convenience was also a common theme as participants were reluctant to cycle to campus because they did not want to bring a change of clothes and worried about bike storage.

Recommendations were made to address these barriers. In the short-term, recommendations included encouraging students to adopt a hybrid approach to their UBC commute by combining both passive transportation (PT) and AT, incentivizing the use of AT with the use of prize draws, implementing a buddy program where students could support each other in the use of AT, and spreading awareness of current AT resources such as UBC Bike Kitchen and HOPR bike rental services. In the long-term, recommendations included, increasing the capacity for students to bring bicycles onto transit vehicles with additional bike racks, increasing sanitation on transit vehicles, creating a semester-long bike rental program for UBC students, and placing bike racks near ‘Emergency Blue Phones’ or areas under surveillance on campus.

Introduction & Literature Review

Background

It is well-established that decreasing physical activity and fitness levels of the Canadian population has led to the increase of obesity-related comorbidities as well as physical activity guidelines being left unmet (Tremblay et al., 2011). Particularly, only 15% of Canadian adults accumulate 150 minutes of moderate-to-vigorous physical activity (MVPA) per week, and it declines with increasing age and adiposity (Colley et al., 2011). Guidelines for adults aged 18-64 recommend at least 150 minutes of MVPA per week (Tremblay et al., 2011). Physical activity (PA) can be defined as “any bodily actions produced by the contraction of skeletal muscle that increase energy expenditure above basal level” (US Dept. of Health and Human Services, 2008). A significant way in which PA has been reduced in industrialized urban settings is through the use of gasoline vehicles for single-occupancy transportation on a daily, or near-daily basis (Youngkin et al., 2021). However, studies investigating changes in transportation during the COVID-19 pandemic have found reduced rates of general transportation along with reduced fuel consumption and air pollutant levels (Rahman et al., 2021). A report by the International Association of Public Transportation (2020) found a drop in public transportation ridership during lockdown periods of up to 80-90% in major cities. These data are a result of changes in citizen behaviour due to government guidelines, and a shift towards essential travel only (Nicola et al., 2020). Additionally, transitions in work practices to stay-at-home offices have contributed to lower ridership levels and ultimately impacted all forms of travel (Nicola et al., 2020). When considering different ways that individuals engage in transportation, one major and practical way to increase routine and consistent PA is through the use of AT, defined as “any self-propelled human-powered mode of transportation” (Zwald et al. 2018). Examples of AT include cycling,

walking, and skateboarding (Zwald et al. 2018). As a subset of the larger population, university campuses are notable hotspots for transportation. In terms of university students, AT would largely present itself in the form of walking or bicycling to campus, while PT would be characterized as using cars and public transit (Zwald et al., 2018).

Beyond its contribution to physical health, it has been deduced that increased AT can also have considerable overall health benefits. AT contributes to overall health by reducing risk factors from urban pollution, chronic disease, and obesity (Giles-Corti et al., 2010). For instance, Zwald et al. (2018) found associations between higher levels of AT and a decrease in cardiovascular disease risk factors. Additionally, PA helps in maintaining and enhancing mental health (Raglin, 1990). Given the inadequate levels of PA and the high prevalence of poor mental health on university campuses (Ebert et al., 2018), university students can especially benefit from the promotion of PA through AT. Thus, studying AT is crucial to meeting PA guidelines and achieving better health outcomes for students (Chaix et al., 2014).

Gap in Literature

Currently, there is a considerable amount of research that focuses on the transportation patterns of children, adolescents, and adults. For instance, Pabayo et al. (2011) examine the transportation patterns of children and adolescents in primary and secondary schools across Canada. Pabayo et al. (2011) found that there was a discernible increase in AT use among children up until the age of ten. However, consistent AT use seemed to decline as children aged and started entering secondary school (Pabayo et al., 2011). With respect to adults, Hilbrecht et al. (2014) found that a vast majority of adults take a form of PT to work. For example, it was

found that 82% of Canadian working adults take a car to work, 12% take public transit, and forms of AT are only used by approximately 6% (Hilbrecht et al., 2014).

Though the present literature contains a vast array of evidence concerning the broad trends in transportation, the most prevalent research is centered on children and older adults, which fails to address how the COVID-19 pandemic has affected AT patterns in specific institutions such as university campuses. While it is important to explore AT in relation to staff and faculty, we will specifically be analyzing a population of UBC students. Presently, there is a scarce amount of literature that explores how the COVID-19 pandemic has specifically affected UBC students when it comes to AT. According to Ebert et al. (2019), university students are a population that is highly susceptible to poor mental health and insufficient daily PA. Since PA is also associated with positive educational outcomes (Ebert et al., 2019), university students are a group that can particularly benefit from the promotion of PA through AT. Therefore, we must determine the accessible forms of AT that can be employed by UBC students, in order to help mitigate some of the effects on health attributed to the lack of PA during the COVID-19 pandemic.

Task & Challenge

Our assigned task is to investigate how the COVID-19 pandemic has impacted transportation use among UBC students across different time points such as before, during, and after the pandemic. Moreover, we have been tasked with determining different ways in which we can increase AT use. Currently, there is more research needed that compares transportation patterns of UBC community members before and after the pandemic, aside from the University of British Columbia's yearly Vancouver Transportations Status Reports (UBC, 2020). With our

study, we hope to gain a better understanding of how the pandemic has affected transportation use among UBC students. Through our results, we then hope to outline recommendations for our campus partners on different strategies to increase the use of AT. Therefore, this study is crucial because it will allow for more effective and pragmatic strategies to increase AT use. In other words, without knowing exactly how the pandemic has influenced transportation use, it may be unwise to prescribe any recommendations. Lastly, the promotion of AT use is imperative because AT can help meet PA guidelines and achieve better health outcomes (Chaix et al., 2014).

Purpose Statement & Research Questions

The purpose of our study will be to compare transportation use in UBC students prior to the COVID-19 pandemic (2019) against their current perceptions of transportation use, with the intent of using this knowledge to create recommendations for our campus partners to increase AT use for students in and around the UBC campus.

Our research hopes to answer the questions: What is the degree to which the COVID-19 pandemic has affected the use of AT for UBC students, both positively and negatively? What forms of transportation were taken by students, both before the pandemic and currently, and why has it changed? What factors related to the COVID-19 pandemic have affected how UBC students use transportation? And lastly, what are the different barriers that prevent students from accessing AT as a result of the COVID-19 pandemic?

Methods

Population and Scope

For this study, our target population was undergraduate students at UBC living both on and off campus. To be eligible to participate in our study, individuals had to be an undergraduate student currently taking courses at UBC, be able to read and understand English, be registered in at least 24 credits for the 2021 Winter Session, have taken at least 24 credits for the 2020 Winter Session, and have taken at least 24 credits for the 2019 Winter Session. Students who were taking/have taken more than four 3-credit online courses in the 2021 Winter Session were excluded.

We set the inclusion criteria of 24 credits in the 2019, 2020, and 2021 Winter Session because we thought it would be a fairly accurate indication of transportation patterns before, during, and after the pandemic, respectively. For instance, since the pandemic hit North America in March 2020 (Jang et al., 2021), we thought it would be appropriate to use the 2019 Winter Session as a proxy for UBC students' transportation patterns before the pandemic. We set the exclusion criteria of having no more than four 3-credit online courses because we did not want the students' schedules to comprise a majority of online courses. According to Little & Cordero (2014), it was found that a higher amount of hybrid courses in students' schedules resulted in a decreased number of student trips to campus. Therefore, it is natural to assume that fully online courses will have even lower levels of student trips to campus. Thus, we did not want a majority of students' schedules to be online courses because we thought that it would skew the results of our study on transportation patterns. Moreover, we used the arbitrary number of four 3-credit courses because that equates to 12 credits, exactly half of the required 24 credits per school year.

This was a sensible cutoff point because anything over 12 online credits in a single Winter Session meant that the majority of the courses were being delivered online.

Research Design

In order to measure changes in transportation behaviors due to the COVID-19 pandemic we created a digital survey consisting of questions regarding the amount of transportation of UBC students as a whole, as well as their use of AT at different time points: pre-pandemic, during, and currently as we return to some normalcy (see Appendix A). Our study design included both quantitative and qualitative approaches, and in using this design approach we have the ability to counteract the respective limitations of each approach, whilst also magnifying the strengths of each method, resulting in more accurate data (Doyle et al., 2009). This approach enabled us to draw connections and contradictions between the quantitative and qualitative data, providing participants with opportunities to share details of their individual experiences, which may identify areas that can be explored in future research (Shorten & Smith, 2017).

Due to the ongoing COVID-19 pandemic, we recruited all of our participants through online methods. We recruited participants to survey through convenience sampling via social media posting (primarily using Facebook) and personal contacts (see Appendix C). Convenience sampling is often used in both qualitative and quantitative research, and was used for this study, as the target population for this survey was students at UBC (Robinson, 2014). The data was collected and recorded using the online survey, Qualtrics. Prior to interacting with the survey, participants were shown a consent form containing information regarding the purpose, study procedures, and distribution of study results to the general public following its completion (see

Appendix B). The consent form also emphasized that participants reserve the right to withdraw at any point during the survey and their responses will remain anonymous. Students were incentivized to participate by having their name entered into a draw to win a 1-year HOPR membership or a FitBit. We aimed to recruit a minimum of 40 participants; however, we set an upper limit of 60 responses to account for any participants that may be ineligible due to our exclusion criteria. Following the completion of our survey, we used descriptive statistics and qualitative descriptive analysis to find trends and themes within our data.

Data Collection

In terms of data collection, our study focused on using a combination of open- and closed-ended questions. Our main topics of interest included the amount of transportation use by UBC students, and more specifically, AT use by UBC students. Within this realm of transportation, we were also interested in the barriers that prevented UBC students from accessing transportation, and their perspectives on how the COVID-19 pandemic has affected their transportation patterns.

To explore these topics, a combination of quantitative and qualitative questions was used. To begin with, a series of questions were asked to determine eligibility, as per our inclusion criteria. Participants were asked closed-ended questions on their hours of transportation use followed by AT use, before, during, and after the COVID-19 pandemic. However, instead of using the broad statement of AT, participants were asked about common modes of transportation, and how often they take them per week. These modes of transportation included taking the bus or skytrain, driving, biking, skateboarding, and walking. Biking, skateboarding, and walking

would be considered the modes of AT. Beyond these descriptive statistics, we also collected information using open-ended questions asking about their perspectives on the impacts of the COVID-19 pandemic on their use of transportation, and the barriers that prevented them from accessing transportation at this time. To do so, a combination of 5 and 7 point Likert scale questions were used to gauge the extent that they agree with statements on the barriers to transportation, followed by an open-ended question asking them to write their own thoughts. Through this, our goal was to see if the COVID-19 pandemic has increased or decreased their transportation use, positively or negatively, and how it has done so.

Following the completion of the survey, data analysis involved a combination of descriptive statistics and qualitative descriptive analysis. We compared the descriptive statistics, particularly the averages of each score in order to compare the transportation use data from each year. This involved Likert scales used to quantify the days per week in using transportation, and the perceived barriers that the participants face. Thus, we were able to see the change in trends of transportation use at different time periods over the course of the COVID-19 pandemic. For our qualitative descriptive analysis, the open-ended participant responses were collected and analyzed to recognize the most common themes, such as the most prominent barriers that affected their transportation use during the COVID-19 pandemic. The responses of the individuals in the last question were collected, compared, and contrasted to find trends in the data to create a comprehensive summary.

Results

The survey had a total of 55 responses with zero incomplete submissions. According to Figure 1, the vast majority of our participants were in their third year of study at UBC. After looking at the number of days per week that participants physically attended class on campus during the 2019/2020 Winter Session, it was found that most participants answered with “5 days a week” (Figure 2). Next, when looking at the number of days per week that participants physically attended class on campus during the 2020/2021 Winter Session, it was found that an overwhelming number of students answered with “zero days per week” (Figure 3). However, when looking at the number of days per week that participants physically attended class on campus during the 2021/2022 Winter Session, there was a much more even spread (Figure 4).

Upon looking at the predominant mode of transportation during the 2019/2020 Winter Session, it was found that “Walk” was the most popular answer with “Bus/Skytrain” and “Car/Carpool” coming in second and third, respectively (Figure 5). Next, in order to understand patterns of transportation during the COVID-19 pandemic, our survey asked for the predominant mode of transportation during the 2020/2021 Winter Session (Figure 6). In turn, it was found that a strong majority of our participants selected “Other (please specify)” (Figure 6). Upon further review, the participants stated that they did not go to campus at all, because of the online classes, thus they did not use any mode of transportation (Figure 6). Yet, for the few participants that did come to campus, “Car/Carpool” was the most popular answer (Figure 6). When looking at the predominant mode of transportation during the 2021/2022 Winter Session, we found a much more even spread (Figure 7). For instance, the options of “Bus/Skytrain”, “Car/Carpool”, and “Walk” came first, second, and third, respectively, and somewhat shared similar response numbers (Figure 7). Furthermore, in terms of patterns of transportation use before, during, and

after the COVID-19 pandemic, it was deduced that there was a discernible increase in the number of individuals that took cars to campus in the 2021/2022 Winter Session compared to the 2019/2020 Winter Session (Figure 5, Figure 7). Moreover, we found that the number of individuals that biked to campus did not change at all as not one participant stated that they biked to campus during the 2019/2020, 2020/2021, or 2021/2022 Winter Session (Figure 5, Figure 6, Figure 7). Lastly, another pattern was that, compared to the 2019/2020 Winter Session, the 2021/2022 Winter Session experienced an increase in the number of “Bus/Skytrain” users and a slight decrease in the number of “Walk” users to campus (Figure 5, Figure 7).

Next, we also looked at five different barriers to AT, economic, geography, social, environment, and safety, in order to detect if there was any change in the participants’ perception of these barriers before, during, and after the COVID-19 pandemic. In order to measure this, we had participants record the extent to which they considered the aforementioned factors as being barriers to AT. The available responses were “Strongly Disagree”, “Disagree”, “Neutral”, “Agree”, and “Strongly Agree”. According to Figure 8, it was found that, prior to the COVID-19 pandemic, “geography” was the factor that most participants agreed as being a significant barrier to AT. During the pandemic (i.e. 2020/2021 Winter Session), it was found that safety and geography were the factors that most participants agreed on as being a significant barrier to AT (Figure 9). Then, in the 2021/2022 Winter Session, safety and geography again were the most commonly cited barriers to AT (Figure 10). Furthermore, across all three Winter Sessions, it was found that “social” factors (i.e. gender, age, disability) were the least perceived barrier to AT (Figure 8, Figure 9, Figure 10). Across all three Winter Sessions, the factors of “economic” and “environment” showed relatively little change as most participants “disagreed” that they were barriers to AT (Figure 8, Figure 9, Figure 10).

We also asked participants an open-ended question about different ways that would motivate students to take AT to campus more often. Upon descriptive qualitative analysis, it was found that there was a hierarchy of three tiers in terms of the popularity of responses. The first tier had categories/elements that were the most commonly cited such as distance and cost. In other words, participants consistently mentioned that the long distance between their home and campus was a major contributing factor in their unwillingness to use AT to campus. Also, participants commonly mentioned that the cost of owning/maintaining a bike extremely limited their willingness to bike (AT) to campus. Next, the second tier consisted of categories such as weather, time, and convenience (i.e. bringing a change of clothes and worrying about where to store your bike). Tier three was comprised of safety and infrastructure as participants explained that they would be motivated to use AT to campus if there were more bike lanes and wider bike lanes. In terms of safety, participants explained that they were worried about getting into collisions while using AT (i.e. walking or biking).

Lastly, we also asked the open-ended question of how participants' transportation use was directly impacted by the COVID-19 pandemic. It was found that the two most common answers were that there was either no change or they transited less because of COVID-19 safety concerns. It is also worth noting that participants indicated that they chose to transit less and drive more, ever since the COVID-19 pandemic began.

Discussion

When examining the extent to which certain factors were barriers to taking AT, geography (e.g. weather and climate) was found to be the most common barrier, with students' perceptions towards this factor remaining very stable across all three Winter Sessions. Across all

three Winter Sessions, the majority of participants either strongly disagreed, disagreed, or were neutral about economic (finances), social (gender, age, disability), and environmental (pollution, air quality) factors as being barriers to taking AT. It was also found that compared to other barriers, concerns about safety increased the most dramatically when comparing the 2019 Winter Session (pre-pandemic) responses to the 2020 Winter Session (during-pandemic) and the 2021 Winter Session (post-pandemic) responses. When asked about their predominant mode of transportation to attend class on campus, walking was by far the most common form of transportation in the 2019 Winter Session, followed by public transit, then by car. In the 2020 Winter Session, all methods of transportation dramatically dropped as a result of courses moving online, which was expected. Many participants identified a transition towards private transportation and driving and were less reliant on transit, with some students indifferent due to campus living. In the 2021 Winter Session, public transit use became the most common form of transportation, closely followed by car, then by walking. Furthermore, written responses from the participants were centered upon barriers related to time and distance from campus that hindered them from taking AT. This data gives us insight into how transportation use has changed for UBC community members between pre, during, and post-pandemic, and helps us to create recommendations to increase student engagement in AT.

The data collected is in line with the studies investigating changes in transportation during the COVID-19 pandemic. All methods of transportation use during the 2020 Winter Session were dramatically reduced, which agrees with Rahman et al. (2021), who stated that during the COVID-19 pandemic there were reduced rates of general transportation. The ease at which participants could transition to driving and take their own personal vehicles was evident, as many participants specified that they drove during the height of the pandemic. This is similar

to Youngkin et al. (2021), who identified an increase in the use of gasoline vehicles for single-occupancy transportation on a daily, or near-daily basis in industrialized and urban settings, though our data was only within the UBC community.

By looking at the predominant modes of transportation taken by UBC students across the three Winter Sessions, the trends and changes in modes of transportation can be analyzed and provide us with context as to if it has changed due to the pandemic. Furthermore, the use of an open-ended section allowed for participants to clearly identify why their personal transportation use has changed as a result of the COVID-19 pandemic. Next, students were asked about the barriers that they consider to affect how and why they use transportation. This provides important information on what is stopping them from engaging in AT, and what the recommendations suggested should target. Along this trajectory, an open-ended response section was used to ask the students what they personally thought would encourage them to participate in AT. These questions further helped to shape our recommendations to increase engagement in AT.

However, various limitations exist in our study. The most obvious limitation in our study was the use of convenience sampling, which inevitably skewed participant responses as our participant selection was not random. Because our lack of random sampling is an immediate bias to our results, it is unlikely that we can make any specific claims with complete confidence.

Previous literature has pointed out that AT, as a form of PA, is associated with mental health benefits and positive educational outcomes (Ebert et al., 2019; Raglin, 1990), and that university campuses have been found to have inadequate PA levels along with a high prevalence of poor mental health (Ebert et al., 2019). Due to the significant associations between PA and mental health, one limitation in our study was that we did not ask participants about changes in

their mental health over the pandemic. Potentially, having data about participants' mental health and how that changed over time could have helped to inform our recommendations by using mental health promotion strategies to increase AT (and vice versa) since the two are bi-directionally related.

Despite safety continuing to be a primary concern currently in the 2021 Winter Session, our data shows that students' predominant mode of transportation to attend class in the 2021 Winter Session is via public transit. This is in contrast to the 2019 Winter Session, when students' predominant mode of transportation, by far, was walking, with much lower rates of public transit and car use. These results potentially suggest a limitation in the way we designed the survey when asking students about their 'predominant mode of transportation to attend class.' As mentioned earlier, walking was found to be, by far, the most common mode of transportation in the 2019 Winter Session. However, we should have also included a question in the survey that asked students to clarify the context of their transportation, such as whether they lived on campus or commuted to campus from home. Knowing this information across each of the three Winter Sessions would have allowed us to distinguish between students who were already on campus and were thus within walking distance from classes, from students who first needed to commute to campus before they could walk to class. By considering the contextual factors impacting transportation choice, this would have allowed for a more accurate representation of students' transportation patterns.

As safety is a primary concern in the 2021 Winter Session, this also brings into question why public transit became the predominant method of transportation despite increases in safety concerns. The ambiguity of the term 'safety' as presented to participants in the survey could be another limitation in the design of our study. While the rise of safety as a barrier could be

potentially attributed to concerns about the spread of the virus (thus discouraging the use of public transit and/or AT), we are unable to make assumptions about what specific safety concern(s) participants increasingly began to perceive as a barrier, especially given the fact that bus/skytrain use actually increased in the 2021 Winter Session as compared to the 2019 Winter Session. This was an error in the design of our survey, as we did not develop a method to effectively probe into the underlying reasons for why participants considered each factor (particularly safety) to be a barrier for AT.

One final limitation of our study was that we did not ask participants about the intensity and time spent in AT as part of their commute in a typical week. Had we measured these metrics across all three Winter Sessions, this would have allowed us to more tangibly measure changes in PA levels via AT over the pandemic, in addition to seeing changes in the degree to which students were meeting weekly adult PA guidelines using AT (Tremblay et al., 2011). Furthermore, it would have allowed us to distinguish the AT levels of students who lived on campus, compared to students who had to commute to campus. A follow-up question could have asked participants about why they thought their activity levels had changed. Potentially, having information about distinct trends among participants' activity levels would have allowed us to create more specific recommendations.

Recommendations

In order to promote the use of AT among UBC students, we have outlined several tangible recommendations to be implemented by our campus partners. These recommendations were designed in accordance with our findings, specifically the barriers that were identified by students. This is of significance because we wanted to ensure that our recommendations would

be relevant and effective by addressing the student population specifically. Also, in order to support students immediately as well as implement sustainable changes for the future, we have created recommendations with both short-term and long-term approaches.

One key barrier that was identified was the student's geographical location. This pertains to the extensive distance that a student needs to cover in order to attend UBC. For this reason, some students feel that it would not be feasible to take AT due to time constraints. Thus, we recommend encouraging students to identify a route that enables them to adopt a hybrid approach, encompassing both passive and AT. With this approach, the student is able to use PT, such as public transit, for a portion of the route and use a form of AT for the rest of their commute. This optimization of transport is also a great way for students to slowly transition from PT to AT.

A second short-term recommendation would be to incentivize the use of AT with different prizes. The idea of a reward for engaging in AT provides an extrinsic motivator for students. Depending on the financial capacity of our partners, these incentives could occur monthly, weekly, or as frequently as possible to help promote the use of AT.

In order to address the safety concerns of students, we recommend implementing a buddy program in the short term. This would ensure that all students engaging in AT have another student to support them. In case of an emergency, no student would be alone and thus they may feel more comfortable taking AT. Additionally, a buddy program could make AT more enjoyable as students would be able to connect with others and establish friendships.

Finally, in the short term, we recommend spreading awareness about current AT resources that are available to students. As students identified infrastructure as a barrier, it is

important to explore this further. Perhaps students are not familiar with the programs and resources that currently exist and thus that is something that needs to be addressed. Currently, there are programs on campus such as the HOPR bike rental service and Bike Kitchen, which are currently available to students. For example, our campus partners can utilize social media and work with professors to share information about AT resources for students.

In order for students to engage in a hybrid approach to transportation as a resolution to the barriers of geographical location and time, there must be changes to the amount of space on transit vehicles for items such as bicycles. Currently, transit vehicles have a very limited amount of space to store bicycles. To elaborate, buses in Vancouver can only hold up to two bicycles at a time and on skytrains, those who wish to bring a bike are constrained to open areas of the train near the exit (TransLink, n.d.). This is not ideal as it restricts the number of students who are able to employ a hybrid approach to transportation to UBC, particularly during times when transit vehicles are crowded. Thus, we recommend the addition of more bike racks on transportation vehicles as this would allow the maximum number of students to be able to combine passive and active transport to UBC in the long term.

Additionally, to address safety barriers to transportation in terms of the health of students, we recommend increasing the amount of sanitation on transit vehicles. This is based on the fact that both during the COVID-19 pandemic and currently, there was an increase in the use of cars and a decrease in the use of transportation among many of our participants. If a more frequent cleaning was implemented over the long-term, students may feel more comfortable and safe using transit to get to UBC.

Another barrier to AT that students mentioned in our survey was the cost of owning and maintaining a bike. For those who do not have the funds to purchase a bicycle, and pay for maintenance fees, this form of AT is not feasible. In order to address this concern in the long-term, we recommend creating a semester-long bike rental program specifically for UBC students where the maintenance fees would be covered. By creating a program such as this, we will allow those who would like to start biking to classes to do so, without having to pay for a bike and associated fees. The program may also appeal to international students who would like to have a bike to get around but do not see the need to buy one for just a few months. With this program, we might also be able to partner with already established organizations such as UBC's Bike Kitchen who seek to "engage in cycling education, outreach and advocacy to promote biking as a safe and sustainable means of transportation" (Bike Kitchen, n.d.)

Lastly, convenience was another barrier to using AT amongst the students who responded to our survey. A major part of this concern was fear of bikes being stolen. To address concerns of convenience over the long-term, we recommend placing bike racks near the 'Emergency Blue Phones' on campus and/or areas under surveillance. This would help students who viewed their bike being stolen have a bit more reassurance that their bikes would be safe and secure.

References

- Bike kitchen*. Bike Kitchen. (n.d.). Retrieved April 12, 2022, from <https://www.thebikekitchen.ca/>
- Bikes on transit*. TransLink. (n.d.). Retrieved April 12, 2022, from <https://www.translink.ca/rider-guide/bike-and-ride-on-transit/bikes-on-transit>
- Chaix, B., Kestens, Y., Duncan, S., Merrien, C., Thierry, B., Pannier, B., Brondeel, R., Lewin, A., Karusisi, N., Perchoux, C., Thomas, F., & Meliene, J. (2014). Active transportation and public transportation use to achieve physical activity recommendations? A combined GPS, accelerometer, and mobility survey study. *International Journal of Behavioural Nutrition and Physical Activity*, *11*(6), 5-13. <https://doi.org/10.1186/s12966-014-0124-x>
- Colley, R. C., Garrigueta, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. S. (2011). Physical activity of Canadian adults: accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. *Health reports*, *22*(1), 7–14.
- Doyle, L., Brady, A.-M., & Byrne, G. (2009). An overview of mixed methods research. *Journal of Research in Nursing*, *14*(2), 175–185. <https://doi.org/10.1177/1744987108093962>
- Ebert, D. D., Franke, M., Kählke, F., Kuchler, A., Bruffaerts, R., Mortier, P., Karyotaki, E., Alonso, J., Cuijpers, P., Berking, M., Auerbach, R. P., Kessler, R. C., Baumeister, H.. (2019). Increasing intentions to use mental health services among university students. results of a pilot randomized controlled trial within the world health organization's world mental health international college student initiative. *International Journal of Methods in Psychiatric Research*, *28*(2), e1754. <https://doi.org/10.1002/mpr.1754>

- Giles-Corti, B., Foster, S., Shilton, T., & Falconer, R. (2010). The co-benefits for health of investing in active transportation. *New South Wales Public Health Bulletin*, 21(6), 122.
<https://doi.org/10.1071/nb10027>
- Hilbrecht, M., Smale, B., & Mock, S. (2014). Highway to health? Commute time and well-being among Canadian adults. *World Leisure Journal*, 56(2), 151-163.
<https://doi.org/10.1080/16078055.2014.903723>
- Jang, H., Rempel, E., Roth, D., Carenini, G., Janjua, N.Z. (2021). Tracking COVID-19 discourse on Twitter in North America: Infodemiology study using topic modeling and aspect-based sentiment analysis. *J Med Internet Res*, 23(2): e25431.
<https://doi.org/10.2196/25431>
- Little, M., & Cordero, E. (2014). Modeling the relationship between transportation-related carbon dioxide emissions and hybrid-line courses at a large urban university. *International Journal of Sustainability in Higher Education*, 15(3), 270-279.
<https://doi.org/10.1108/IJSHE-11-2012-0100>
- Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M., & Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International journal of surgery (London, England)*, 78, 185–193.
<https://doi.org/10.1016/j.ijssu.2020.04.018>
- Pabayo, R., Gauvin, L., & Barnett, T. (2011). Longitudinal changes in active transportation to school in Canadian youth aged 6 through 16 years. *Pediatrics*, 128(2), 11-12.
<https://doi.org/10.1542/peds.2010-1612>

- Rahman, S. M., Ratrout, N., Assi, K., Al-Sghan, I., Gazder, U., Reza, I., & Reshi, O. (2021). Transformation of urban mobility during COVID-19 pandemic – Lessons for transportation planning. *Journal of Transport & Health*, 23, 101257. <https://doi.org/10.1016/j.jth.2021.101257>
- Raglin, J. S. (1990). Exercise and mental health. *Sports Medicine*, 9(6), 323–329. <https://doi.org/10.2165/00007256-199009060-00001>
- Robinson, O. (2014). Sampling in Interview-Based Qualitative Research: A Theoretical and Practical Guide. *Qualitative Research in Psychology*, 11(1), 25-41. <https://doi.org/10.1080/14780887.2013.801543>
- Shorten, A., & Smith, J. (2017). Mixed methods research: Expanding the evidence base. *BMJ Journals*, 20(3), 74-75. <http://dx.doi.org/10.1136/eb-2017-102699>
- Teuber, M. & Sudeck, G. (2021). Why Do Students Walk or Cycle for Transportation? Perceived Study Environment and Psychological Determinants as Predictors of Active Transportation by University Students. *Int. J. Environ. Res. Public Health*, 18(4), 1390. <https://dx.doi.org/10.3390%2Fijerph18041390>
- Tremblay, M. S., Warburton, D. E., Janssen, I., Paterson, D. H., Latimer, A. E., Rhodes, R. E., Kho, M. E., Hicks, A., LeBlanc, A. G., Zehr, L., Murumets, K., & Duggan, M. (2011). New Canadian Physical Activity Guidelines. *Applied Physiology, Nutrition, and Metabolism*, 36(1), 36–46. <https://doi.org/10.1139/h11-009>
- UITP. (2020b). *Public transport authorities and COVID-19: impact and response to a pandemic*. Retrieved May 30, 2020, from <https://www.lek.com/sites/default/files/PDFs/COVID19-public-transport-impacts.pdf>

United States. Dept. of Health and Human Services. Physical Activity Guidelines Advisory Committee & United States. Dept. of Health and Human Services. (2008). *Physical Activity Guidelines Advisory Committee report, 2008: To the Secretary of Health and Human Services*. U.S. Dept. of Health and Human Services.

The University of British Columbia (2020). UBC Vancouver Transportations Status Report Fall 2020. Retrieved from <https://planning.ubc.ca/transportation/transportation-planning/research-and-reports>

Youngkin, S. G., Fremont, H. C., & Patz J. A. (2021). The Health-Oriented Transportation Model: Estimating the health benefits of active transportation. *Journal of Transport & Health*, 22, 101103. doi:10.1016/j.jth.2021.101103

Zwald, M. L., Fakhouri, T. H. I., Fryar, C. D., Whitfield, G., & Akinbami, L. J. (2018). Trends in active transportation and associations with cardiovascular disease risk factors among U.S. adults, 2007–2016. *Preventive Medicine*, 116, 150-156.
<https://doi.org/10.1016/j.ypmed.2018.09.008>

Appendix A

Figure 1

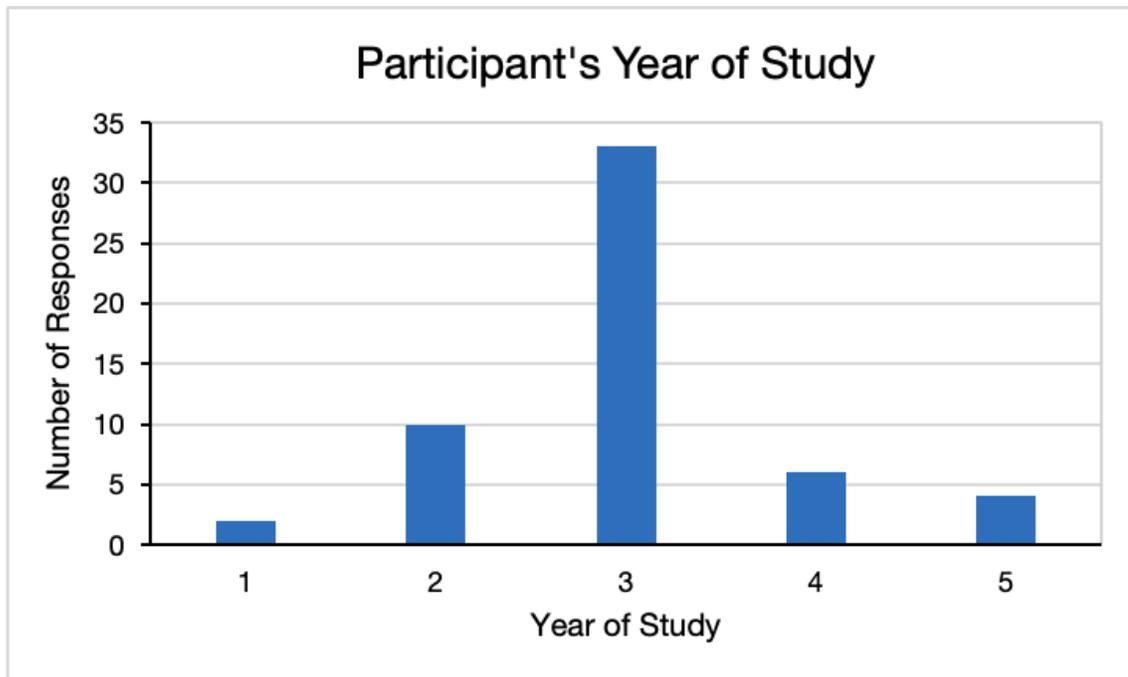


Figure 2

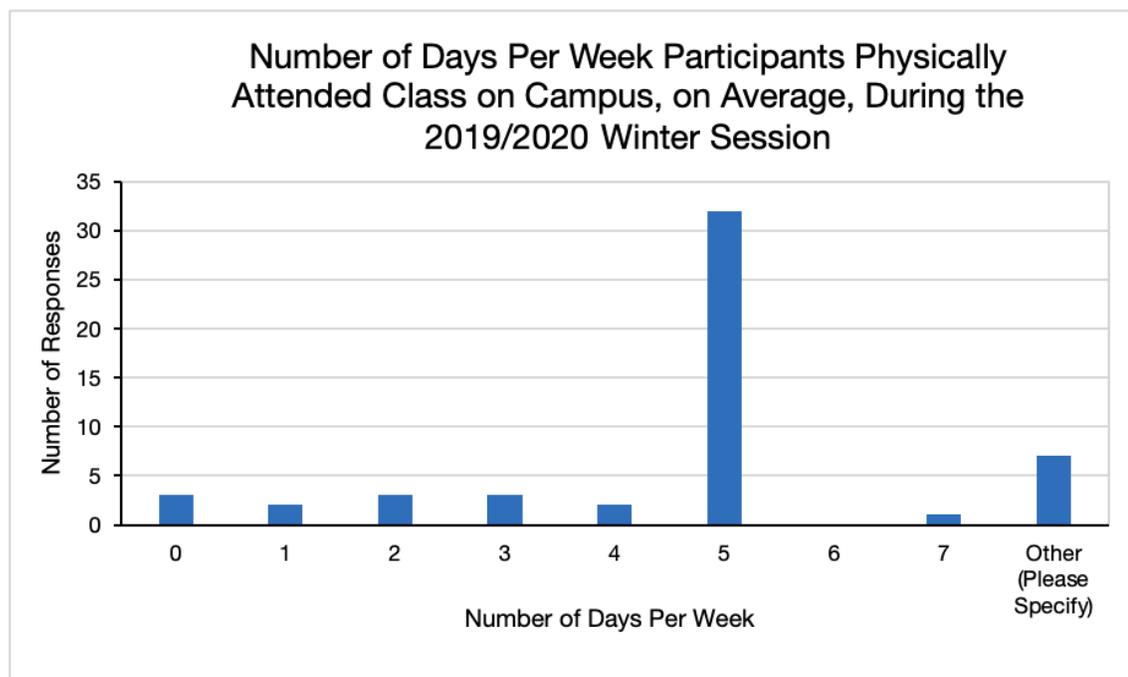


Figure 3

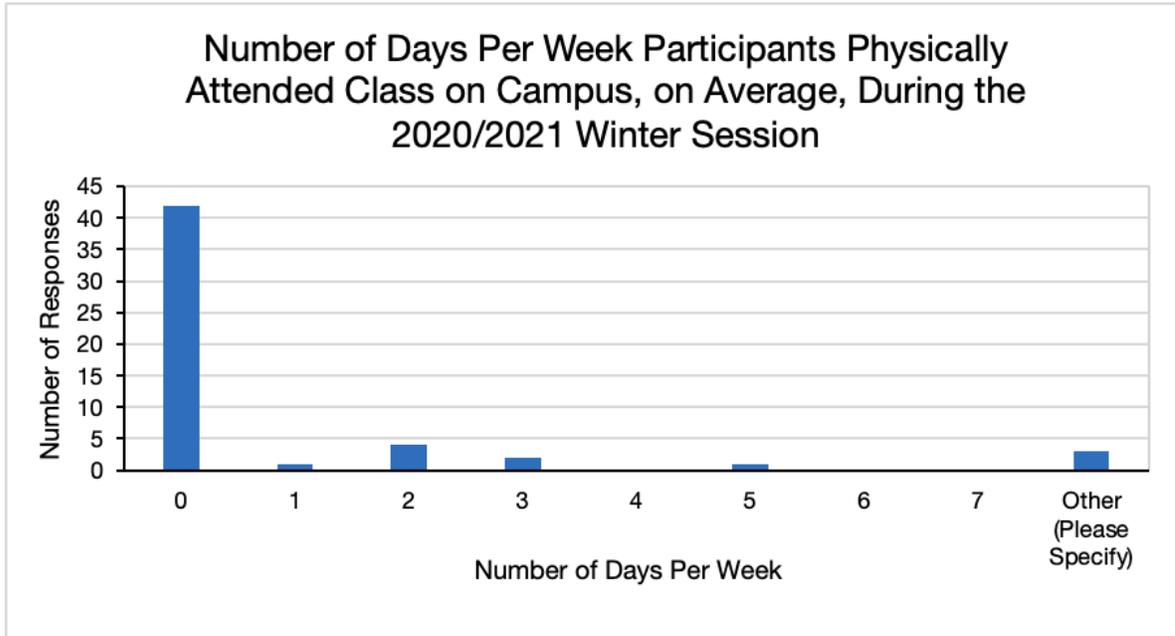


Figure 4

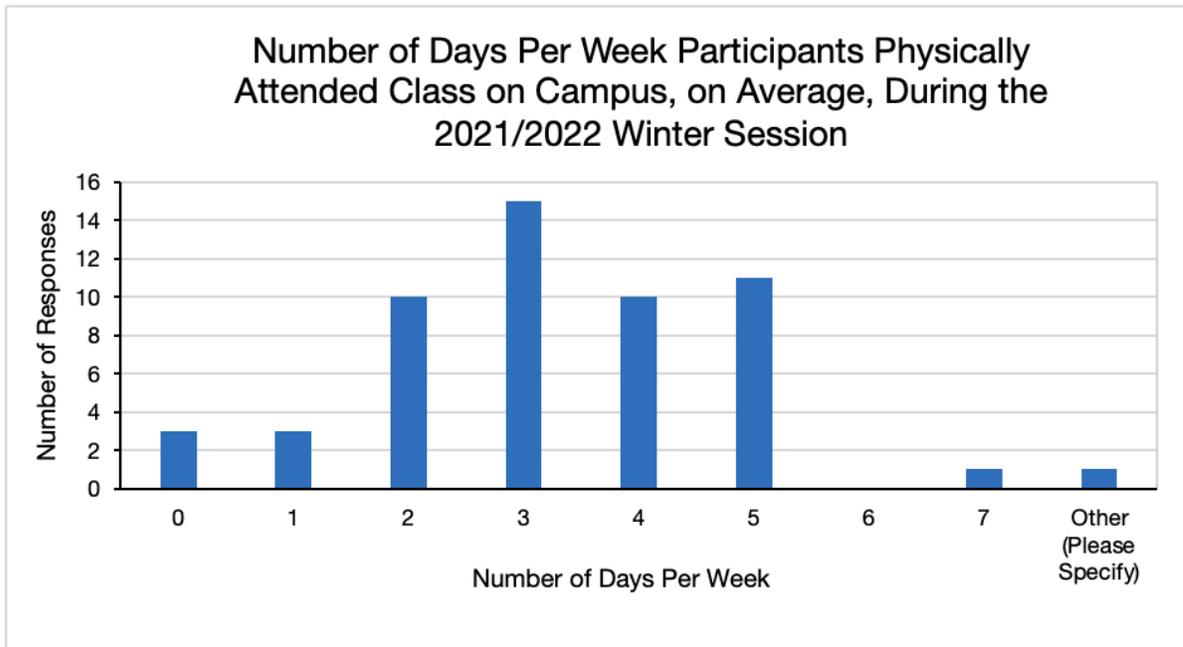


Figure 5

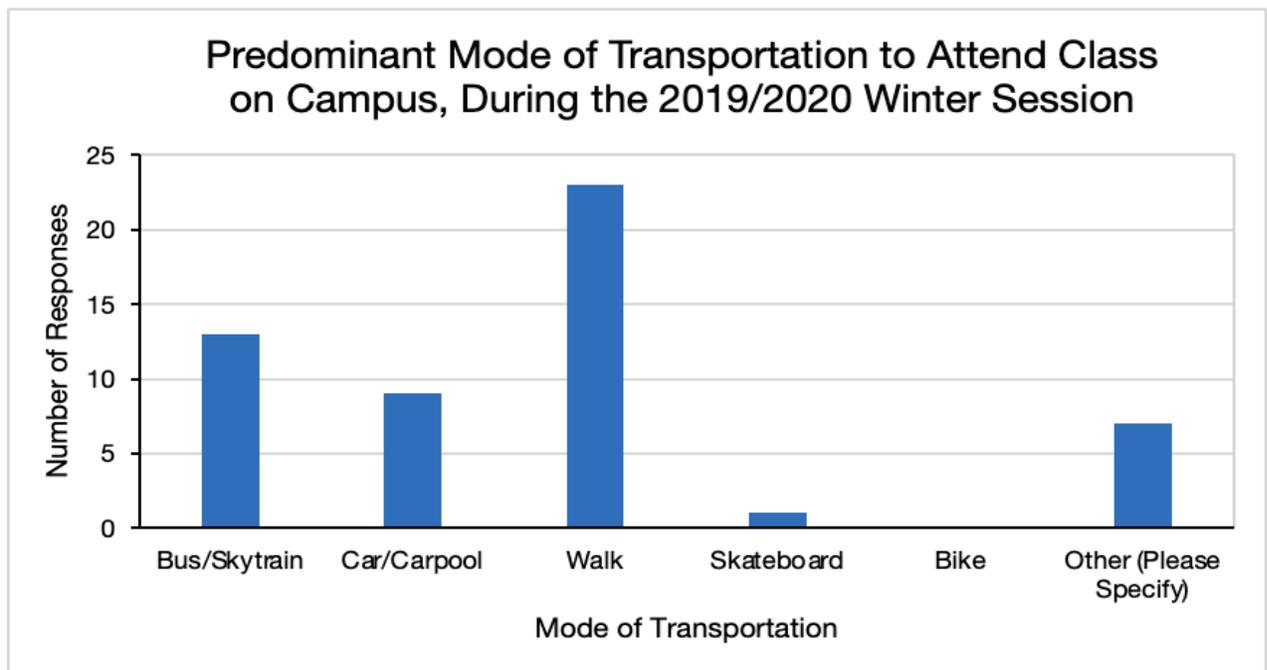


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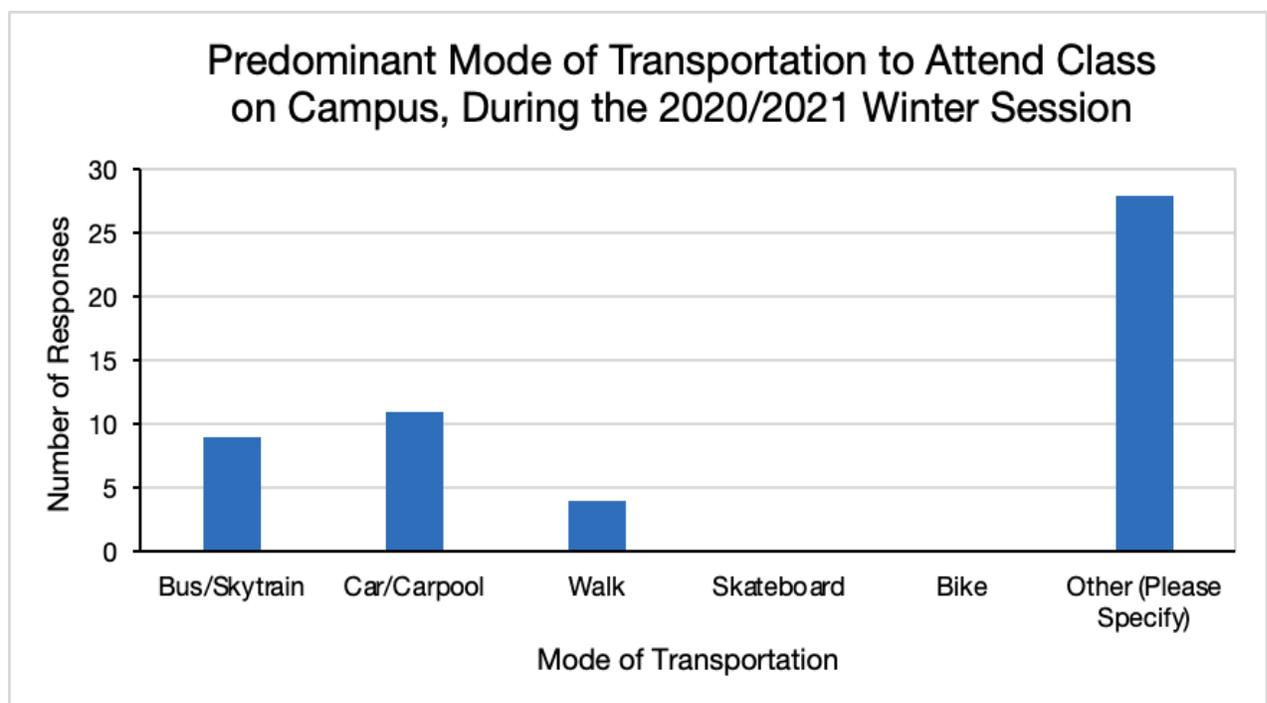


Figure 7

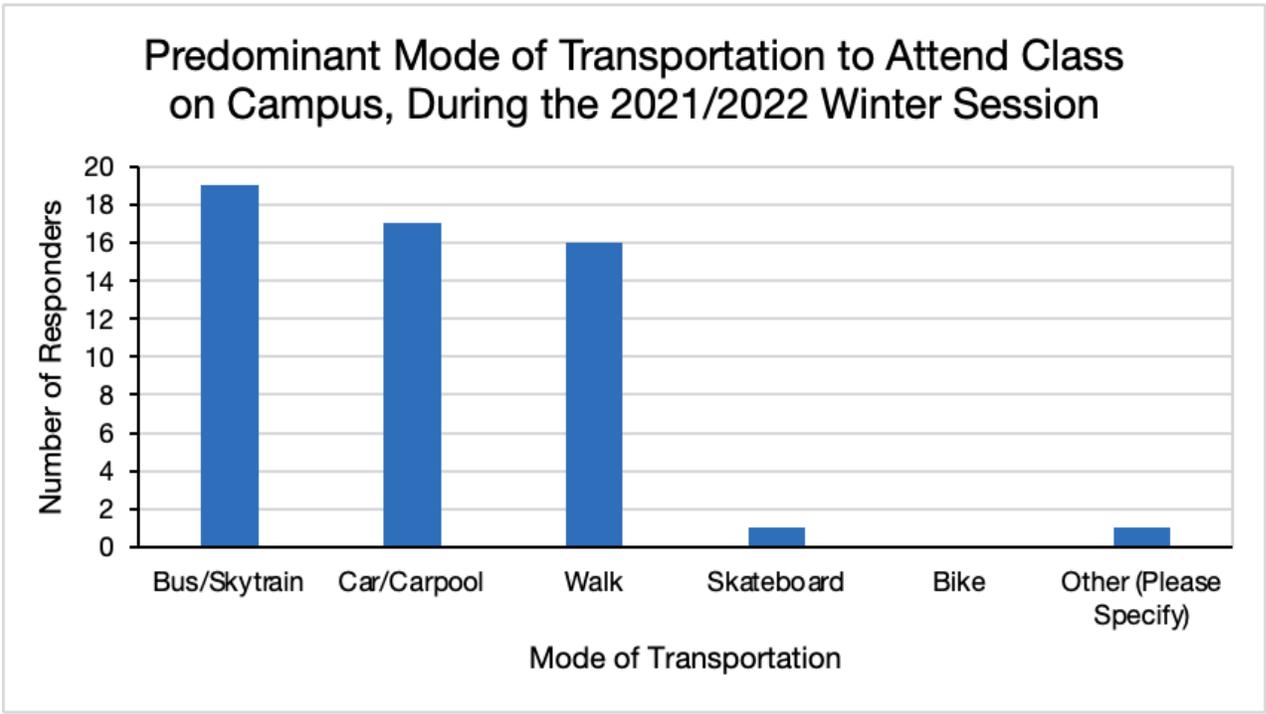


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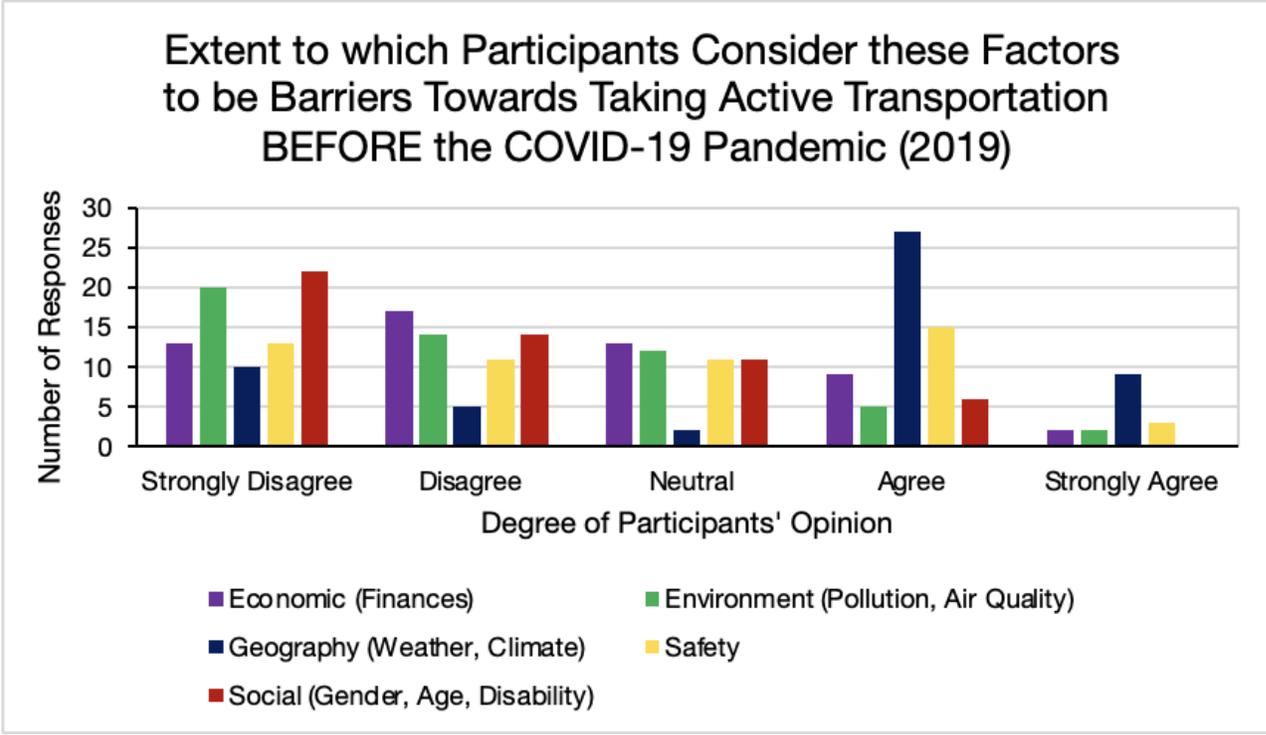


Figure 9

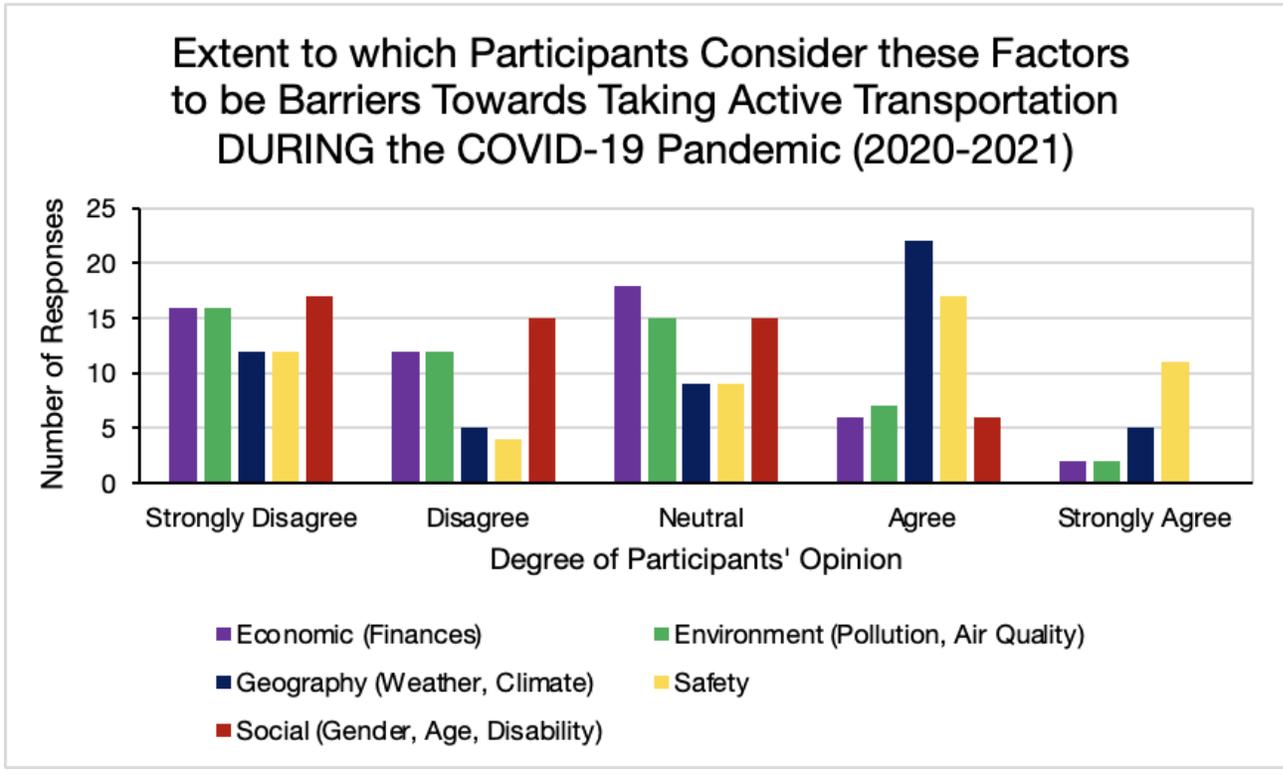
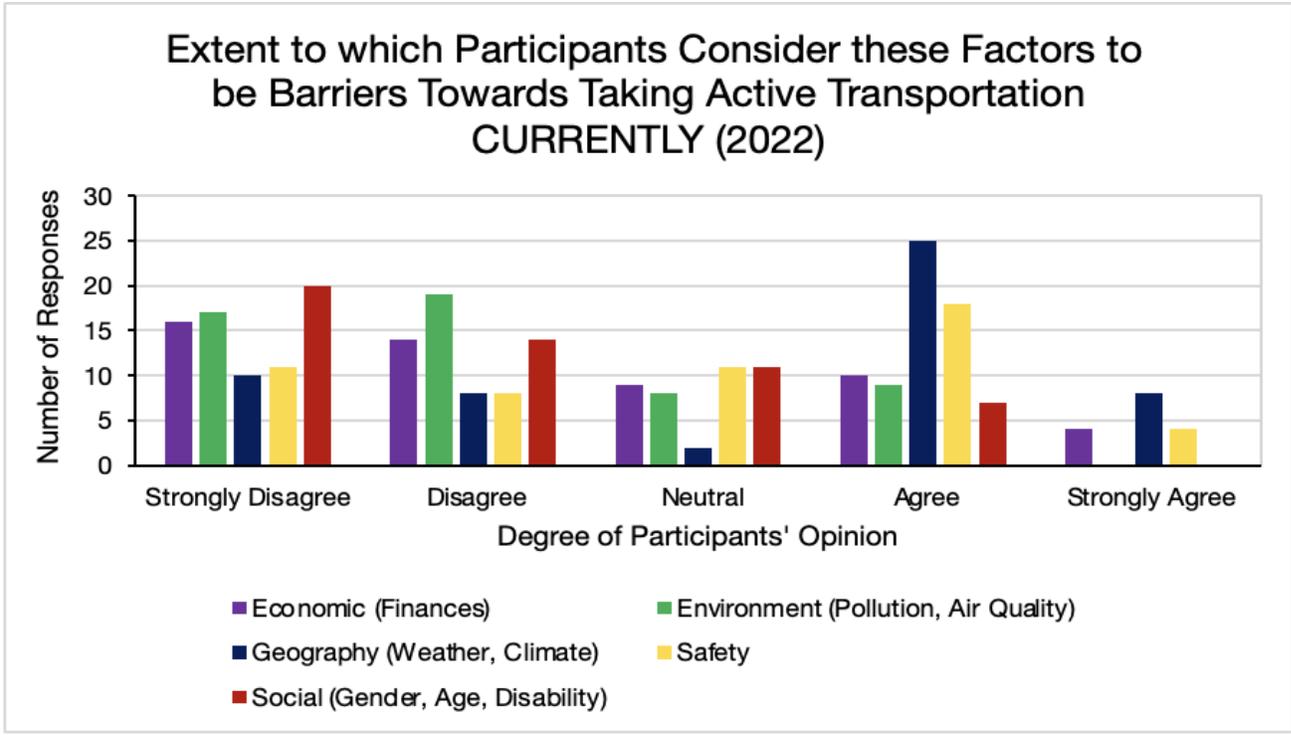


Figure 10



Appendix B

Digital Qualtrics Survey

https://ubc.ca/qualtrics.com/jfe/form/SV_6QjOnBIZrNe5sAC

Appendix C

Participant Consent Form

CLASS PROJECT: Health Promotion and Physical Activity (KIN 464)

Participant Consent Form

An Analysis of the Evolution of Transportation Use at UBC: Impacts of COVID-19 Pandemic (pre, during, and post) Group # 4

Principal Investigator:

Dr. Andrea Bundon (Assistant Professor, School of Kinesiology, Faculty of Education)

Sessional Instructor:

Dr. Negin Riazi (School of Kinesiology, Faculty of Education)

The purpose of the class project:

To gather knowledge and expertise from UBC community members on how transportation use has changed since the pandemic, and to provide recommendations on how we can promote active transportation amongst the UBC community.

Study Procedures:

With your permission, we are asking you to participate in a survey. You may only complete the survey once.

With the information gathered, students will critically examine how different individuals understand or engage in health promoting activities or health promotion initiatives.

Project outcomes:

The information gathered will be part of a written report for the class project. The written report will be shared with campus partners involved with the project. Summaries of findings will also be posted on the following websites. *No personal information/information that could identify participants will be included in these reports or shared with campus partners.*

UBC SEEDS Program Library:

<https://sustain.ubc.ca/courses-degrees/alternative-credit-options/seeds-sustainability-program/seeds-sustainability-library>

Potential benefits of class project:

There are no explicit benefits to you by taking part in this class project. However, the survey will provide you with the opportunity to voice your opinion on your experiences with health promoting activities or initiatives in a broad sense and will provide the students with an opportunity to learn from your experiences.

Confidentiality:

Maintaining the confidentiality of the participants involved in the research is paramount, and no names of participants will be collected.

At the completion of the course, all data (i.e. notes) and signed consent forms will be stored on a secure electronic drive by Drs. Riazi and Bundon. All data and consent forms will be destroyed 1 year after completion of the course.

Risks:

The risks associated with participating in this research are minimal. There are no known physical, economic, or social risks associated with participation in this study. You should know that your participation is completely voluntary and you are free to **withdraw from the study** and there will not be negative impacts related to your withdrawal. If you withdraw from the study, all of the information you have shared up until that point will be destroyed.

Contact for information about the study:

If you have any questions about this class project, you can contact Negin Riazi by email at negin.riazi@ubc.ca.

Research ethics complaints:

If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at 604-822-8598 or e-mail RSIL@ors.ubc.ca . or call toll free 1-877-822-8598.

Consent:

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time.

By clicking 'Next,' you are consenting to participate in the study.

Appendix D

Social Media Recruitment Poster

KIN 464: Health Promotion and Physical Activity Class-based Project

**If you are a UBC undergraduate student,
we would love to speak with you!**

As part of a course-based research project (KIN 464), we are conducting a study examining how transportation use has changed since the pandemic, to provide some recommendations on how we can promote active transportation amongst the UBC community. If you are a UBC undergraduate student who is completing 24 or more credits this term (2021W) and have completed 24 or more credits in the 2019W term, we would love for you to complete a survey. More information on https://ubc.ca1.qualtrics.com/jfe/form/SV_6QjOnBIZrNe5sAC or email mwhl@student.ubc.ca.

Please note that this post is public and anyone who likes, comments, or shares the link will, by doing so, be associated with the study. The Principal Investigator on this project is Dr. Andrea Bundon (andrea.bundon@ubc.ca) and Dr. Negin Riazi (negin.riazi@ubc.ca) is the sessional instructor for the course.

Scan the QR Code for more information!

