8-21-2019 10:30 AM

Routines to Enhance Active Lifestyles (REAL) Projects: A Pilot Program to Promote Incidental Physical Activity

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Health Promotion

Abstract

Engaging in different types of incidental physical activity of daily living (e.g., walking to school or stair climbing) could contribute to individuals leading more active lifestyles by improving their total physical activity levels and reducing rates of inactivity. Particularly, post-secondary students are highly inactive and innovative strategies are needed to encourage them to be more active. The overall purpose of this research program was to explore the use of evidence-informed and tailor-made point-of-choice prompts to promote active transportation and staircase use among university students. Study 1 employed focus groups to determine the most suitable health messages and designs to create point-of-choice prompts for promoting active transportation and staircase use that would appeal to undergraduate students. Study 2 included an online questionnaire to assess students' awareness, impact, and feedback regarding the suitability of utilizing active transportation-promoting point-of-choice prompts at transit hubs on campus. Study 3 incorporated a pre-post study design to examine the influence of a multi-component poster-based intervention to promote stair climbing at a campus library.

The results of Study 1 indicated that undergraduate students preferred simple point-of-choice prompt designs with tailored messages. Additionally, students from the focus groups had diverse lifestyle-based values associated with physical activity and their participation in activities were affected by uncontrollable factors (e.g., time, built environment, and weather). Study 2 determined that approximately 41% of respondents were aware of the prompts, with awareness levels being associated with the distribution and the design of the displays. Although students assessed them as suitable, the prompts did not impact the transportation choices of the majority of respondents who saw them. The findings from Study 3 indicated that the frequency of stair climbing on weekdays was significantly higher during the intervention and follow-up periods

compared to the baseline period. This effect was not found on weekends. The overall increase stair climbing rate observed in this study (2.5%) is similar to previous research using point-of-choice prompts only.

In conclusion, the findings from these studies helped to determine the extent to which tailored and strategically-placed point-of-choice prompts aid to increase levels of active transportation and stair climbing on a university campus.

Keywords: health promotion, signage, active transportation, stair climbing, university students

Lay Summary

Physical activity is a health promoting behaviour that decreases risk factors for chronic diseases and enhances well-being. Engaging in different activities of daily living—such as walking for transport or stair climbing—may help many adults lead more active lifestyles. College/university students are generally not active enough to gain health benefits and new strategies are needed to encourage them to be more active. The overall purpose of the *Routines to Enhance Active Lifestyles* (REAL) Projects was to explore the use of health promotion posters and signs to encourage walking/biking and staircase use among Western University students. Study 1 utilized focus groups to determine what undergraduate students thought would be the most effective messages and poster/sign designs to encourage their peers to walk/bike (instead of using cars and buses) and use the stairs (instead of elevators). Study 2 included an online questionnaire to assess students' awareness of the study material, impact of the signage, and overall feedback about the signs that were designed to promote walking/biking that were displayed at transit hubs on campus. Study 3 incorporated a multi-component poster-based intervention to influence the rates of stair climbing at a campus library.

The results of Study 1 indicated that students preferred simple health poster/sign designs with tailored messages; had different values associated with physical activity; and perceived their participation in different activities were affected by uncontrollable factors such as time/weather. Study 2 determined that approximately 41% of participants were aware of the health promotion signs, with awareness levels being associated with the distribution and the design of the displays. Although participants rated the intervention as suitable, the displays did not impact the transportation choices of most of the participants who saw them. In Study 3, when the health promotion posters were displayed at a campus library, there were more stair climbers on

weekdays versus weekends. The overall increase stair climbing rate was similar to findings from previous research.

In conclusion, the results from the three studies helped to determine the extent to which health promotion posters/signs could help to increase rates of walking/biking and stair climbing on a university campus.

Co-Authorship

Although this dissertation contains my original work (study design, data analysis, and preparation of manuscripts), I would like to acknowledge the major contributions made by my graduate supervisor, Dr. Jennifer D. Irwin (a co-author), for all three studies. I would like to extend my sincere and honest gratitude for the guidance and insights that I received from my advising committee members, Dr. Chris Lee and Dr. Trish Tucker. In particular, I would also like to thank Dr. Chris Lee (a co-author) for providing his statistical expertise and support for Study 3.

Acknowledgements

I would like to thank my graduate supervisor, Dr. Jennifer D. Irwin, for her constant support. Beyond the feedback and mentorship I have received from her, she has played an integral role in my personal growth, and her kindness has inspired and motivated me to become a better person. I am eternally grateful to have been taught by such an amazing teacher who has helped guide me through my education and has provided me with many valuable life lessons.

I also owe a debt of gratitude to members of my advising committee, Dr. Chris Lee and Dr. Trish Tucker. It was a pleasure to work and learn from these phenomenal academics who have taught me to be more patient and pragmatic about various aspects of research. Thank you very much for all of your insights, feedback, and support throughout the years.

I am truly appreciative to have met and worked with all of the colleagues in my lab who were always willing to extend their help whenever I needed it. I am particularly thankful to all of the undergraduate research assistants who provided me with the necessary support to complete my doctoral work. I had a great time and lots of fun working with such a dedicated team.

I would like to extend a special thank you to my late grandfather who was the main inspiration for this research program. Words cannot describe my gratitude to all of my friends and family, particularly my aunt Thoai and uncle An, who stood by me through all of the hardships. I have only reached this point in my life thanks to all of your ongoing support.

I would like to thank my partner, Vivian, who has been the key source of inspiration when I needed it most. I can honestly say that without her strength and support, completing this degree would have been an ineffable task. Especially at my lowest points, she has been the only person that can lift my spirit, and encourage me to smile and persevere. As I have often told her before, “You are the sunshine of my life.” Thank you for everything, Vivian.

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Chapter 1: Introduction

Over the last several decades, numerous health researchers have found that physical activity promotes both physiological and mental well-being for adults of all ages.[1–3] Possibly one of the best things an individual can do for his/her own health is to adopt a regular physical activity routine; consequently, obtaining an adequate amount of physical activity can potentially be considered a panacea that can ameliorate common health problems and reduce the risks of many diseases that plague the public healthcare system.[1–3] In particular, engaging in different forms of incidental physical activity of daily living throughout the day could help countless individuals be more active.[4] However, Canadian adults aged 20 years and older are highly inactive and objective data from accelerometers illustrated that only 15% of adults are meeting the Canadian Physical Activity Guidelines (i.e., 150 minutes of moderate- to vigorous-intensity aerobic physical activity [MVPA] per week).[3,5] This is problematic because the generally low levels of physical activity across the nation can contribute to negative health-related consequences among Canadian adults, such as the overall increasing rates of obesity in Canada.[6] Although it may be difficult to change adults' physical activity behaviours and habits, it is a worthwhile pursuit given that people who lead active lifestyles can improve their own health, while also helping to alleviate the economic burden of physical inactivity on the public healthcare system.[7] A simple but effective solution to the problem of inactivity might be to display health posters or signs that prompt individuals to engage in active behaviours such as walking and stair climbing.[8–12] As additional physical activity interventions are needed to help Canadian adults become more active, tailored health posters/signs could be an appropriate public health approach to help reduce the national inactivity crisis among Canadian adults.

Physical Activity Recommendations and Guidelines

Physical activity is defined as any movements that requires a person to utilize energy,[13] and the adherence to physical activity recommendations could help reduce risk factors that are associated with a variety of physical and mental illnesses such as cardiovascular diseases and depression.[14] Additionally, incidental physical activities of daily living are different types of physical activity that are accumulated in small amounts over the day and are unstructured and non-deliberate, such as: (a) walking/biking to school or work (i.e., active transportation); (b) walking up the stairs (i.e., stair climbing); (c) doing household chores; or (d) completing workplace tasks.[4] Ultimately, developing a physical activity routine may lead to the prevention of premature death and enhance one's quality of life.[15] Physical activity guidelines are evidence-based documents that contain recommendations to inform the public about the health benefits of physical activity and exercise. In accordance with current physical activity guidelines, the main recommendation for Canadian adults, 18 to 64 years old, is to participate in two and a half hours of MVPA on a weekly basis in bouts of 10 minutes or more.[3] Additionally, the Canadian Society for Exercise Physiology (CSEP) recommends that engaging in more physical activity may provide greater health benefits.[3] The metabolic equivalent of task (MET; a ratio of the rate of energy expended while performing an activity to the rate of energy used at rest) is a uniform measure of different types of physical activities. For example, the rate of energy expenditure at rest is approximately one MET, while stair climbing is an activity that requires, on average, eight METs.[16] There are many forms of physical activities that have been categorized using METs, which is often differentiated by three different intensities: (a) light (routine tasks associated with typical everyday life, and are between 1.6–2.9 METs); (b) moderate (activities that increase breathing and heart rate, but still allow for a comfortable conversation, and are between 3–5.9

METs); and (c) vigorous (activities that elevate a person's heart rate considerably and have other physical effects to improve a person's fitness level, and are ≥ 6 METs).[16]

Although the Canadian Physical Activity Guidelines have not changed since 2011,[3] the second edition of the Physical Activity Guidelines for Americans was recently released in 2018.[1,2] The American guidelines include more specific recommendations for adults to perform between 150–300 minutes of moderate-intensity aerobic physical activity, or 75–150 minutes of vigorous-intensity aerobic physical activity on a weekly basis.[1,2] This may highlight a particular gap in translating findings from physical activity research because different countries are developing their own guidelines and making different recommendations to the public. In addition to the recommendations offered in the physical activity guidelines, adults are encouraged to accumulate 10,000 steps or more everyday in order to meet the current step count recommendation.[17] However, individuals may have different levels of energy expenditure depending on whether they are brisk walking to catch a bus or taking a stroll around the park.[18] In regards to physical activity measurements, accelerometers are useful and more reliable tools than pedometers to help researchers differentiate between different forms of physical activity that participants performed during data collection. For example, a recent study that investigated the step volume of older adult women using accelerometers found that accumulating 4,400–7,500 steps could lower mortality rates within this cohort.[19] Even though there are different physical activity recommendations, researchers are in agreement that engaging in small doses of physical activity throughout daily life could still result in some health benefits.[1–4]

Post-Secondary Students' Physical Activity Levels

College and university students often have new-found independence, and this formative period of time includes various explorations of lifestyle choices that can determine habits and

routines that could last a lifetime.[20,21] Interestingly, researchers have found that there is a general decline in physical activity among young adults (≥ 5 minutes/day in MVPA),[22] which could roughly translate to an averaged 24% decrease in physical activity for the general young adult population.[23] It is important to note that physical activity levels may differ among young adults attending a college/university compared to others from this cohort.[24,25] For example, researchers utilized accelerometers to measure physical activity in Australian young adults, and reported that 67.8% of participants met physical activity recommendations (participants engaged in an average of 36.2 minutes of MVPA/day).[24] However, there is evidence indicating that only 35% of Canadian post-secondary students are sufficiently active,[25] and only 50% of post-secondary students are reporting adequate levels of physical activity worldwide.[26] For those who are more active, there are some essential psychological-related benefits of physical activity that are important for students' mental health—namely a reduction in stress, anxiety, and depression.[27] Also, regular participation in physical activity has been found to be associated with improved academic performances and graduation rates among post-secondary students.[28,29] The mechanism for this relationship might, at a very simplistic level, be explained through this example: if a student takes a 15-minute walking trip before studying, this could potentially improve their memory function, which could lead to higher chances of academic success.[28] Post-secondary students with busy lives may not prioritize their time to commit to regimented leisure-time physical activity schedules offered at a campus gym. With the many health benefits that physical activity offers for students, it is a worthwhile pursuit to encourage them to be more active throughout their daily lives. Health promotion programs that include behavioural prompts could promote incidental physical activity and serve as an inexpensive intervention to enhance students' daily physical activity levels.[4,30]

Incidental physical activity of daily living can be seen as a task with a wide variety of health and practical/functional benefits.[4,31,32] One contribution toward addressing the problem of insufficient activity levels among post-secondary students is the promotion of physical activity via increase rates of active transportation and staircase use on college and university campuses. In other words, students could accumulate physical activity benefits while performing mundane tasks such as taking the stairs or walking to school. However, raising awareness could be a difficult process with numerous requirements. First, school administrations would need to be involved in order to increase the success rates of any campus-based physical activity health promotion program.[31] Additionally, researchers have described that university students have reported lower motivation to participate in physical activity, and they generally engage in less incidental physical activity (e.g., walking) and MVPA in comparison to high school students.[21] Furthermore, short distance transit trips are problematic for the activity levels of student with unlimited access to public transit if they replace active transportation trips.[32] Although physical activity could be accumulated spontaneously or during leisure-time, there is a need for additional strategies to promote incidental physical activity, such as active transportation or stair climbing, which might encourage students to develop healthier and more active lifestyles.[4] Thus, the use of behavioural prompts on a campus could be seen as a convenient and cost-effective way to increase participation in incidental physical activity of daily living (e.g., walking to school or using the stairs) among university students.

Study Setting – Western University

College and university campuses are busy worksites that serve thousands of adult students and workers on a daily basis.[33] These research-based institutions are prime locations to implement a physical activity, health promotion program because of the low physical activity

levels reported among its biggest cohort, undergraduate students who are young adults.[25,33] The study setting, Western University, is a large Canadian post-secondary institution located in London, Ontario, Canada. This post-secondary institution is where the three studies in this dissertation's research program were conducted. At the time of the research, the university's population included over 34,000 full-time students, faculty, and staff. More specifically, institutional data from 2018 indicated that Western University hosted: 24,587 full-time undergraduate students (71.5%), 5,935 full-time graduate students (17.3%), 1,405 full-time faculty (4.1%), and 2,455 full-time staff (7.1%).[33] For its relevance to this dissertation's focus, it is important to note that Western University contains several transit hubs on its main campus, with a number of bus stops that are within walking distance to each other, which are spread across from each end of the university grounds. During the time that this dissertation research program took place, Western undergraduate students received universal transit passes, providing them with unlimited access to the city buses run by the London Transit Commission (LTC). On the main campus grounds, the most central campus library is Weldon Library, which has five floors and can receive over 5,000 visitors/day during a busy month (e.g., March). Interestingly, several health researchers from this institution have identified the need for physical activity initiatives to help improve students' activity levels on campus.[34,35] In concert, other Canadian researchers have found that fitness and healthy lifestyles are of interest to undergraduate students at their institution.[36] Hence, it is particularly beneficial to explore the impact of an innovative health promotion physical activity program at this Canadian post-secondary institution.

The Efficacy of Point-of-Choice Prompt Interventions

Point-of-choice prompts are health posters or signs with informative health messages that could potentially influence people to engage in health behaviours such as stair climbing.[8,9] The

success rate of point-of-choice prompt interventions to promote staircase use is well-documented.[10] When researchers pooled over 30 years worth of data from staircase interventions that employed the use of point-of-choice prompts, it was reported that 52% (i.e., OR = 1.52) of participants who were exposed to health posters/signs were more likely to engage in staircase use.[10] Furthermore, researchers have reported that point-of-choice prompt interventions have been implemented successfully at several post-secondary institutions, and their efficacy could be enhanced when used with additional motivational health posters or directional signs.[9–11,30] Interestingly, researchers have explored the use of point-of-choice prompts to promote other forms of physical activity such as walking,[12,37] and this type of intervention has also been associated with deterring sedentary behaviours (e.g., sitting) among office workers.[38,39] As noted earlier, engaging in various forms of incidental physical activity throughout the day could help improve individuals' total physical activity levels.[4] Along with stair climbing, walking for transport is a form of incidental physical activity that could help individuals to accumulate more physical activity.[4,18] In one study, researchers found that walking for transport may help adults accumulate over 28 minutes of physical activity per day, which could encourage more people to meet physical activity recommendations.[18] Even if the threshold to meet physical activity recommendations is not reached, "virtually everyone can benefit from becoming more physically active."[40(p210)] Young adults, including college/university students who have previously identified 'time' as a primary barrier,[21,36] can accrue both physiological and psychological health benefits if they incorporate incidental physical activity of daily living into their busy lives.[1–4] Innovative, population-based physical activity interventions are needed to reduce physical inactivity rates among young adult students. The following sections below will outline information about the current health promotion research program, which included a needs

assessment and two formative evaluations to determine the impact of using point-of-choice prompts to influence rates of active transportation and stair climbing on a Canadian university campus.

Theoretical Framework Informing Point-of-Choice Prompts

The main underlining theory that informed the following point-of-choice prompts intervention studies is called, the Theory of Planned Behaviour.[41] This theory postulates that an individual's action will be determined by their intention, which is also highly associated with a person's attitude for an activity or particular behaviour.[9,42] Although point-of-choice prompts could influence an individual's intention to perform an action (a volitional component), other tools such as educational health posters could be used to influence their attitude for a behaviour (a motivational component). [9] In the past, researchers have tested the differences between motivational and volitional components using health posters and point-of-choice prompts at a post-secondary campus. [9] For example, researchers compared the effects of displaying a health poster in an elevator while in the absence/presence of a point-of-choice prompt (placed outside of the elevator); and the results indicated that the prompt significantly promoted higher rates of staircase use than only displaying a health poster. [9] Further testing of these interventions also occurred at multiple worksites and similar findings were found.[42] Thus, it is important to define the tools included in a health promotion program, and also provide the rationale for its implementation.

Rationale for the Current Health Promotion Research Program

Motivating university students to engage in more physical activity could translate into positive health trends for future generations, and doing so via incidental movement behaviours could represent an appropriate public health approach. In particular, a signage-based intervention

that is tailored for a post-secondary campus (an institution where thousands of adults work/visit on a daily basis) could serve as an inexpensive intervention for enhancing not only students' but other adults' daily physical activity levels. The pilot program outlined in this dissertation's program of research included the design and evaluation of tailored point-of-choice prompts on university students' decisions to engage in incidental physical activity. It is important to involve the target population in the design process to create suitable point-of-choice prompts that properly motivate individuals to engage in a behaviour.[8] Before the completion of this research program, it was previously unknown as to whether the use of point-of-choice prompts could substantially influence university students to engage in active transportation. Furthermore, the efficacy of using multiple health posters (i.e., displaying point-of-choice prompts, directional posters, motivational posters, *and* stairwell posters) as part of a health promotion intervention to promote stair climbing needed to be further examined.

The Generalized Model for Program Planning is a prominent and widely acceptable framework that outlines important steps for planning and evaluating a health promotion program.[43] This framework was used to guide this health promotion research program, and it includes five essential steps that are necessary for the success of the program: (a) assessing needs; (b) setting goals and objectives; (c) developing an intervention; (d) implementing the intervention; and (e) evaluating the results.[43] The findings from Study 1—a needs assessment (focus groups were used to determine the populations' views, opinions, and preferences about point-of-choice prompts)[40]—helped the investigators to create suitable poster designs and messages for the student population, in service of tailoring the point-of-choice prompts to encourage more incidental physical activity on campus. Studies 2 and 3 were formative evaluations (an assessment to determine the value and acceptability of the interventions, and

their short-term results in order to make improvements), [43] which helped to examine the impact of tailored point-of-choice prompts on university students' transportation choices, and their decisions to engage in staircase versus elevator use. This doctoral dissertation followed the integrated-article format and certain information will be repeated in Studies 1–3.

Purpose Statements

The overall purpose of this doctoral research program was to explore the use of evidence-informed and tailor-made point-of-choice prompts to promote incidental physical activity among undergraduate students at a Canadian university. This dissertation is composed of three studies intended to help promote *routines to enhance active lifestyles* (i.e., REAL Projects). Firstly, the main objective of Study 1 was to determine the most suitable health messages and designs to create point-of-choice prompts for promoting active transportation and staircase use that would appeal to the undergraduate student population at a large, urban university in Canada. Secondly, Study 2 included a three-fold purpose to determine undergraduate students' *awareness* of, *perceptions* of, and *feedback* regarding the appeal and suitability of the study-specific point-of-choice prompts. Lastly, Study 3 examined a multi-component health promotion poster-based intervention, tailored specifically for a busy library, to increase rates of stair climbing among adults on a Canadian post-secondary campus. Together, the three studies identified the impact of tailored point-of-choice prompts on Canadian university students' decisions to engage in incidental physical activity. This is the first health promotion research program to explore the use of multiple health posters/signs with tailored messages to enhance both active transportation and stair climbing rates among post-secondary students on a Canadian university campus. The implementation of a health promotion program like the REAL Projects may help initiate a

paradigm shift from disease treatment to prevention among major stakeholders such as administrators and healthcare professionals.

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Chapter 2: Designing Effective Point-of-Choice Prompts to Promote Active Transportation and Staircase Use at a Canadian University (Study 1)[1]

Introduction

In the years since researchers began to appreciate the benefits of routine patterns of physical activity on individuals' health, it has been a challenge to find effective ways to motivate people of all ages to engage in more physical activity.[1–3] Physical activity provides numerous immediate (e.g., improved sense of wellbeing and reduction of stress) and long-term health benefits (e.g., decrease risk factors of chronic illnesses such as diabetes and cardiovascular diseases), and could decrease the likelihood of premature death.[4,5] Internationally, approximately two thirds of adults have self-reported that they met physical activity guidelines;[2] however, objectively measured data revealed activity levels as low as 15% among adults in a Western country such as Canada.[3] Young adults (e.g., those attending post-secondary institutions, typically between the ages 18–24 years), in particular, are highly inactive and spend a large amount of time being sedentary.[6] University students represent a large subpopulation of young adults, who generally accumulate low physical activity levels,[7] with global reports of only 50% of post-secondary students meeting recommended physical activity guidelines.[8] It is crucial to motivate university students, who typically have flexible and modifiable lifestyles, to cultivate healthy habits and routines because lifestyles created during the young adult years are likely to track long-term.[9] Incidental physical activities may provide effective avenues for creating long-term healthy routines; these may include unstructured activity choices such as walking to school rather than taking a car[10] or using the stairs rather than an elevator.[11] Participation in incidental

[1] This is an accepted manuscript of an article published by Taylor & Francis in the Journal of American College Health on 09/19/2018, available online (see Appendix A for copyright information): https://www.tandfonline.com/doi/full/10.1080/07448481.2018.1469503

physical activity has been deemed a convenient, and potentially effective, way for university students to enhance their lifestyles by increasing their average physical activity levels.[12]

Many post-secondary students are young adults with newly inherited personal responsibilities such as financial and lifestyle independence. Consequently, they may not want to devote additional time, money, energy, and scheduling requirements to participate in planned physical activities such as working out at the gym or playing sports.[6,13] Promoting staircase use and active transportation (e.g., various modes of transportation that require individuals to exert physical efforts such as walking or biking) could be a difficult task because these behaviours might be perceived as unnecessary inconveniences. For instance, stair climbing is a health promoting behaviour that may be incorporated into individuals' daily routines,[14] but proximity of a staircase to the entrance of a building could impact students' decisions to use the stairs.[15] As another example, post-secondary institutions may serve as transit hubs and public transit trips may help students to accumulate some physical activity during their commutes, which might be an ideal mode of transportation for those attending post-secondary schools because it is inexpensive.[16–18] However, short distance transit trips are problematic for students' activity levels if they replace active transportation trips.[10,19] Thus, given the potential value of promoting staircase use and active transportation (especially, to replace the more inactive alternatives such as elevator use and short distance transit trips) for enhancing students' physical activity levels, a campus-based intervention may be valuable for encouraging the student population to uptake these behaviours.

Health promotion initiatives should aim to incorporate the priority population's views and opinions, and the goals of a health promotion program should meet individuals' needs.[20] Both staircase use and active transportation may be ideal target behaviours for point-of-choice

prompts (e.g., various types of displays such as posters or signs with informative health messages that help facilitate intentions into behaviours), given each is considered inexpensive and potentially impactful for enhancing post-secondary students' daily physical activity levels.[11,21] Despite the simplicity of utilizing informative posters or signs to enhance students' engagement in physical activity, it is important to design and use point-of-choice prompts that are suitable, tailored, and appealing to the priority population.[22] Additionally, the complexity of the messages presented in point-of-choice prompts may affect individuals' decisions to engage in health promoting behaviours (e.g., simple messages are more effective in high-traffic areas).[23] Because it is not known what types of poster designs and messages will be effective for creating physical activity-related point-of-choice prompts that are appealing to the undergraduate student population, it is important to conduct a study to determine students' preferences to ensure optimal impact. As such, the purpose of the first *Routines to Enhance Active Lifestyles* (REAL) Project was to determine the most suitable health messages and designs to create point-of-choice prompts for promoting active transportation and staircase use that would appeal to the undergraduate student population at a large, urban university in Canada. A qualitative study design using focus group discussions provided student participants with the opportunities to voice their opinions, views, and preferences for the most motivational health messages and poster designs. Focus groups were chosen because interactions among the participants tend to elicit insightful information as students share their thoughts and perspectives with each other.[24]

Methods

Participants and recruitment

The inclusion criteria for this study included undergraduate students who were enrolled in a full-time program at the host university and those who were fluent in English. Upon receiving

approval from the Office of Research Ethics (Appendix B), the mass email system from the host university was employed to send a recruitment message (Appendix C) to all undergraduate students included within the mailing list (i.e., to students who had not opted out from receiving notifications regarding participation in research). In the Fall (2016) semester, recruitment efforts included sending out a mass email to all undergraduate students (28,560 emails were sent out), snowball sampling (i.e., researchers asked potential students to tell their friends about the study), and making one class announcement in a Health Sciences class. In total, 53 students responded via email and 19 students completed screening forms. One student was rejected because the individual was not fluent in English, one individual dropped out from the study, and five students were unable to attend any of the focus groups due to their lack of availability. In summary, three focus groups were conducted and 12 participants were recruited during the Fall semester. Participant recruitment continued in the Winter (2017) semester because data saturation was not achieved. A second mass email was sent out to all undergraduate students (31,312 emails were sent out), snowball sampling was also employed, and 36 instructors were contacted (Appendix D) to make a class announcement or to have them post a recruitment message on their course website. Afterwards, 55 students emailed the investigators and 19 students completed screening forms. Five students were not available to participate in any of the scheduled focus groups, one student was rejected from the study because the individual was enrolled as a part-time student, and four potential participants agreed to attend a focus group but then dropped out from the study. As such, two focus groups and one interview were conducted and nine participants were recruited in the Winter semester. A total of 21 undergraduate students were recruited; 20 full-time students participated in five focus groups and one individual attended a one-on-one interview session due to other students dropping out from the focus group last minute.

Students who contacted the investigators were asked to answer some preliminary questions (Appendix E) about themselves during the initial contact in order to assess their eligibility to participate in this study. In accordance with previous recruitment protocols for selecting participants,[25,26] the investigators divided eligible participants into homogenous groups based on those who met or did not meet the recommendation of 150 minutes or more of moderate- to vigorous-intensity physical activity within the previous seven days, as recommended by the Canadian Physical Activity Guidelines for adults.[5] Emails were also sent to participants the day prior to the focus groups in order to remind them of the time and location (Appendix F), which is a recommended protocol.[27] Participant recruitment ended once the research team concluded that data saturation (i.e., no further information could be obtained from holding more focus groups) had been met.

Data collection

At the beginning of each focus group, participants were asked to read a letter of information and sign the consent form (Appendix G). Students who participated in this study were also asked to complete a short demographic survey containing nine questions (Appendix H) in order to allow other researchers to determine the potential transferability of the data.[26] This study was conducted in the Health Promotion Research Laboratory at the host university during convenient times for participants. No incentive or compensation was provided for participation in this study. Snacks and light refreshments were available for participants during each session. The focus group moderator and an assistant moderator used a semi-structured discussion guide (Appendix I) to explore participants' opinions about the most appropriate poster designs and messages for promoting active transportation and staircase use, and the locations they should be placed for maximum impact. To help facilitate this process, multiple photos were shown to focus

group participants as examples of potential poster designs (Figure 1) and locations for posting the point-of- choice prompts (Figure 2). Specifically, participants were asked to describe their preferences for specific components of the poster designs (e.g., the fonts, colours, and sizes of posters) and health messages (e.g., simple or complex messages) that would motivate them to engage in active transportation or staircase use. The discussions lasted between 50 to 80 minutes and were audio recorded with a Sony® digital recorder. Guidelines to ensure data trustworthiness were adhered to during data collection and analyses.[28,29] For instance, during each focus group, member checking was performed between questions and at the conclusion of each session to ensure that all participants' responses were accurately captured and understood by the investigators. Team meetings between the focus groups' moderator and co-moderator were held to consider and ensure that any possible biases were thoroughly discussed and recorded. Furthermore, the moderator and co-moderator documented and kept notes from each session to ensure that the research process was transparent, and could be potentially replicated by others while also being specifically detailed to support other researchers' decisions to transfer the findings' to other settings and participants.

Figure 1. Examples of point-of-choice prompts that were shown to participants as potential poster designs and health messages (the images and messages were adapted from the Middlesex-London Health Unit's Physical Activity Toolkit and the University of Toronto's MoveU program).

Figure 2. Examples of locations on a university campus for displaying point-of-choice prompts.

Data analysis

Data collection and preliminary analysis were performed simultaneously in order to determine when data saturation was met, and the investigators utilized the editing organizing style (as described by Crabtree and Miller, 1999).[27] QRS International NVivo (version 11, 2015) was used to code and categorize potential themes from the data. Descriptive statistics of the demographic data were organized within a word document and reported to identify the potential transferability of the data. Comments and responses provided in the focus groups were analyzed using inductive content analysis,[26] whereby the major themes that emanated from the data were identified and supporting quotations were provided to illustrate prominent themes. Multiple coders were used (i.e., at least two of: the principal investigator, co-investigator, and research assistant) and each researcher independently identified major themes from verbatim transcripts. Importantly, the themes were discussed and agreed upon between the researchers to enhance data confirmability and as such, its trustworthiness.[28,29]

Results

Demographic information

Overall, 21 undergraduate students (12 participants were sufficiently active) met the inclusion criteria and were included in this study. Although 108 students emailed the investigators about participation, only 38 students completed screening forms, and 26 students agreed to participate in a focus group session (attrition rate of 19.23%). As shown in Table 1, the majority of participants were Caucasian (38.10%), female students (71.43%) from the Faculty of Health Sciences (47.62%) who were between the ages of 20–24 years (57.14%). Most of the respondents lived off campus (71.43%) and only resided in the university's city during the Fall and Winter semesters (76.19%).

Table 1. Demographic Information for Study 1 Participants (*N* = 21)

Characteristic	*n*	%
Sex		
Male	6	28.57
Female	15	71.43
Age		
19 years and under	8	38.10
20-24 years	12	57.14
25 years and over	1	4.76
Ethnicity		
Caucasian	8	38.10
East Asian	6	28.57
Other	7	33.33
Program of Registration		
Faculty of Health Sciences	10	47.62
Faculty of Social Science	4	19.05
Faculty of Science	3	14.29
Other	4	19.05
Year of Academic Enrollment		
First	6	28.57
Second	6	28.57
Third	2	9.52
Fourth	7	33.33
Employment Status*		
Not Employed	12	57.14
Part-time	6	28.57
Full-time	1	4.76
Place of Residence		
London, ON (F/W Semesters)	16	76.19
London, ON (F/W/S Semesters)	5	23.81
Living Arrangement		
On Campus	6	28.57
Off Campus	15	71.43

Note. Some participants did not provide a response to this question.

Simple designs and health messages: Tailored point of choice prompts for university students

The responses below encapsulate participants' expressed preferences for the most appealing point-of-choice prompt designs. It was widely recommended by the majority of participants from all focus groups that point-of-choice prompts include brightly coloured, simple designs with messages that required few words presented on posters with a solid background. They also underscored the importance of creating messages in a large font size, and specifically using poster printing size A2 (60 cm by 42 cm) or A3 (42 cm by 30 cm) depending on where the poster will be displayed. Participants indicated that posters should be displayed at places on campus with high volumes of daily traffic such as the main library (when the aim is to increase staircase use) and transit hubs (when the goal is to increase active transportation rates and decrease short distance transit trips). Moreover, the simple and short messages for the prompts should be tailored for university students and be interesting enough to catch their attention (e.g., by including an interesting fact). Respondents preferred messages (Appendix J) that emphasized convenience and productivity (i.e., best use of their time) such as, "Regular stair climbing burns more calories per minute than jogging. Raise your level of fitness one step at a time,"[30] and a previously adapted statement, "Skip the wait and take a walk home! Physical activity could be the most productive 30 minutes of your day."[31] Specific comments by participants included:

> "Simple messages are easier to walk away with and they do not complicate things." (Active Participant)
>
> "I like the minimalist poster with very few words and it has to have a message as well. I like solid colours; patterns are a little bit distracting I think, so a nice solid colour with very few lines of text captures my attention the most." (Insufficiently Active Participant)

> "I think it is important to have an informative message so whether that is like a fact that you will remember or just tell you something that you did not know that will help you remember it." (Insufficiently Active Participant)

Some participants also suggested including questions and answers on different signs or posters in order to challenge readers and motivate them to perform a behaviour such as climbing the stairs (e.g., one poster at the bottom of the stairs would have a question and another poster at the top of the stairs would include the answer to the question). Point-of-choice prompts that include various questions may intrigue those who see the displays to perform the behaviour by making the activity more fun. The quotation below illustrates the above recommendation:

> "I like the idea of asking a question because the poster gets you to think about something as you are walking away." (Active Participant)

Perceptions of physical activity: Healthy students lead active lifestyles

Participants were divided into groups during the screening process based on their weekly activity levels. Overall, more students who participated in this study were considered active (i.e., individuals who performed 150 minutes or more of physical activity on a weekly basis) than inactive. For some discussions, active and insufficiently active participants had polarizing opinions about physical activity. Several participants who were considered insufficiently active mentioned that they would prefer to choose the options that required them to exert less physical effort such as taking the elevator or using public transit. In contrast, active participants illustrated how engaging in physical activity would make them feel better throughout a school day. Specifically, the more active individuals expressed support about the different opportunities that allowed them to be more active on campus such as using the stairs or walking to class. As such, participants who adhered to the physical activity guidelines appeared to have more active

lifestyles and may prefer to accumulate activities in small amounts throughout the day compared to those who did not meet the physical activity recommendations. The following quotes highlight the different views that focus group participants shared:

> "Sometimes, I am just really tired after class. I just do not feel like walking. I would rather just take the bus…or take the elevator in that building." (Insufficiently Active Participant)
>
> "I do not like walking, and even if it is a short distance, I would rather take the bus." (Insufficiently Active Participant)
>
> "I definitely find that I take the stairs because I feel a nice sense of accomplishment, and I know that if I get my heart rate up a little bit, I will be a little more focused on my studies." (Active Participant)
>
> "I really like walking around from class to class because I find like as a student I do a lot of sitting when I am at the library or in class, and going to the gym too is sometimes hard to fit in. So I try and just walk when I can." (Active Participant)

In terms of health benefits that could be attained by increasing their physical activity levels, the majority of participants mentioned that they do not have concerns about some physical activity-related improvements for health such as decreasing the likelihood of some chronic illnesses (e.g., diabetes and cardiovascular diseases). However, participants were especially interested in improving their mental health by participating in more physical activity. Thus, point-of-choice prompts that are tailored for university students might benefit from including health promoting messages about improving their mental health. The following comment illustrated participants' particular interest in mental health:

> "I would not want to say diseases because, in general, if you say diseases people are kind of more, 'so what?' If you say something specific like mental health or something else that is specific to young people. (Insufficiently Active Participant)

Extrinsic factors that impact students' decisions to engage in physical activity: Time, built environment, and weather

Several extrinsic and uncontrollable factors reportedly hindered the participants' decisions to be active. Respondents illustrated that time and convenience could be a barrier for them to engage in various activities such as walking to school or working out at a fitness center. A point-of-choice prompt that emphasized the benefit of saving time (e.g., arriving to a destination faster) was presented as a stronger motivating factor than highlighting health benefits for some participants. For instance, walking to classes on campus was also seen as a convenient way to be more active without having to spend additional time at the gym to work out. As such, time and the perception of convenience when performing an activity affected participants' decisions to engage in different behaviours. The following quotations depict the importance of saving time for participants:

> "I would rather take the elevator if it is close instead of going all the way around to the stairs." (Insufficiently Active Participant)

> "I think for me personally, because I live in residence, when I choose to walk sometimes it is motivated by urgency. If there is no bus coming within a certain time period, I know that I have to walk." (Insufficiently Active Participant)

The built environment on campus reportedly impacted undergraduate students' decision for staircase use and participation in active transportation. Specifically, the proximity of the staircase to the entrance of a building and its visibility were factors for whether or not many

participants use a staircase (i.e., participants will more likely use visible staircases and those with which they are familiar). Additionally, the staircase itself was deemed to be a barrier for those with heavy bags and/or too much to carry. Furthermore, the availability of bike lanes around the university campus encouraged more participants to ride their bikes to school. The comments below illustrate how the built environment may impact respondents' decisions to be active:

> "I think if the stairs are closer to the door you are entering, than the elevator is, then you are more likely to take the stairs." (Insufficiently Active Participant)
>
> "Sometimes, I feel like going up the stairs is a workout for me when my backpack is heavy!" (Active Participant)
>
> "The bike lanes on campus are good and there are always places for you to lock your bike. It definitely helped me in making my decision to bike more to campus." (Active Participant)

Lastly, weather patterns are uncontrollable extrinsic factors that affected participants' choices to engage in active transportation. Participants articulated that they are more likely to walk or bike when the weather is pleasant (i.e., warmer weather and no precipitation). The following statements illustrate participants' preference to engage in active transportation during warmer weather:

> "If it is snowing you are more likely to take the bus instead of walk because… you could be warm in the bus for five minutes instead of walking outside for five minutes." (Insufficiently Active Participant)
>
> "I feel like a lot more students walk in the summer, like for me too personally, it is easier to get outside and want to walk when it is nicer out." (Active Participant)

Comment

For many decades, researchers have recognized the health benefits of physical activity and attempted to increase physical activity levels around the world with varying success.[1–5] It is important to focus beyond developing interventions that only consider planned or leisure physical activity, and also aim to enhance individuals' lifestyles by incorporating daily or routine incidental physical activity.[5,12,21] The results from this study underscored a number of important findings. Primarily, participants' preferred simple point-of-choice prompt designs with tailored messages specific to students' values regarding physical activity based on their current lifestyles. In concert with previous findings,[23] the focus group participants reported that simple messages to promote physical activity were appealing and motivational to them. Researchers should incorporate specific messages that will adequately captivate university students' awareness such as including messages about improving their mental health via physical activity to maximize the impact of point-of-choice prompts. Perhaps something specific to this cohort is that students might be more willing to engage in health promoting behaviours if the displays included a trivia question. This information suggests that health promotion program planners could produce creative prompts that are not typical of most health messages but may be uniquely suitable for this population. Additionally, point-of-choice prompts could simply serve as decorations to improve the ambience within a building, and more esthetically appealing prompts (i.e., displays that are designed according to the students' preferences) could also make it easier for students to notice and read the health messages. For example, an unattractive staircase (i.e., stairs that are unpainted) could benefit from having colourful prompts displayed to create a more user-friendly environment to potentially increase its usage.[22] It is also important that the point-of-choice prompts are noticeable to students, by displaying larger posters, because they will be competing

for their attention with other advertisements and displays around campus. Similar to the findings from previous research, poster printing size A2 was found to be the most effective to significantly increase a health promoting behaviour such as staircase use.[32] Notably, participants greatly valued their time, and students mentioned that they will often select the most convenient choices presented to them. Hence, tailoring the messages to this priority population should promote the value of saving time as a result of performing a certain action (e.g., it takes less time to use the stairs rather than wait for the elevator). It is also crucial to consider uncontrollable factors such as seasonal effects when developing a campus-based intervention with the aim of increasing rates of active transportation among postsecondary students. Furthermore, there are different aspects of the built environment that are positively associated with the participation in physical activity such as the availability of sidewalks, and this may differ in urban and rural areas.[33] This study served as an important preliminary step to identify the needs of the student population in order to develop highly tailored interventions that will meet their recommendations.

Health promotion programs have included different strategies and tools to promote physical activity at the population level, and combining multiple components within a program may increase its success.[30] Tailored point-of-choice prompts could be included within social marketing campaigns that aim to increase health promoting behaviours, which utilizes conventional marketing techniques to influence individuals' behaviours in order to improve their personal well-being.[34] However, if key social marketing aspects were excluded from a study (e.g., exchange theory), it cannot be considered a complete social marketing campaign.[34] In particular, a campus-based social marketing campaign focused on the potential benefits of physical activity specific to students' values, such as those related to improved academic

performances, may encourage their increased uptake, and could fit within a health promotion framework.[31,35] As such, point-of-choice prompts could serve as effective cues to help motivate university students to engage in healthier lifestyles and could be used as part of a social marketing campaign that promote physical activity on a post-secondary campus.[11,21] For example, a social marketing campaign at a Canadian university was conducted and utilized focus groups to identify motivational factors for engaging in physical activity before implementing their program.[31] The researchers found that some students thought that physical activity was a healthy and social activity that made them feel more productive, and the results indicated that the program may potentially help enhance some students' physical activity levels.[31] Furthermore, in order to establish a sound rationale for any physical activity program, tools that are utilized within the program need to be clearly explained during the planning and development phase. Therefore, it is important to recognize that point-of-choice prompts are meant to help facilitate individuals' intentions into behaviours (e.g., having a poster displayed where an individual has to decide whether to use the staircase or elevator) compared to motivational posters, which are meant to enhance individuals' attitudes toward a behaviour (e.g., a poster in an elevator that promote the health benefits of staircase use).[30] A clear explanation of the tool used within a physical activity program could help relieve any possible confusions that might occur, and ensure that the program is replicable by others.

The insights gained from the participants of this study are valuable considering it is essential to find different ways to motivate inactive undergraduate students who are at highest risks of developing poor behavioural routines beyond early adulthood.[9] In particular, researchers have also reported that inactive individuals may actually achieve the most health benefits with modest improvements to their physical activity levels.[4,5] Although there have been mixed

outcomes for interventions that targeted incidental physical activity in the past,[12] conducting a study to determine what the priority population will be most receptive to is a salient first step to understanding this cohort before implementing a health promotion program.[20] In other words, it is crucial to properly plan a health promotion program before moving to the implementation phase in order to thoroughly consider the various components that should be included within the program. Researchers suggested that interventions that incorporate multiple components (e.g., motivational signs and point-of-choice prompts) are potentially more beneficial and may have greater buy-in from the population.[30,31] Furthermore, individuals' behavioural patterns are important to consider when developing interventions to enhance physical activity routines because people's daily routines are developed through the formation of habits.[36–38] If used well, point-of-choice prompts are tools that could help create and/or disrupt negative behavioural patterns in order to support students' participation in physical activity, which could lead to healthier lifestyle choices. As such, it is necessary to aid the student population to find the motivation to initiate and maintain active lifestyles because the routines and habits may ultimately last a lifetime. Therefore, it is crucial to understand the priority population's perspectives and preferences in order to create the most effective point-of-choice prompts that are tailored for a cohort.

Limitations and future directions

A number of limitations from the current study warrant discussion. First, although honesty demands were used to help reduce the likelihood, social desirability bias could have influenced participants to provide dishonest responses.[39] For example, focus group participants may have wanted to appear more active than they actually were in order to please the focus group moderators, who conduct physical activity research. Self-selection bias is also a potential

limitation for this study because the majority of students who participated in this study were students from the Faculty of Health Sciences, which could have meant that the participants had greater knowledge and interest in physical activity than a typical student. Despite multiple recruitment methods to attempt to invite a wide variety of students from different faculties from the host university, a fairly homogeneous sample was secured, and a relatively small one at that. Although data saturation was reached, this study included a small sample of Canadian university students who were young adults, which might limit the possibility of the findings being transferrable or representative of other cohorts or the general population of Canadian undergraduates. As such, the findings from this study could be limited and any further inferences should be made with caution.

Future research should focus on exploring and implementing the use of point-of-choice prompts to increase staircase use and active transportation rates through a campus-based health promotion program targeting post-secondary students. The results from this study could be utilized to guide the creation of the posters or signs (e.g., the poster design and messaging) for any future interventions that aims to incorporate point-of-choice prompts on post-secondary campuses. In order to investigate the effectiveness of point-of-choice prompts for improving rates of both staircase use and active transportation on a post-secondary campus, investigators may need to conduct multiple studies to identify the impact of the intervention for both behaviours. It is also important that researchers consider the use of point-of-choice prompts to increase physical activity levels among other cohorts such as secondary school students and older adults in order to better understand the efficacy of this particular intervention for improving rates of physical activity at the population level.

Conclusion

University students may feel overloaded with responsibilities and perceive that they have little time to schedule physical activity into their daily lives. Consequently, some may find themselves stuck in negative behavioural patterns. Point-of-choice prompts that are tailored for the student population may serve as powerful cues to disrupt unhealthy routines and help foster positive decisions and changes in order to motivate students to be active. The findings from this study illustrate students' preferences for simple poster designs and messages, which will help customize suitable point-of-choice prompts to encourage students to incorporate routines to enhance their active lifestyles. In conclusion, motivating university students to engage in more physical activity will translate to positive health trends for future generations, and doing so via incidental physical activity could represent an appropriate public health approach.

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Chapter 3: Skip the Wait and Take a Walk Home! The Suitability of Point-of-Choice Prompts to Promote Active Transportation among Undergraduate Students (Study 2)[2]

Physical activity is a health promoting behaviour that declines over time, with notable decreases taking place upon entering college and university.[1–5] In fact, researchers have found that university students not only have lower motivation to participate in physical activity, but they also engage in less walking and MVPA compared to high school students.[5] Through participation in physical activity, students can acquire health and other benefits, such as improvements in physical fitness, stress, and academic performance, all of which have been identified as areas students want to improve.[1,2,6–9] Addressing each of these areas does not have to be done in isolation. For instance, Sng and colleagues[1] discovered that engaging in a 15 minute moderate-intensity walking trip (i.e., *physical activity*) was associated with improved memory function (i.e., relevant to *academic performance*) for post-secondary students.[1] Additionally, daily transport-related physical activity, such as walking briskly and biking, could fall into the category of MVPA, which is associated with *stress reduction*, fitness improvements, and enhanced energy expenditure. As such, transport-related physical activity might represent a convenient and effective way for students to experience improvements in their physical and mental health, as well as academic performance.[1,6,10,11]

Active transportation can be described as any form of transportation that requires a person to exert physical effort to travel from one place to another.[12] Interestingly, post-secondary students in Australia who travel by public transportation have reported significantly higher levels of physical activity – through additional or lengthier walking trips – in comparison to those commuting by cars.[13] Similar findings have been reported by American researchers who

[2] A version of this chapter has been submitted for publication and is currently under review.

described public transport users as more likely than drivers to meet physical activity guidelines and recommendations (e.g., 150 minutes of MVPA participation on a weekly basis or accumulating 10,000 steps per day).[14,15] As such, providing students with unlimited access to public transport services, through a fare-free universal transit pass, could help to improve active transportation rates and alleviate common problems such as parking availability and traffic congestion on post-secondary campuses.[11,16,17] While public transit has been deemed a cost-effective mode of transportation that can help post-secondary students engage in increased amounts of physical activity during their daily commutes,[13] short distance transit trips could actually be detrimental to students' physical activity levels if they replace active modes of transportation, such as walking or biking, for commuters with unlimited access to public transit.[18-20] This is an inherent issue for any post-secondary institution that provides college or university students with fare-free universal transit passes (i.e., yearly bus passes as part of tuition).[21] Furthermore, common barriers to various modes of active transportation among post-secondary students include travel time and distance.[22] Thus, it is crucial to avoid inadvertently creating hindrances to physical activity when developing active transportation interventions for this particular cohort.

In the past, health promoting campaigns on post-secondary campuses that included motivational messages and behavioural prompts have been associated with some improvements in physical activity levels for the student population.[23,24] Point-of-choice prompts are behavioural prompts that take the form of posters or signs with informative health messages intended to help facilitate intentions into behaviours.[25] When designed well and strategically placed,[26] these prompts could help to reduce short distance transit trips and promote active transportation on post-secondary campuses, thus serving as an inexpensive intervention to enhance students' daily

physical activity levels.[27] A search of the existing literature on this topic reveals that there have been relatively few interventions that aim to increase rates of active transportation among this population.[28,29] Furthermore, the findings from the literature depicted varying levels of success for campus-based interventions that aim to promote active transportation among staff and students,[28] or for a particular mode of travel such as biking.[29] There is a need to further explore this topic, and displaying population-tailored point-of-choice prompts at campus transit stops may be an innovative strategy to decrease the number of short distance transit trips made on post-secondary campuses.

To date, no study known to the authors has been conducted to explore behavioural prompts for encouraging students' participation in active transportation and discouraging short distance transit trips on campus. Because the host institution already had an established universal transit pass program operating on campus at the time of this research, a unique opportunity was available to study a novel point-of-choice prompt intervention to investigate these relationships among a sample of Canadian university students. As such, this study represents a formative evaluation to assess the suitability of a point-of-choice prompt intervention delivered to public transit users at the host university's main campus. McKenzie and colleagues[30] described formative evaluations, which are implemented during an intervention's development stage, as helpful for determining the feasibility and acceptability of interventions, as well as their short-term results. This type of evaluation allows researchers to assess the program's quality and determine improvements that could enhance its value in the future.[30] The three-fold purpose of the second *Routines to Enhance Active Lifestyles* (REAL) Project was to: (a) determine undergraduate students' *awareness* of study-specific and strategically displayed point-of-choice prompts; (b) explore the perceptions of the *impact* of the point-of-choice prompts on the active

transportation choices (e.g., walking and biking) among students who were aware of the prompts; and (c) obtain students' *feedback* regarding the appeal and suitability of the study-specific point-of-choice prompts.

Methods

Study design

This was a cross-sectional intervention study. Two point-of-choice prompts (printing size A2: 60 cm by 42 cm) with encouraging messages to promote individuals' participation in active transportation were professionally designed and created for the current study (Figure 3). The prompts were crafted using the recommendations from a previous study that specifically focused on the design of effective point-of-choice prompts to promote active transportation among the target audience.[26] Before the behavioural prompts were displayed on campus, the investigators liaised with numerous administrative staff (i.e., media relations officer, building managers, project manager, fire safety manager, and a member of the advisory committee on environment and sustainability) to ensure that the plan for displaying the behavioural prompts met the school's policies and safety codes. There were several transit hubs located on the main campus of the host university at the time the study was conducted, and the behavioural prompts were displayed at two of its major/busiest hubs for 15 days in March 2018 (as shown in Figure 4). For context, it should be noted that the host institution spans approximately 481 hectares, is located in an urban environment, and the campus itself hosts 24,587 full-time undergraduate and 5,935 full-time graduate students. The investigators performed daily checks to ensure that the displays were undamaged and remained positioned at the pre-determined locations. At the end of the 15th day, the prompts were removed and student recruitment for data collection began. Approval from

the institutional review board was obtained to conduct all aspects of this study (Institutional Health Sciences' Research Ethics Board approval #110648; Appendix K).

Figure 3. The professionally designed and tailored point-of-choice prompts.

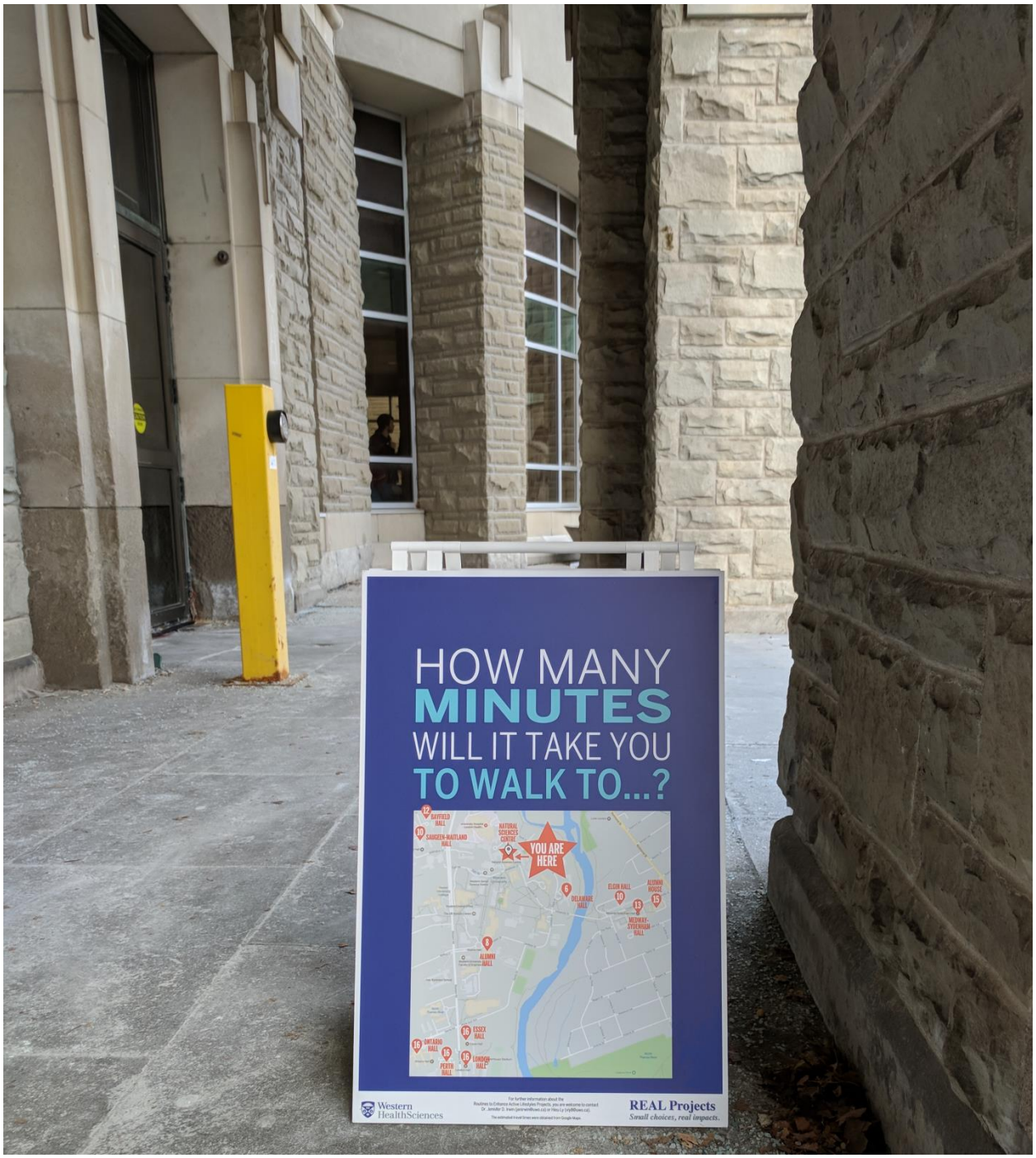

Figure 4. A point-of-choice prompt displayed on a university campus to promote active transportation (printing size A2: 60 cm by 42 cm).

Data collection tool

An online questionnaire was created specifically to address the purpose of this study (Appendix L). It contained a total of 20 questions, and was divided into four sections to explore students': (Section 1; one contingency question and one closed-ended question) awareness of the point-of-choice prompts; (Section 2; two questions on a five-point Likert scale) perceptions of the impact of displaying point-of-choice prompts to promote active transportation on campus; (Section 3; five questions on a five-point Likert scale and one open-ended question) feedback regarding the appeal and suitability of the study specific point-of-choice prompts; and (Section 4; ten closed-ended questions) demographics. Honesty demands were included in the instructions of the online questionnaire to discourage social desirability bias through encouraging participants' to provide their honest views and opinions.[31] The letter of information explained that consent was implied through access and completion of the online questionnaire, which was hosted on Qualtrics® (2018), and active for the month of April 2018. Lastly, 10 post-secondary students who were not involved in the study were asked to review the questionnaire to ensure its readability and item clarity.

Participant recruitment

This study took place during March and April of 2018. Eligibility criteria included being full-time, English speaking, undergraduate students registered at the host university. Invitations to complete the online questionnaire were sent via mass email (Appendix M). Additionally, recruitment flyers (Appendix N) advertising a link to the questionnaire were posted around campus, and 36 course instructors from various departments were contacted to share the recruitment information with their classes (Appendix O). There were no incentives or compensation for participation in this study.

Data analysis

There were 421 individuals who viewed the online questionnaire. Data from 15 individuals were eliminated for failure to meet the inclusion criteria, and data from an additional 60 individuals were also not included in the analysis because the questionnaires were left blank (i.e., no answers were provided for any of the questions). As part of the data cleaning process, all answers provided in section 2 of the questionnaire by those who indicated that they had *not* seen the prompts were removed because having seen the displays on campus was required in order to respond to these particular questions. Quantitative data collected from the closed-ended items on Likert scales were analyzed using descriptive statistics, in which worded options were translated to numerical indicators. Afterwards, means were calculated to depict the overall average for each question. The qualitative analysis included 444 quotations taken from all open-ended questions from the online questionnaire. Participants' responses were entered into QRS International NVivo® (version 10, 2012) to code and categorize potential themes from the qualitative data, and to perform different queries such as the Text Search and Word Frequency Query. The analysis of different nodes allowed for the organization of data, and this process helped the researchers to identify and make sense of the emergent themes. Additionally, comments provided in the open-ended questions were charted and analyzed using inductive content analysis,[32] whereby the major themes were identified by the investigators of this study and two research assistants. Lastly, demographic information was utilized to ensure that participants met the eligibility criteria and to provide for implications of the study's external validity.

Results

A convenience sample of 346 undergraduate university students of all sexes (61% identified as female) participated in this study (Table 2). Approximately 67% of participants

were under the age of 25, and over half of those recruited were Caucasians. Many participants were enrolled in the faculties of Health Sciences (21%), Science (20%), or Social Science (16%). Most respondents were unemployed and living off campus with others. About 44% of the participants lived in the university's city only during the Fall and Winter semesters, and 31% of them walked as their main mode of transportation. Other main modes of transportation included travelling by bus (23%) or car (15%).

Table 2. Demographic Information for Study 2 Participants (*N* = 346)

Characteristic	*n*	%
Sex		
Male	42	12.14
Female	212	61.27
Other	1	.29
Age		
19 years and under	89	25.72
20-24 years	144	41.62
25-29 years	15	4.34
30 years and over	6	1.73
Ethnicity		
African Heritage	3	.87
Caucasian	183	52.89
East Asian	27	7.80
Hispanic	4	1.16
Indigenous	2	.58
Middle Eastern	7	2.02
South Asian	14	4.05
Other	14	4.05
Employment Status		
Not Employed	148	42.77
Part-time	103	29.77
Full-time	4	1.16
Program of Registration		
Faculty of Arts and Humanities	16	4.62
Faculty of Engineering	6	1.73
Faculty of Health Sciences	74	21.39
Faculty of Information and Media Studies	5	1.45
Faculty of Music	5	1.45
Faculty of Science	68	19.65
Faculty of Social Science	55	15.90
Other	26	7.51
Year of Academic Enrollment		
First	77	22.25
Second	56	16.18
Third	46	13.29
Fourth	57	16.47
Other	17	4.91
Place of Residence		
London, Ontario (Fall and Winter semesters)	151	43.64
London, Ontario (year round)	96	27.75
Outside of London, Ontario	8	2.31

Living Arrangement		
On campus	75	21.68
Off campus by myself	16	4.62
Off campus with roommates	104	30.06
Off campus with family or relatives	60	17.34
Typical Mode of Transportation		
Walk	107	30.92
Bike	4	1.16
Bus	78	22.54
Car	53	15.32
Other	13	3.76

Note. Responses may not reflect the total number of participants, and thus, not all percentages add up to a hundred percent due to responses received.

As shown in Table 3, 41% (*n* = 143/346) of respondents were aware of the point-of-choice prompts that were displayed on campus. The majority (~ 60%) who saw the prompts reported that the displays had little to no impact on their transportation choices (i.e., the respondents answered either: neither agree nor disagree, disagree, or strongly disagree to the following statement, *"Overall, the point-of-choice prompts that were displayed on campus encouraged me to participate in active transportation."*). However, about 21% of participants (*n* = 27/131) reported that the prompts motivated them to engage in some form of active transportation (as illustrated in Table 4). Overall, the majority of participants rated the designs (84%), messages (78%), and locations of where the point-of-choice prompts were displayed on campus (86%) as suitable and appealing (Table 5). The major themes derived from the inductive content analysis supported the notion that the design of the displays and the locations of the point-of-choice prompts affected whether or not they noticed the intervention on campus. In summary, the most prevalent themes from the open-ended questions included: (a) participants' awareness levels were associated with the designs, messages, and distribution of the displays; (b) the point-of-choice prompts did not impact the transportation choices of the students who saw them; (c) the point-of-choice prompts positively reinforced respondents to engage in active transportation; and (d) respondents' perceptions of active transportation and external factors were noteworthy barriers to higher rates of physical activity (Table 6).

Table 3. Awareness of Point-of-Choice Prompts among Participants (*N* = 346)

	Items and Options	*n*	%
1	I have seen one or more of the point-of-choice prompts above displayed at a transit hub on campus.		
	- Yes, I have seen one or more of the poster(s)	143	41.33
	- No, I have not seen any of the posters	203	58.67
2	Please specify the location(s) where you saw any of the point-of-choice prompts shown above.		
	- One location	99	28.61
	- Two locations	39	11.27

Note. Responses may not reflect the total number of participants, and thus, not all percentages add up to a hundred percent due to responses received ; *n* = number of participants that responded to the question and were included in the analysis.

Table 4. Impact of Active Transportation-Promoting Point-of-Choice Prompts

	Item	*n*	*M*	*SD*
1	Overall, the point-of-choice prompts that were displayed on campus encouraged me to participate in active transportation.	131	3.14	1.01
2	I have engaged in more active transportation as a result of seeing the point-of-choice prompts on campus.	131	2.70	1.01

Note. Items were on a five-point Likert scale and anchor scores were (1) strongly disagree and (5) strongly agree; *n* = number of participants that responded to the question and were included in the analysis; *M* = mean score; *SD* = standard deviation.

Table 5. Participants' Feedback of Point-of-Choice Prompts Suitability

	Item	*n*	*M*	*SD*
1	I feel motivated by the point-of-choice prompts shown above.	255	3.57	.96
2	The designs (e.g., images and colours) of the point-of-choice prompts are suitable and appealing to me.	255	3.91	.78
3	The messages contained in the point-of-choice prompts are suitable and appealing to me.	255	3.89	.91
4	Alumni Hall is a suitable location to display point-of-choice prompts to encourage undergraduate students to participate in active transportation.	253	4.09	.89
5	Natural Sciences Centre is a suitable location to display point-of-choice prompts to encourage undergraduate students to participate in active transportation.	255	4.25	.75

Note. Items were on a five-point Likert scale and anchor scores were (1) strongly disagree and (5) strongly agree; *n* = number of participants that responded to the question and were included in the analysis; *M* = mean score; *SD* = standard deviation.

Table 6. Number of Supporting Quotations for Each Theme (*N* = 444)

	Themes	*n*	%
1	Participants' awareness levels were associated with the designs, messages, and distribution of the displays.	315	70.95
2	The point-of-choice prompts did not impact the transportation choices of the students who saw them.	70	15.77
3	The point-of-choice prompts positively reinforced respondents to engage in active transportation.	34	7.66
4	Respondents' perceptions of active transportation and external factors were noteworthy barriers to higher rates of physical activity.	25	5.63

Note. The quotations were collected from all of the open-ended responses from the online questionnaire.

Designs, messages, and locations of the prompts

Many participants commented on the designs, messages, and locations of the point-of-choice prompts. For the most part, respondents provided positive feedback about the signs and expressed that the displays were well-designed and included effective messages. An example below illustrates reasons one participant thought the designs of the prompts were effective:

> "The posters are very aesthetically-pleasing, in that the fonts are large enough and clear enough to be read, while every aspect of the poster – from the words to the images – stands out. The posters are not cluttered with information, and while the map information might be small, the orange stars that highlight the key buildings make it manageable to navigate through campus, if you chose to walk instead of take the bus."

By contrast, some participants thought that different colours (i.e., other than school colours) should have been used in order to make the displays stand out from other advertisements on campus. For example, one participant wrote:

> "I think there could be more contrast in the colours to make the message pop [out]. There are a lot of advertisements from clubs on campus and I do not think the designs of these prompts really pop out from the rest."

Most participants described the messages included on the displays as appropriate and appealing for students on campus. The quote below reflects a respondent connecting with the messages, which, in turn, motivated them to engage in active modes of transportation to/from school or home:

> "I like the terms/words 'skip the wait', 'physical activity' and 'productive'. As a busy student who cares about my health, it encourages me to walk to my destination because I am able to get physical exercise just by going to class/going home."

According to the participants, the two campus locations where the prompts were displayed were suitable to promote active transportation among students. Participants described the chosen locations as high traffic areas on campus where students normally pass by or wait for public transit. Respondents said:

> "This building is almost exclusively used as a bus stop on a regular school day and I feel like a lot of students catch buses here to get to other areas on campus, which would be the target demographic for the prompts."
>
> "It [the building] is in the heart of the campus and is a stop for both public buses and the [university] affiliates' shuttle buses, so there would be huge volumes of foot-traffic passing by the building, which can maximize the impact of these prompts."

The impact of the prompts on active transportation

Some participants articulated that the point-of-choice prompts motivated them to engage in some form of active transportation. Notably, the point-of-choice prompts served as a reminder that physical activity could be easily included during commutes rather than taking a bus for one or two stops. For instance, two participants wrote:

> "The signs remind me that walking to my destinations does not take as much time as I think it does. I really like seeing them on campus."
>
> "I live far from campus and I usually drive to and from campus. However, I am sometimes lazy and will bus to the parking lot. The signs reminded me that I should just walk instead."

In contrast to the finding above, many individuals commented that the point-of-choice prompts had little to no impact on their transportation choices because they already typically use a form of active transportation to travel to campus. For example, a respondent who regularly

walks to campus found that the behavioural prompts were not effective tools for encouraging additional walking trips off campus. This respondent stated:

> "I have always chosen to walk to other parts of campus, rather than take the bus or drive. I would only take the bus or drive to go off campus. While I found the poster interesting, it did not increase the amount of active transportation that I do."

Perceptions and barriers to active transportation

Three factors that affected students' mode of travel included travel distance, poor weather conditions, and lack of time. For instance, some participants mentioned that they would rather allocate their time to do other things (e.g., studying) rather than increasing their length of commute or travel time. Moreover, the cold weather and precipitation that occurred during the duration of the study could have also prevented students from choosing to participate in active transportation as their daily mode of travel. The following quotes exemplify these sentiments:

> "I live too far to walk home in a reasonable amount of time."

> "I saw it [the point-of-choice prompt] on the day I decided to take the bus instead of walking home due to the cold weather. So seeing the sign did not encourage me to walk home that day."

Lastly, comments suggested that participants' perception of active transportation could have affected their transportation choices. Specifically, students with some knowledge about the health benefits of physical activity could potentially view the point-of-choice prompts with indifference. For example, one participant stated:

> "The prompts might be viewed by individuals who already understand the benefits of exercise and may simply choose to ignore the signs."

Comment

In recent years, there has been a shift towards the promotion of, and participation in, lifestyle-based activity over leisure-time physical activity.[18–21,33] Active transportation, in particular, has been identified as a form of regular incidental physical activity that can be part of adults' daily lives.[21,33] With many university students reporting low rates of physical activity,[3,4,34] campus-based physical activity initiatives are recommended.[24,28] The results of the current intervention study underscored that students' perceptions of active transportation and external factors (e.g., weather, travel time, and distance) were noteworthy barriers to their physical activity. Although students assessed the point-of-choice prompts as suitable, the displays did not impact the transportation choices of the majority of participants who saw them. Other novel campus-based health programs to promote physical activity, such as the MoveU and Active Lions campaign, have seen some success to increase physical activity and active transportation among post-secondary students.[24,28] The findings from the current study revealed higher levels of students' awareness of prompts (41%) compared to other physical activity interventions, such as the MoveU program at another Canadian university (36% awareness level),[24] and the Active Lions campaign to promote active transportation on an American campus (30% awareness level).[28] Moreover, participants from this study found that the point-of-choice prompts were well-designed and suitable motivational tools, but it had little impact to increase active transportation rates among those who saw them. It is important to consider that barriers to active transportation could have greatly decreased rates of participation on campus. Similar to other studies, the investigators of this study found that students reported time constraints, travel distance, and weather as major barriers for engaging in active transportation.[26,33] Of note, the city in which the current study took place experienced colder temperatures (average of -1°C with

highs and lows between 9°C and -9°C) during the intervention period.[35] Nonetheless, some individuals reported that active transportation could be a way for them to accumulate physical activity during commutes rather than spending additional time performing leisure-time physical activity at recreational facilities (e.g., playing sports).

College and university students tend to engage in low levels of active transportation despite the potential health benefits they could gain by shifting from their typical and less active modes of travel during their daily commutes.[36–38] For instance, in a longitudinal study that examined different health behaviours among high school and post-secondary students, a decrease in physical activity levels were associated with higher body mass index scores.[34] Of particular relevance to the current study, the authors found the students' active transportation rates decreased among both male and female students upon entering post-secondary studies.[34] Similarly, Yang and colleagues[36] examined longitudinal changes in active transportation rates over 27 years and found a decline in levels of engagement among teenagers; but importantly, it was also reported that increasing rates of participation in active transportation was associated with higher physical activity levels among young adults. Furthermore, the findings of a seminal study from Japan indicated that adults' daily walking trips to work were significantly associated with health benefits, including reductions in hypertension and decreased premature death.[37] Of note, this seminal study contributed substantially to the preliminary body of research that highlighted the possibility of gaining health benefits from engaging in non-deliberate physical activity behaviours such as walking to work during daily commutes. As previously noted, active transportation rates remain low among the college and university student population despite the potential health gains that active transportation could provide.[29,38] For example, a mere 16%[38] of Australian to 33%[29] of Spanish post-secondary students reported walking as their main mode of

transportation. When considering biking as the main mode of transportation, the findings are even lower, at 5%[38] to 11%[29] of students. Rissel and colleagues[38] completed a large study that included over 2,000 Australian post-secondary students. They concluded that participants who walked or biked to school were more likely to meet physical activity guidelines compared to those who used motor vehicles. Although the current study yielded mixed results, when combined with other studies in the field, what remains clear is the need to determine effective strategies to help post-secondary students adopt and maintain active transportation routines.

Limitations and future directions

Although the findings above represent important contributions to the point-of-choice prompts literature, they are not without limitations. Firstly, as with any survey study utilizing questionnaires, it is impossible to rule out the effects of social desirability and self-selection bias. For this study, honesty demands were utilized to help mitigate the effects of social desirability biases, yet there is no way to know how those who did not choose to participate would have responded (i.e., it is possible that the prompts did impact the active transportation rates among others who did not choose to complete the online questionnaire). The sample for this study included mostly Caucasian female undergraduate students from one Canadian university; and consequently, the findings may not be representative of the entire targeted cohort. Additionally, the cold temperature during the intervention period undoubtedly served as a deterrent to students engaging in active transportation. Since this was a formative evaluation to assess the overall suitability of the point-of-choice prompt intervention, two weeks of displaying the prompts was deemed appropriate. However, to increase students' awareness of the prompts, the intervention should last throughout the school year. In terms of future directions for those engaging in this

field of study in multi-season locales, we recommend student-tailored prompts suited to each season.

Conclusions

There are low rates of active transportation on post-secondary campuses among college and university students, and novel campus-based strategies are needed to encourage active lifestyles. The findings from this research contributes to developing interventions to increase active transportation rates among college and university students, and to further understanding the extent to which behavioural prompts will influence transit users' decisions to engage in active transportation.

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Chapter 4: Step on Up! A Multi-Component Health Promotion Poster-Based Intervention to Promote Stair Climbing at a Library on a University Campus (Study 3)[3]

With the recent release of the second edition of the Physical Activity Guidelines for Americans,[1] a spotlight has once again been cast upon physical activity and its many health benefits. Around the same time that these guidelines were released, the World Health Organization (WHO) published a Global Physical Activity Action Plan[2] that focused on reducing rates of adults' physical inactivity, on an international level, by 10% by 2025 (and 15% by 2030).[2] WHO researchers also published a comprehensive analysis of physical inactivity, and concluded that population-based policies need to be mandated in order to meet the goal of reducing insufficient physical activity levels worldwide.[3] One population-based approach which could evolve into such a policy—and that was mentioned by the 2018 Physical Activity Guidelines Advisory Committee—is point-of-choice prompts (e.g., posters/signage that promote the use of staircases instead of elevators).[1] Due to their potential positive influence on behaviours, point-of-choice prompts might be a cost-effective and impactful public health approach for promoting higher activity levels.[4,5]

Point-of-choice prompts, as a type of population-based physical activity intervention, might be particularly impactful if implemented among populations with higher physical inactivity rates. An example of one such population is Canadian adults, and more specifically, Canadian young adults attending post-secondary education. That is, objectively measured activity levels using accelerometers (among adults aged 20 years and older) have indicated rates of compliance to physical activity guidelines as low as ~15% in Canada.[6] When considering early adulthood in particular, these formative years often include transitions (e.g., change of

[3] A version of this chapter has been submitted for publication and is currently under review.

personal habits and/or residences) that can both disrupt current lifestyle behaviours and help to establish longer-term ones.[7,8] In fact, during this time of early adulthood there is a noticeable decline (≥ 5 minutes/day) in MVPA.[9,10] This concerning trend of insufficient physical activity remains true when focusing specifically on Canadian post-secondary students.[11]

Physical activity has numerous health benefits such as, but not limited to, improving cognitive functions and brain health, reducing the risk of excessive weight gain, and lowering the risk of some diseases (e.g., diabetes and certain types of cancers).[1,12] Additionally, post-secondary students who regularly engage in physical activity are known to have lower levels of anxiety and depression, and better mental health than students who are less active.[13] Of note, stair climbing is a physical activity that is available to many, and could help individuals accrue health benefits such as improving cardiovascular functions and fitness.[14,15] In terms of the amount of energy stair climbing necessitates, the updated compendium of physical activities described stair climbing (i.e., going up a flight of stairs) as a vigorous form of physical activity that requires 8 METs—this makes it a more vigorous activity than "general" jogging (7 METs).[12] In comparison, descending a flight of stairs requires only 3.5 METs (a moderate-intensity physical activity).[12] Therefore, the promotion of stair climbing through a population-based intervention (e.g., point-of-choice prompts) could concomitantly facilitate the acquisition of physical activity-related health benefits and help to combat the high rates of inactivity.

A recent systematic review of all signage-based staircase interventions since the 1980s reported that point-of-choice prompts could increase the likelihood of staircase usage by 52%.[16] Although point-of-choice prompts have been recommended as an efficacious way to promote this behaviour, there were relatively few studies that used a multi-component approach utilizing different types of health posters simultaneously to promote staircase use.[16] A variety of health

posters could be utilized to promote staircase use. For example, point-of-choice signs could be posted to encourage intentions into actions (e.g., a poster displayed at a location where someone has to choose between using the stairs or elevator).[17–19] Additionally, motivational posters could be displayed to enhance attitudes towards an action (e.g., a poster with information about the benefits of stair climbing displayed inside of an elevator).[17–19] Also, trivia-based posters in a stairwell (e.g., one question on the main floor with the answer and a new question on the next floor up) might also encourage some adults to participate in stair climbing by making the activity more engaging and fun.[17] Lastly, posting directional signs (i.e., arrows indicating staircase locations) can help people find hidden staircases.[20] It is imperative that the messages presented on each poster are suitable for a particular location because different types of information (e.g., a simple message versus a complex message) can impact whether people choose to engage in the activity.[21]

Even though some researchers have found no significant changes in staircase use among adults exposed to point-of-choice prompts,[22,23] those who have studied the impact specifically on post-secondary campuses in the United States and United Kingdom have found it to be an effective strategy to increase staircase use.[19,20,24] However, it is unknown whether the simultaneous use of multiple types of health posters (i.e., displaying point-of-choice prompts, directional posters, motivational posters, *and* stairwell posters) as part of a health promotion intervention will substantially enhance rates of stair climbing among adults on a Canadian university campus—a place of study and worksite for thousands of young and other adults. As such, the third *Routines to Enhance Active Lifestyles* (REAL) Project examined a multi-component health promotion poster-based intervention, tailored specifically for a busy library, to increase rates of stair climbing among adults on a Canadian post-secondary campus.

Methods

Study setting and research context

To contextualize this study, the post-secondary institution where it was conducted included: 24,587 full-time undergraduate students (71.5%), 5,935 full-time graduate students (17.3%), 1,405 full-time faculty (4.1%), and 2,455 full-time staff (7.1%).[25] The study site—a campus library—has five floors that also include a mezzanine and ground floor and received over 5,000 visitors on average per day in March 2018. Prior to this study, focus groups were conducted in order to determine the most suitable and appealing poster designs and messages.[17] The current study provides a formative evaluation of the use of a multi-component poster-based intervention to promote stair climbing among adults at the campus library. Although this study is only assessing short-term results, a central aspect of this type of evaluation is to allow researchers to verify the acceptability of this health promotion intervention and/or discover possible issues that could reduce the quality of this type of research. Additionally, conducting a formative evaluation could potentially help investigators make improvements to the intervention in future studies.[26]

Study materials

The current study included four different types of posters: a point-of-choice prompt, directional posters, motivational posters, and stairwell posters (see details below). Based on participants' suggestions from a previous study that focused on what students find most suitable and appealing in point-of-choice prompts,[17] the poster designs were specifically tailored and professionally created by a graphic designer. Most posters were printed on ledger size paper (~ poster printing size A3, 42 cm by 30 cm) and laminated (Figure 5), and one directional poster for locating the staircase was printed on letter size paper (~ poster printing size A4, 30 cm by 21 cm)

so it could fit in a frame that was placed underneath the elevator buttons (Figure 5). The point-of-choice prompt message was, “Stair climbing burns more calories per minute than jogging. Raise your level of fitness one step at a time.” [18] and it was posted on the wall of a corridor that provided access to the elevators and stairwell. The more complex message stating, “Stair climbing always burns calories; 10 flights a day for over a year burns over 3lb of fat!” [19] was included on the motivational posters, and these were displayed inside two elevators. These messages were adapted from previously published studies about staircase use, [18,19] and they were selected based on ratings from focus groups with undergraduate students as part of a needs assessment.[17] Directional signs were also posted on the walls of a corridor and below the elevator buttons to help individuals locate the stairs. Lastly, stairwell posters that contained a trivia question/answer (i.e., “How many steps would it take to walk to the next floor?” and “It took ___ steps to get up to this floor.”) were displayed at the bottom and top of each flight of stairs.

Figure 5. Locations of where health posters to promote stair climbing were displayed: (1) top left – a point-of-choice prompt poster displayed before two elevators; (2) top right – a directional poster displayed below the elevator buttons; (3) bottom left – a motivational poster displayed in an elevator; and (4) bottom right – stairwell posters displayed at the bottom and top of a flight of stairs.

Inclusion and exclusion criteria

The inclusion criteria for this study were adults who ascended to upper levels of the building using the busiest staircase and elevators from the main floor of a campus library. The exclusion criteria were children using the staircase/elevators who were with an adult at the library because it could reasonably be assumed that they would comply with the decision made by the adult accompanying them. Individuals were also excluded if they were carrying noticeably heavy objects (e.g., a bin or a large instrument), pushing a cart, or had noticeable physical limitations that might preclude stair climbing (e.g., people in wheelchairs or using a cane/walker).

Study design

Upon approval from the institutional review board (Health Sciences' Research Ethics Board approval # 113009; Appendix P), this pre-post intervention study was conducted for a total of 28 days in March 2019. Before data collection began, the research team observed the study site and also used previously gathered data from electronic sensors at the entrance of the library to determine times of high levels of pedestrian traffic (data from March of the previous year was used). Consequently, data collection occurred at 12:30pm–1:30pm on weekdays and 1:30pm–2:30pm on weekends during the 7-day baseline assessment period, 14-day intervention period, and 7-day follow-up period. On the first floor of the library, an investigator and a research assistant observed a set of two elevators and a stairwell with 14 flights of stairs. A convenience sample of adults who used the elevators and stairs to go to upper levels were recorded with a tally counter (Staples® Tally Counter—a mechanical device with a thumb push that can record and display a count between 0–9,999), while either in the absence/presence of a point-of-choice prompt, motivational posters, directional posters, and stairwell posters. At

baseline, no prompts or posters were displayed and each adult who used the stairs or elevator was counted. During the intervention phase, the study materials were displayed and the research team recorded the number of individuals who used the stairs or elevators. At follow-up, the prompts and posters were removed and final observations were made. The lead investigator and research assistants met before each data collection period to confirm the posters were properly displayed and then after each period to discuss any disruptions in data collection. To help facilitate this process, an observation guide (Appendix Q) with a comment section was created to track any inconsistencies at the study site that may have disrupted data collection (e.g., the need to replace missing posters or fix those not properly displayed).

Data analysis

The data were entered in Microsoft Excel (version 16, 2016). Frequencies and percentages were calculated to summarize each phase of data collection. Chi-square tests were performed, using an alpha of .05, to evaluate whether the frequency of staircase use differed before and after the posters were presented. The data collected on weekdays (Mondays to Fridays) and weekends (Saturdays and Sundays) were analyzed separately given that substantially more people visited the library on weekdays than on weekends during data collection.

Results

In total, 7,663 adults used the staircase or elevator (6,344 on weekdays and 1,319 on weekends) during 28 days of data collection (see Table 7). The frequency of staircase use and elevator use during the three observation periods is depicted in Figure 6.

Table 7. Total Number of Observations and Percentages for Each Phase (*N* = 7,663).

	Weekdays		Weekends	
	Elevators (%)	Stairs (%)	Elevators (%)	Stairs (%)
Baseline	1,405 (84.4%)	260 (15.6%)	379 (91.1%)	37 (8.9%)
Intervention	2,517 (80.7%)	604 (19.4%)	480 (89.2%)	58 (10.8%)
Follow-Up	1,274 (81.8%)	284 (18.2%)	326 (89.2%)	39 (10.7%)
Total	5,196 (81.9%)	1,148 (18.1%)	1,185 (89.8%)	134 (10.2%)

Note. Observations and percentages of adult users who met the inclusion criteria.

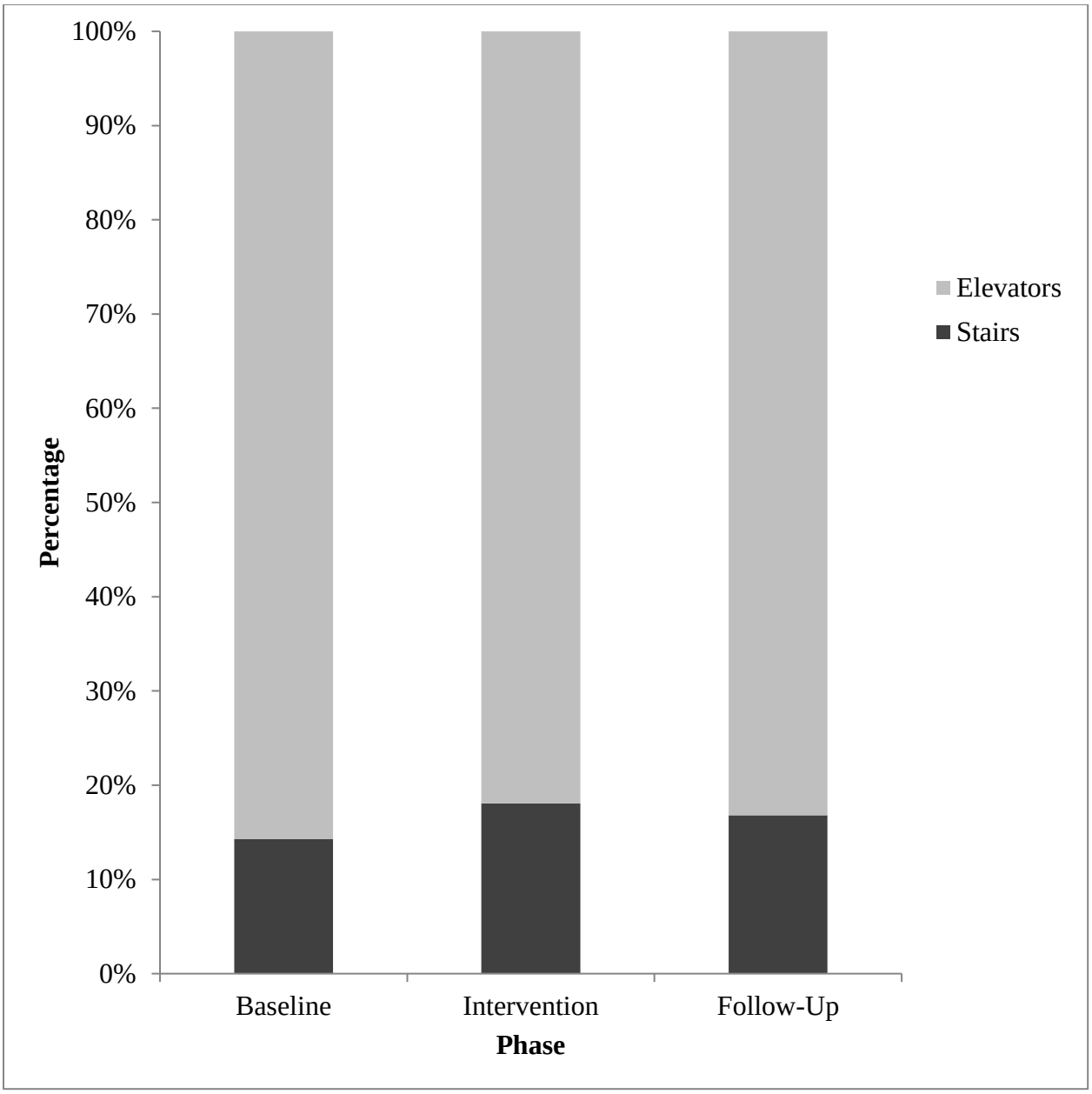

Figure 6. The percentage of stair climbers and elevator users in each observation period.

Rates of staircase and elevator use on weekdays

During the weekday baseline data collection period, approximately 15.6% of adults going to an upper floor of the library used the stairs (260 of a total of 1,665). In comparison, during the intervention period (when the posters were displayed), approximately 19.4% of adults used the stairs (604 of a total of 3,121); and during the follow-up period (posters removed), approximately 18.2% of adults used the stairs (284 of a total of 1,558). Thus, the overall percentage increase in staircase use was 3.7% between the baseline and intervention periods, and 2.6% between the baseline and follow-up periods. A chi-square test of the association between stair use (versus elevator use) and observation period (baseline, intervention, follow-up) was statistically significant [χ^2 (2) = 10.26, $p < .01$], indicating that, overall, staircase use differed among the three observation periods.

This overall effect was followed-up by performing three post hoc comparisons using a Bonferroni-adjusted alpha (i.e., .05 divided by 3). It was found that staircase use during the intervention period (19.4%) was significantly higher [χ^2 (1) = 10.25, $p < .01$] than during the baseline period (15.6%). In addition, staircase use during the follow-up period (18.2%) was significantly higher [χ^2 (1) = 6.72, $p < .01$] than during the baseline period. Lastly, it was found that staircase use did not differ significantly between the intervention and follow-up periods [χ^2 (1) = 3.60, $p = .06$].

Rates of staircase and elevator use on weekends

During the weekend baseline data collection period, approximately 8.9% of adults going to an upper floor of the library used the stairs (37 of a total of 416). During the intervention period, approximately 10.8% of adults used the stairs (58 of a total of 538); and during the follow-up period, approximately 10.7% of adults used the stairs (39 of a total of 365). However,

a chi-square test of the association between stair use and observation period was not statistically significant [χ^2 (1) = 1.07, $p > .05$], indicating that, on weekends, staircase use did not differ among the three observation periods. It is also interesting to note that the overall percentage of adults who took the stairs on weekends (10.2% stairs vs. 89.8% elevator) was significantly lower [χ^2 (1) = 49.4, $p < .001$] than the overall percentage of adults who took the stairs on weekdays (18.1% stairs vs. 81.9% elevator).

Comment

The absolute increase in stair climbing (i.e., the overall percentage increase in staircase use between baseline and follow-up during data collection) [27] from this intervention was 2.5%. Unfortunately, this multi-component poster-based intervention seemed to produce similar findings to using point-of-choice prompts alone (e.g., an absolute median increase of 2.2% was reported from pooled data).[16] Although descriptive statistics indicated relatively small differences in stair climbing between baseline and follow-up periods, significant differences were detected for data collected on weekdays. That said, as this study was conducted at only one building at the host institution, the intervention might see larger differences in staircase use (i.e., be more impactful) if implemented campus-wide. Furthermore, exploring what might help make the intervention more influential during weekends is needed.

This study exemplified that health posters can be part of a health promotion intervention to help change behavioural patterns at a busy library on a Canadian university campus. Previous research reported that point-of-choice prompt interventions had positive results in many different settings such as offices, hospitals, shopping centres, and transportation hubs.[15,18,28] Although the health posters utilized in this study did not differ noticeably from previous findings, one unique and interesting finding from this study is that more adults utilized the stairs from Mondays to

Fridays, and weekend library users were about half as likely to use the stairs as weekday library users. Even though entries in the observation guide revealed that on three occasions the research team noticed a few directional posters had been displaced or flipped backwards (on two consecutive weekdays and one weekend day), these posters were fixed as soon as they were noticed. As such, poster disruptions do not explain the difference.

There are several factors of the built environment that are relevant to this study and might help to explain the lower than anticipated influence of the intervention.[29] Specifically, the location of the stairwell at the campus library is not apparent when entering the building, and the design of the staircase itself (i.e., unpainted and dimly lit with no windows) may have affected adults' decisions to take the stairs.[29] In particular, Basset and colleagues[29] purport that buildings with accessible and well-designed staircases should have substantially higher rates of staircase use compared to elevator-centric buildings. Nonetheless, displaying health posters such as point-of-choice prompts and directional signs in a building should serve as a helpful reminder that triggers some individuals to be more active. [18–20]

Limitations and future directions

First and foremost, one limitation of the current study might pertain to the tailoring of the intervention, which was informed only by undergraduate students' perspectives, and not by graduate students or faculty/staff who also frequent the university campus. Although this is a noteworthy limitation, because over 70% of the host campus is made up of full-time undergraduate students,[25] this was not deemed to be a major concern. A second limitation is social desirability bias. That is, some of the participants being observed throughout this study might have noticed the research team, which might have influenced some of their decisions to take the stairs versus the elevator. In addition, only the busiest staircase and elevators from the

main floor at the campus library were observed, with other staircases and elevators not included in data collection; it is difficult to know if similar findings would have occurred at these other locations. Also, it was not feasible for the research team to conduct data collection during all hours that the library was open. To try to reduce the impact of this reality, periods of highest traffic were chosen. An additional limitation of this study pertains to the timing. That is, the observations during one weekend of the intervention period fell on a holiday (Saint Patrick's Day) commonly celebrated among students. The widespread revelry associated with this holiday weekend might help to explain why fewer people visited the library for a few days and/or their choice to use the stairs when they did. In addition to the specific limitations noted above, the inherent limitations of the observational study design include many confounding variables that may have been at play; no inference of causality can be suggested between the intervention and findings. To help combat this limitation, future studies that employ similar interventions could be conducted in multiple buildings while utilizing one location as a control group. Furthermore, discretely placed video cameras or electronic sensors could be used as objective measurements instead of human observers at the study site(s) in order to reduce the potential effects of social desirability bias. Additional research is needed to explore different interventions to increase stair climbing, particularly on weekends.

Conclusions

This study investigated the use of several different types of health posters to increase rates of stair climbing at a busy library on a Canadian university campus. The results of this study indicated that a multi-component health promotion poster-based intervention was associated with increased rates of stair climbing among adults during weekdays. However, this particular intervention was not associated with similar increases in stair climbing during

weekends. The percentage of absolute change for stair climbing from this study was similar to previous research that relied only on point-of-choice prompts to promote staircase use. In conclusion, the findings from the current study indicate that displaying multiple types of posters simultaneously did not seem to substantially influence adults' decisions to engage in stair climbing beyond the use of only point-of-choice prompts.

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Chapter 5: Summary, Limitations, Future Directions, Implications, and Conclusions

College and university students are at risk of developing poor physical activity patterns that may track long-term, which could result in detrimental health outcomes later on in their lives. [1–3] Incidental physical activity (e.g., walking to school or stair climbing) can be easily incorporated as part of post-secondary students' daily routines. For those at risk of low activity levels, habits and behavioural patterns need to be established early on, and health promoters can help to support healthy behaviours through the implementation of population-based interventions. Point-of-choice prompts attempt to alter and create habits in hopes of becoming the antecedent to a desired behaviour that will one day evolve into an automatic response.[4–6] Therefore, displaying point-of-choice prompts to promote physical activity could be seen as an efficacious solution to the problem of inactivity among undergraduate students.[7,8] As such, the overall purpose of this research program (i.e., the REAL Projects) was to explore the use of tailored point-of-choice prompts to promote active transportation and staircase use among university students. The Generalized Model for Program Planning was used to guide the design, implementation, and evaluation in Studies 1–3.[9] There are numerous barriers that exist to deter undergraduate students from performing physical activity (e.g., time, weather, and the built-environment), and thus, tailored campus-based interventions were implemented in order to encourage students to include additional incidental physical activity within their daily lives. The results of this research program may guide the development of other campus-based physical activity programs that aim to increase rates of incidental physical activity (in particular active transportation and stair climbing) among post-secondary students. Additional studies that include objective measures and control groups are needed before further inferences can be made about the efficacy of utilizing behavioural prompts to increase physical activity among adult students.

Summary of Findings

The findings from the focus group discussions in Study 1 helped the investigators to create highly tailored point-of-choice prompts for the subsequent intervention studies (Studies 2 and 3). It was discovered that participants preferred simple designs and messages (i.e., posters/signs with less graphics and words) within point-of-choice prompts. Participants described how messages that spoke to their values were more likely capture their attention, and motivated them to engage in healthy behaviours. Interestingly, several participants mentioned that interventions should include a fun aspect to encourage undergraduate students to be active (e.g., displaying a trivia question in a poster), and this information helped create point-of-choice prompts that were specific for this population. Additionally, there were plenty of discussions among participants about the value of saving time and how students are likely to choose the most convenient options available to them. The focus groups also informed investigators about the best locations on campus (i.e., Alumni Hall, Natural Sciences Centre, and Weldon Library) to display the point-of-choice prompts for Study 2 and Study 3. This needs assessment allowed students to voice their opinions/preferences that aligned with their values and interests, and provided recommendations for creating suitable point-of-choice prompts that were then used to encourage higher levels of incidental physical activity on campus.

Study 2 was a formative evaluation to examine levels of awareness and the potential impact of displaying point-of-choice prompts at transit hubs to encourage active transportation among undergraduate students. As such, students' feedback about the design, messaging, and location of where the prompts were displayed was also gathered in order to evaluate the accuracy of the information received in Study 1. Although participants were favorable of the design, messaging, and locations of where the prompts were displayed, the point-of-choice prompts had

little impact and only encourage a relatively small percentage (21%) of students to engage in active transportation. Approximately 41% of students were aware of the signs displayed on campus, and this result was better than the awareness level (30%) from a previous campus-based active transportation program.[10] Similar to Study 1, participants from Study 2 reported that time and weather were major barriers to physical activity. Study 2 was the first intervention known to have used point-of-choice prompts to enhance active transportation rates at a university, and the findings contribute to the understanding of whether this type of intervention could be effective at influencing undergraduate students' decisions to engage in active transportation on post-secondary campuses.

An important finding from the multi-component poster-based intervention to promote staircase use (Study 3) was that the overall stair climbing rate from this intervention (absolute increase of ~ 2.5%) was similar to previous results from research that only used point-of-choice prompts (absolute increase of ~ 2.2%).[11] Additionally, this study investigated the differences in staircase and elevator use on weekdays versus weekends and found that it was easier to promote stair climbing to library users on campus between Mondays to Fridays (i.e., there were only significant differences detected for data collected on weekdays). However, a campus-wide intervention that promotes staircase use could be more influential and could have more robust results. In conclusion, the findings from this formative evaluation indicated that point-of-choice prompts could influence adults' incidental physical activity on a post-secondary campus on weekdays.

Limitations, Future Directions, and Implications of Findings

An inherit limitation from all studies in this research program is social desirability bias, which could have influenced participants' behaviours. Participants were also more likely to be

female students from the Faculty of Health Sciences. As such, the results from this research program are limited and not representative of the whole student population at Western University. Additionally, the point-of-choice prompts were only displayed at locations that were suggested by participants in the focus groups (Study 1). A health promotion intervention that is implemented across campus could have a greater impact and will be more generalizable to other post-secondary student populations. Furthermore, the point-of-choice prompts used in the interventions were sometimes damaged and/or displaced while being displayed on campus. However, this issue was minimized because the research team monitored and immediately fixed any signs or posters that were not properly displayed. With regards to Study 2, it was difficult to promote active transportation when competing with harsh weather patterns because students seem to be more likely to engage in active modes of travel when the weather is nicer and warmer outside. Future studies should consider conducting a longer-term intervention study in order to reach more students on campus. In order to effectively promote active modes of travel to the student population on post-secondary campuses, school administration could help increase awareness of the benefits of active transportation and engagement in physical activity. Effective student outreach is necessary and school administration could help increase awareness of various health benefits of being active, which could eventually increase physical activity rates on college/university campuses. For example, efforts should be made to involve the school community in events on campuses such as holding an active transportation awareness week or strategically-placed indicators of how long it may take to walk from one location to another could be displayed on campus grounds. Lastly, both pilot intervention studies did not utilize objective measures or control groups. Future studies that attempt to implement similar

interventions should include objective measures and control groups in order to provide further inferences about the effectiveness of point-of-choice prompts.

In order to facilitate policy changes on a college/university campus, it is important to generate interest and raise awareness among members of the community (e.g., post-secondary students and administrators). A health promotion program such as the REAL Projects could be used help to convince administrators to adopt such programming on university campuses. In particular, mental health among university students is currently a topic of high importance on university campuses.[12–14] Furthermore, researchers have underscored that university students are prone to negative mental health outcomes such as high levels of anxiety and depression.[12–14] Given the correlation between engagement in physical activity and better mental health outcomes,[12–14] it is important to consider the possibility that increasing students' physical activity levels on campus through a highly tailored health promotion program could help improve their mental health, and consequently, support their health- and/or academic-related goals. Additionally, promoting higher rates of active transportation on campus could also help reduce the rates of traffic congestion and the demands for parking spaces. With less traffic on campus, this may improve the overall air quality in the surrounding community as well. Therefore, when considering the potential for students' health and societal gains from campus-wide traffic reductions, university administrators might find substantive value by investing in a low-cost point-of-choice health promotion program, similar to the program outlined in this dissertation.

Conclusions

The findings from Studies 1–3 determined the extent to which highly tailored and strategically-placed point-of-choice prompts were effective interventions to increase active transportation and stair climbing rates on a Canadian university campus. Although there were

mixed results from the studies, this research program had some important findings about the impact of using point-of-choice prompts to increase incidental physical activity levels at post-secondary institutions. In particular, it was discovered that point-of-choice prompts can, in fact, encourage some students to engage in active transportation and to utilize the stairs in a campus library. In conclusion, performing incidental physical activity of daily living could help university students become more active without necessitating tremendous effort or planning, exemplifying the aphorism from the Ottawa Charter for Health Promotion about making "the healthier choice the easier choice."[15]

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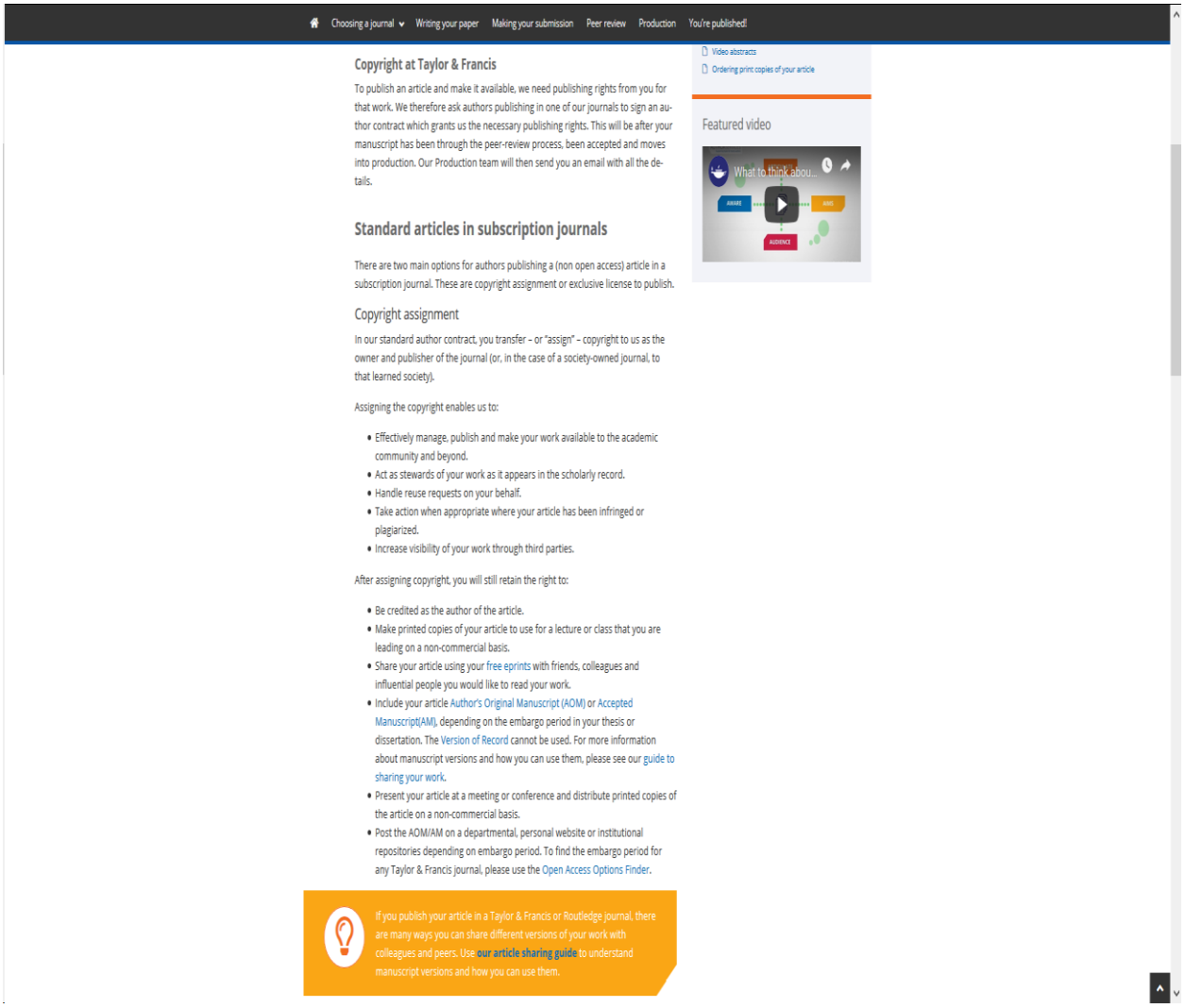
Appendix A

Copyright Information for Study 1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Appendix B

Ethics Approval Notice for Study 1

Western Research

Research Ethics

Western University Health Science Research Ethics Board
HSREB Delegated Initial Approval Notice

Principal Investigator: Dr. Jennifer Irwin
Department & Institution: Health Sciences,Western University

Review Type: Delegated
HSREB File Number: 108334
Study Title: Designing Effective Point-of-Choice Prompts to Promote Active Transportation and Staircase Use at a Canadian University

HSREB Initial Approval Date: October 31, 2016
HSREB Expiry Date: October 31, 2017

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Western University Protocol	Received 2016/10/03	
Letter of Information & Consent	Appendix G	2016/10/03
Other	Appendix M Message for focus groups	2016/10/03
Other	Appendix K Poster samples - Received 2016/10/04	
Other	Appendix J Poster samples 2	2016/10/03
Other	Appendix I Focus group script	2016/10/03
Data Collection Form/Case Report Form	Appendix H Demographic survey	2016/10/03
Other	Appendix F E-mail reminder	2016/10/03
Data Collection Form/Case Report Form	Appendix E Screening questions	2016/10/03
Recruitment Items	Appendix C Script for e-mail, newsletters, social media	2016/10/03
Recruitment Items	Appendix B E-mail to course instructors	2016/10/03
Recruitment Items	Appendix A Mass e-mail message	2016/10/03
Advertisement	Appendix D Recruitment flyer	2016/10/03

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above named study, as of the HSREB Initial Approval Date noted above.

HSREB approval for this study remains valid until the HSREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review.

The Western University HSREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use Guideline for Good Clinical Practice Practices (ICH E6 R1), the Ontario Personal Health Information Protection Act (PHIPA, 2004), Part 4 of the Natural Health Product Regulations, Health Canada Medical Device Regulations and Part C, Division 5, of the Food and Drug Regulations of Health Canada.

Members of the HSREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

[redacted]

Ethics Officer, on behalf of Dr. Joseph Gilbert, HSREB Chair

Ethics Officer: Erika Basile ___ Nicole Kaniki ✓ Grace Kelly ___ Katelyn Harris ___ Vikki Tran ___ Karen Gopaul ___

[redacted]

Appendix C

Mass Email Message for Study 1

Subject Line: Western Undergrad Mass Email Research Recruitment

Dear Student,

Researchers from the Faculty of Health Sciences are conducting a study to determine the most suitable posters for promoting active transportation (e.g., walking or bicycling) and staircase use that will be appealing to undergraduate students at Western University. In this study, full-time Western undergraduate students who are fluent in English are invited to join a focus group that will last approximately 60 minutes in length. Your participation in this study will help researchers create tailor-made posters for future interventions that aim to enhance students' active lifestyles.

If you are interested in taking part in this study or would like to know more about it, you are welcome to contact Hieu Ly ( ) or Dr. Jennifer D. Irwin ( ). Thank you for your considerations.

Best regards,

Appendix D

Email to Course Instructors for Study 1

Subject Line: Health Posters Study

Dear _____,

My doctoral supervisor, Dr. Jennifer D. Irwin, and I are writing to request your assistance for recruiting undergraduate students to participate in a focus group study. We are conducting a study to determine the most suitable health messages and designs to create point-of-choice prompts (e.g., posters with informative health messages) for promoting active transportation (e.g., walking or bicycling) and staircase use that will be appealing to the undergraduate student population at Western University. In this study, full-time Western undergraduate students who are fluent in English will be invited to join focus group discussions that will provide them with the opportunities to voice their opinions, views, and preferences. If possible, we are wondering if a researcher or research assistant could make a quick announcement at the start of one of your classes to bring the study to your students' attention, and then have the following recruitment statement below posted on your OWL site. Or, if having an announcement in your class doesn't work for you, having a statement posted on your OWL site only would also be much appreciated.

"Dear Student,

Researchers from the Faculty of Health Sciences are conducting a study to determine the most suitable posters for promoting active transportation (e.g., walking or bicycling) and staircase use that will be appealing to undergraduate students at Western University. In this study, full-time Western undergraduate students who are fluent in English are invited to join a focus group that will last approximately 60 minutes in length. Your participation in this study will help researchers create tailor-made posters for future interventions that aim to enhance students' active lifestyles.

If you are interested in taking part in this study or would like to know more about it, you are welcome to contact Hieu Ly ([redacted]) or Dr. Jennifer D. Irwin ([redacted]). Thank you for your considerations."

Thank you for considering our request. We would be happy to answer any questions you may have, and share the results with you after the study is completed. If you have any questions and/or require further information about this study, you are welcome to contact Hieu Ly ([redacted]) or Dr. Jennifer D. Irwin ([redacted]).

Best regards,

[redacted]

Appendix E

Screening Questions for Study 1

Screening Form

Name: _____
Email: _____

The following questions will be asked during the initial contact with the student, and the information collected will be used to place the student into a focus group.

1. Are you fluent in English?
   ☐Yes ☐No

2. Are you currently enrolled as a full-time undergraduate student at Western University?
   ☐Yes ☐No

3. What is your current level of physical activity? (*Indicate which applies best to you.*)
   ☐I perform 150 minutes or more of moderate- to vigorous-intensity physical activity on a weekly basis, in bouts of 10 minutes or more. [1]
   ☐I perform less than 150 minutes of moderate- to vigorous-intensity physical activity on a weekly basis. [1]

4. Are you available to attend a focus group held at Western University's main campus?
   ☐Yes ☐No

5. What time and day are you available to attend a focus group? (*Dates of focus groups available for sign-up will be provided.*)

   Availability (date and time): _____

Eligible to participate in this study: ☐Yes (data will be retained) ☐No (data will be destroyed)

Category of focus group: ☐Active ☐Inactive

Date and time of focus group: _____

[1] According to the Canadian Physical Activity Guidelines, moderate-intensity physical activity is define as a rate of personal perceived exertion that is usually a 5 or 6 on a scale of 10. If you are doing moderate-intensity activity you can talk, but not sing your favourite song, during the activity and you are working hard enough to raise your heart rate. Vigorous-intensity physical activity is defined as a rate of personal perceived exertion that is usually a 7 or 8 on a scale of 10. If you are doing vigorous-intensity activity, you will not be able to say more than a few words without pausing for a breath, and your heart rate has gone up quite a bit.

Appendix F

Email Reminder for Study 1

Subject Line: Focus Group Tomorrow

Dear _____,

This is a friendly reminder that the focus group you have registered for will occur tomorrow [date] at [time]. The focus group will be held at the main campus, in the Health Promotion Research Laboratory ([redacted]). For directions and information on parking, please visit the following website, http://www.uwo.ca/about/visit/maps.html.

Thank you in advance for your time. If you have any questions and/or require further information about this study, you are welcome to contact Hieu Ly ([redacted]) or Dr. Jennifer D. Irwin ([redacted]).

Best regards,

[redacted]

Appendix G

Letter of Information and Consent Form for Study 1

Designing Effective Point-of-Choice Prompts to Promote Active Transportation and Staircase Use at a Canadian University

Letter of Information

Investigators:
Jennifer D. Irwin, PhD, Faculty of Health Sciences, Western University, [redacted]
Hieu Ly, MSc, Faculty of Health Sciences, Western University, [redacted]

Background:
Point-of-choice prompts (e.g., posters with informative health messages) may promote physical activity and provide inexpensive interventions to enhance university students' active lifestyles. The purpose of this study is to determine the most suitable health messages and designs to create point-of-choice prompts for promoting active transportation (e.g., walking or bicycling) and staircase use that will be appealing to the undergraduate student population at Western University. Undergraduate students from Western University will be invited to participate in focus groups to provide their feedback on the kind of messages and poster designs that will be appealing and motivational to them. Data collected from this study will help to determine what are the most suitable poster designs and messages in service of creating tailor-made point-of-choice prompts for undergraduate students.

What will happen in this study:
Participants will be asked to provide their opinions about the most appropriate posters designs and messages for promoting active transportation and staircase use, and the locations of where they should be placed for maximum impact. A maximum of 240 students will be invited to participate in focus groups and each session will contain 6-10 participants, which will last approximately 60 minutes in length. All response will be audio-recorded (so that no comments are missed) and then transcribed into written form. All information collected in this study is confidential. After reading this letter, please complete the consent form and return it to the research team.

Inclusion and exclusion criteria:
In order for you to participate in this study, you must be a full-time Western University undergraduate student who is fluent in English. You will not be able to participate if you are: a) a Western University undergraduate student who is not a full-time student; b) a Western University undergraduate student who is not fluent in English; or c) a faculty member, staff, graduate, or postdoctoral student who is not currently enrolled in an undergraduate program at Western University.

Voluntary participation:
Participation in this study is voluntary. You are not obligated to participate or provide answers to any questions in the focus group. You have the right to refuse to participate in the focus group even after you have provided written consent. You may withdraw from the study at anytime without any penalty. If you decide to withdraw from the study, all of your data will be removed and destroyed. Your participation in this study will have no impact on evaluations of you of any kind, academically or otherwise. By signing the consent form, you do not waive any legal rights.

Confidentiality:
The data collected from this study will be presented in aggregate form and no identifiers will be made public. All information gathered will only be used for publication or presentation purposes. Data collected from this study will only be accessible by the investigators and will be safeguarded on password protected devices, which will be destroyed after 5 years.

Cost and compensation:
There is no cost to you for participating in this study. No compensation will be given for participation in this study.

Risks and benefits:
There are no known risks for participating in this study. Your participation in this study will provide researchers with valuable information about Western students' preferences for particular designs and messages used to create point-of-choice prompts. Tailor-made point-of-choice prompts can be incorporated into future interventions that aim to enhance students' active lifestyles and physical activity levels.

Feedback from the Study:
If you wish to receive the results from this study, please send an e-mail to Hieu Ly at [redacted].

If you have any questions and/or require further information about participating in this study, you are welcome to contact Hieu Ly ([redacted]) or Dr. Jennifer D. Irwin ([redacted]). If you have any questions about your rights as a research participant, please contact Western's Office of Research Ethics at [redacted].

Designing Effective Point-of-Choice Prompts to Promote Active Transportation and Staircase Use at a Canadian University

Consent Form

Investigators:
Jennifer D. Irwin, PhD, Faculty of Health Sciences, Western University, [redacted]
Hieu Ly, MSc, Faculty of Health Sciences, Western University, [redacted]

I understand that my participation in this study is voluntary and I may withdraw from the study at anytime without any penalty, academically or otherwise. I also understand that all data collected from this study will be kept strictly confidential and information gathered will only be used for publication or presentation purposes. I have read the Letter of Information, have had the nature of the study explained to me, and I agree to participate. All questions have been answered to my satisfaction.

Date	Participant's Name (please print)	Participant's Signature

Date	Name of Researcher Obtaining Informed Consent (please print)	Signature

Appendix H

Demographic Survey for Study 1

Designing Effective Point-of-Choice Prompts to Promote Active Transportation and Staircase Use at a Canadian University

Demographic Information Survey

Instructions: This survey contains questions about your background and personal information. There are no right or wrong answers. Please select the most appropriate answer relevant for you, personally, for each response. Thank you for taking the time to complete this survey.

1. Sex:
   ☐Male ☐Female

2. Age:
   ☐19 years and under ☐35-39 years
   ☐20-24 years ☐40-44 years
   ☐25-29 years ☐45-49 years
   ☐30-34 years ☐50 years and over

3. Ethnicity:
   ☐Aboriginal ☐Hispanic
   ☐African Heritage ☐Middle Eastern
   ☐Caucasian ☐South Asian
   ☐East Asian ☐Other, please specify: _____

4. Employment status:
   ☐Not employed ☐Part-time ☐Full-time

5. Current student's enrollment status at Western University:
   ☐Part-time ☐Full-time

6. Program of registration:
   ☐Faculty of Arts and Humanities ☐Faculty of Law
   ☐Faculty of Education ☐Faculty of Music
   ☐Faculty of Engineering ☐Faculty of Science
   ☐Faculty of Health Sciences ☐Faculty of Social Science
   ☐Faculty of Information and Media Studies ☐Other, please specify: _____

7. Year of academic enrollment:
   ☐First
   ☐Second
   ☐Third
   ☐Fourth
   ☐Other, please specify: _____

8. With regards to your place of residence:
   ☐I live in London, Ontario during the Fall and Winter semesters
   ☐I live in London, Ontario during the Fall, Winter, and Summer semesters
   ☐I do not live in London, Ontario

9. My living arrangement is:
   ☐On campus (i.e., residence) ☐Off-campus with roommates
   ☐Off-campus by myself ☐Off-campus with family or relatives

This is the end of the survey. Thank you for participating.

Appendix I

Focus Group Script for Study 1

Designing Effective Point-of-Choice Prompts to Promote Active Transportation and Staircase Use at a Canadian University

Interview Guide and Questions for Focus Groups

Introduction

Hello everyone,

First and foremost, we would like to thank you for volunteering your time to participate in this focus group. My name is (*name of moderator 1*), and this is (*name of moderator 2*). Today, (*name of moderator 2*) and I will be your focus group moderators. As moderators, we are here to guide and encourage the group's discussions and to make sure that everyone has an equal chance to voice their opinions in a comfortable environment. There are no right or wrong answers. Everything discussed here today will be kept confidential (i.e., no names or identifiers will be made public); therefore, participants must not discuss what is said during this focus group outside of the focus group session, nor talk about any of the information revealed during this focus group to any outside person. Your participation in this study is voluntary and you are not obligated to participate or provide answers to any questions. You have been given a copy of the Letter of Information that contains all the information about this study. If you have any questions after the focus group is over, please direct them to Hieu Ly or Dr. Jennifer D. Irwin at the contact information provided in the Letter of Information.

We are here today to discuss your thoughts about creating tailor-made point-of-choice prompts, which are signs and posters with informative health messages. Point-of-choice prompts could be used to promote physical activity and provide inexpensive interventions to enhance university students' active lifestyles. It is important to design and use point-of-choice prompts that are suitable and appealing to the target population. Specifically, we are looking to gather your feedback to help us to determine the most suitable health messages and designs to create point-of-choice prompts for promoting active transportation (i.e., modes of transportation that require the person to exert physical effort, such as walking or bicycling) and staircase use that will be appealing to the undergraduate student population at Western University. The information collected today will serve as an important first step in a campus-based intervention named, the REAL Projects, which aim to enhance students' active lifestyles and physical activity levels. Your comments and feedback on this topic are important and will help us understand the kind of messages and poster designs that will be appealing and motivational to the undergraduate population at Western University.

If you need to use the washroom it is located outside of this room *(indicate location)*. We have bottles of water and light snacks on the table that you are welcome to at any time. There will be no breaks during today's focus group session, and should you need to be excused to use the washroom please do so; you do not need to ask. The focus group will be about 60 minutes in length and conclude with a short debriefing. Please carefully read the Letter of Information provided, and complete the consent form and demographic information survey before we begin the group discussions. Are there any questions before we start?

Questions

1. *Opening Question*: Can you please tell us your first name, your favourite hobby, and what program and year you are currently in?

2. *Introductory Questions*:
- What facilitates your participation in active transportation on campus?
- What are the barriers for engaging in active transportation on campus?
- What facilitates your staircase use on campus?
- What are the barriers for using the staircases on campus?
- What else motivates or prevents you from using active transportation or staircases?

3. *Transition Questions*: What are some examples of point-of-choice prompts that you have come across in your daily lives?
- What were the characteristics that made them stand out to you?
- What impacts did they have on your behaviours?
- What else were significant about the examples that came to your mind?

4. *Key Questions*:

a) Please take a look at the poster samples and describe what feature(s) of the designs are most appealing and motivational to you.
- What kind of images should the posters include?
- What colours should be used in the posters?
- What font and font size will make it easier for you to read the messages?
- What size should the poster be so it would be easy to see?
- What are other ideas that we have not discussed so far that you would wish to add to make the design of the point-of-choice prompts more appealing to you?

b) Please take a look at the list of potential messages and rank the messages from best to worse. The highest ranked message for each category will be used in the posters.
- What revisions do you recommend to make the messages more appealing?
- Are simple or complex messages more appealing and motivating to you?
- What are the best part(s) of your highest ranked message?
- What are the worse part(s) of your lowest ranked message?
- What are other ideas that we have not discussed so far that you would wish to add to make the messages more suitable and appealing to you?

c) i) What locations would be suitable for posting the point-of-choice prompts?
ii) Please take a look at the photos of potential locations for posting point-of-choice prompts on this campus.
- Where should the posters about active transportation be display on campus for maximum impact (i.e., increase rates of active transportation near bus stops)?
- Where should the posters about staircase use be display on campus for maximum impact (i.e., increase rates of staircase use on campus)?
- What other locations would be suitable for posting the point-of-choice prompts?

5. *Ending Questions*: What are your overall thoughts about the value of using these kinds of point-of-choice prompts on campus?

a) As mentioned earlier, one of the things we want to use these point-of-choice prompts for is to promote active transportation for people near bus stops. We are asking you all these questions because we want to make this as effective as possible so we want to be mindful of any guidance you can provide. Please describe any pitfalls or challenges you envision to this being successful.
    - What do you think would help us to overcome those challenges?

b) Additionally, one of the things we want to use these point-of-choice prompts for is to promote staircase use on campus. We are asking you all these questions because we want to make this as effective as possible so we want to be mindful of any guidance you can provide. Please describe any pitfalls or challenges you envision to this being successful.
    - What do you think would help us to overcome those challenges?

Before we conclude this focus group session, does anyone have anymore comments or anything else they wish to add?

Debriefing

Thank you for your participation in the focus group. We hope you had a great experience and we appreciate your comments and feedback. Since it is important to have tailor-made point of choice prompts for the target population, we decided to conduct a focus group study to provide you with the opportunities to voice your opinions, views, and preferences. Your participation in this study will help researchers create tailor-made point-of-choice prompts, which could be incorporated into future interventions that aim to enhance students' active lifestyles. If you have any questions about your role in this study, you are welcome to contact Hieu Ly or Dr. Jennifer D. Irwin. If you have any questions about your rights as a research participant, please feel free to contact Western's Office of Research Ethics. Thank you again for your time.

Appendix J

Message for Focus Groups for Study 1

Messages for Posters

Instructions: Please rank these messages from best (1) to worse (5). The highest ranked message for each category will be used in the posters.

Messages for Staircase Posters

1. Walking up stairs burns almost 5 times more calories than riding an elevator.
2. Regular stair climbing burns more calories per minute than jogging. Raise your level of fitness one step at a time.
3. In one minute, a 150 pound person burns approximately 10 calories walking up stairs and only 1.5 calories riding an elevator.
4. Doctors have found that 7 minutes of stair climbing a day halves your risk of a heart attack over a 10 year period. There are 1440 minutes in a day. Can you spare 7 minutes to live longer?
5. Stair climbing always burns calories. One flight uses about 2.8 calories, but 10 flights a day uses 28 calories. Over a year that adds up to 10,000+ calories; that's more than 3lb of fat.

Messages for Active Transportation Posters

1. Skip the wait and take a walk home! Physical activity could be the most productive 30 minutes of your day.
2. Enjoy a walk home! There are lots of ways to be active. Exercise doesn't have to happen at the gym.
3. Walk on the healthy side! Regular exercise can help prevent diseases and improve your mental health.
4. Take time to walk! Doctors recommend that being active just 30 minutes per day can help you maintain a healthy weight and ward off many diseases.
5. All you need is 30 minutes of walking each day. You'll decrease your risk of stroke, reduce your cholesterol, and lower your blood pressure. So walk on!

Appendix K

Ethics Approval Notice for Study 2

Western Research

Date: 12 February 2018

To: Dr. Jennifer Irwin

Project ID: 110648

Study Title: The Impact of Utilizing Point-of-Choice Prompts to Promote Active Transportation at Transit Stops within a Canadian University Campus

Application Type: HSREB Initial Application

Review Type: Delegated

Full Board Reporting Date: February 20, 2018

Date Approval Issued: 12/Feb/2018

REB Approval Expiry Date: 12/Feb/2019

Dear Dr. Jennifer Irwin

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date
Ly_Irwin_Email_Request_Course_Websites_(January 25, 2018)	Email Script	25/Jan/2018
Ly_Irwin_Email_Request_Course_Websites_(January 25, 2018)	Recruitment Materials	25/Jan/2018
Ly_Irwin_Email_Request_Newsletter_(January 25, 2018)	Email Script	25/Jan/2018
Ly_Irwin_Facebook_Recruitment_Message_(January 25, 2018)	Recruitment Materials	25/Jan/2018
Ly_Irwin_Letter_of_Information_(January 25, 2018)	Written Consent/Assent	25/Jan/2018
Ly_Irwin_Questionnaire_(January 25, 2018)	Online Survey	25/Jan/2018
Ly_Irwin_Recruitment_Flyer_(January 25, 2018)	Recruitment Materials	25/Jan/2018
Ly_Irwin_Research_Plan_(January 25, 2018)	Protocol	25/Jan/2018
Ly_Irwin_Transporation_POC	Recruitment Materials	25/Jan/2018
Ly_Irwin_Transporation_POC (maps)	Recruitment Materials	25/Jan/2018

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB , except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Karen Gopaul, Ethics Officer on behalf of Dr. Joseph Gilbert, HSREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Appendix L

Questionnaire for Study 2

The Impact of Utilizing Point-of-Choice Prompts to Promote Active Transportation at Transit Stops within a Canadian University Campus

Investigators:
Jennifer D. Irwin, PhD, Faculty of Health Sciences, Western University
Hieu Ly, MSc, Faculty of Health Sciences, Western University

Purpose of the Study:
The three-fold purpose of this study is: (a) to determine undergraduate students' *awareness* of study-specific and strategically displayed point-of-choice prompts (e.g., signs or posters that help facilitate intentions into actions); (b) for those aware of them, to explore students' perceptions of the *impact* of the point-of-choice prompts on their active transportation choices (e.g., walking and biking); and (c) to obtain students' *feedback* regarding the appeal and suitability of the study-specific point-of-choice prompts.

What Will Happen in the Study:
The investigators are conducting a study to explore the relationship between point-of-choice prompts and active transportation. In this study, full-time Western undergraduate students who are fluent in English will be invited to complete a 5 minute online questionnaire through Qualtrics®. The link to the questionnaire will remain active until April 30, 2018, or when a maximum of 3,500 Western undergraduate students have completed the online questionnaire.

Inclusion and Exclusion Criteria:
In order for you to participate in this study, you must be a full-time Western University undergraduate student who is fluent in English. You will not be able to participate if you are: (a) a Western University undergraduate student who is not a full-time student; (b) a Western University undergraduate student who is not fluent in English; or (c) a faculty member, staff, graduate, or postdoctoral student who is not currently enrolled in an undergraduate program at Western University.

Voluntary Participation:
Participation in this study is voluntary. If you choose to participate, you are able to leave any question unanswered, should you choose to do so, and still complete the remainder of the questionnaire. You may withdraw from the study at anytime without any penalty. Your participation in this study will have no impact on evaluations of you of any kind, academically or otherwise.

If You Decide to Participate:
If you decide to participate in this study, you will be asked to complete a 5 minute online questionnaire through Qualtrics®. By accessing and completing the questionnaire, you are providing implied consent to participate. All information collected is confidential.

Confidentiality:
No names or identifiers will be collected within the study and information gathered will only be used for publishing or presentations purposes. Data collected from this study will be accessible by the investigators and will be safeguarded on password protected devices, which will be destroyed after 7 years. The Western University Health Sciences Research Ethics Board may access the data collected for this study.

Cost and Compensation:
There is no cost to participate in this study. No compensation will be given for participation in this study.

Risks & Benefits:
There are no known risks for participating in this study. Participants will have the opportunities to voice their opinions about tailor-made point-of-choice prompts that encourage participation in active transportation. Participants will also have a chance to reflect on their engagement in physical activity.

Feedback from the Study:
If you wish to receive the results from this study, please send an e-mail to Hieu Ly at [redacted].

If you have any questions and/or require further information about participating in this study, you are welcome to contact Hieu Ly ([redacted]) or Dr. Jennifer D. Irwin ([redacted]). If you have any questions about your rights as a research participant, please contact Western's Office of Research Ethics at [redacted].

The Impact of Utilizing Point-of-Choice Prompts to Promote Active Transportation at Transit Stops within a Canadian University Campus

Investigators:
Jennifer D. Irwin, PhD, Faculty of Health Sciences, Western University
Hieu Ly, MSc, Faculty of Health Sciences, Western University

Purpose of the Study:
The three-fold purpose of this study is: (a) to determine undergraduate students' *awareness* of study-specific and strategically displayed point-of-choice prompts (e.g., signs or posters that help facilitate intentions into actions); (b) for those aware of them, to explore students' perceptions of the *impact* of the point-of-choice prompts on their active transportation choices (e.g., walking and biking); and (c) to obtain students' *feedback* regarding the appeal and suitability of the study-specific point-of-choice prompts.

Instructions:
This self-administered online questionnaire will take approximately 5 minutes to complete. Your decision to complete the questionnaire constitutes consent. Your participation in this questionnaire is completely voluntary and will not have an impact on your grades. You may skip any of the questions or withdraw from the study at any time. There are no right or wrong answers, please only select the option that best reflects your honest views, experiences, or opinions. Thank you for taking the time to complete this questionnaire.

Section 1: Awareness of Prompts
This first section of the questionnaire is about your awareness of the point-of-choice prompts (the posters shown below) that were displayed on campus to promote active transportation.

Please select the most appropriate answer relevant to you, personally, for each response.

1. I have seen one or more of the point-of-choice prompts above displayed at a transit hub on campus (if you have not seen the posters above, select "No" and then skip to *Section 3: Feedback for Prompts*).

☐ Yes, I have seen one or more of the poster(s)

☐ No, I have not seen any of the posters

2. Please specify the location(s) where you saw any of the point-of-choice prompts shown above.

☐ Alumni Hall ☐ Natural Sciences Centre ☐ Both (Alumni Hall & Natural Sciences Centre) ☐ Other(s)

Section 2: Impact of Prompts

The second section of this questionnaire is about the impact of displaying point-of-choice prompts to promote active transportation on campus. Please select the most appropriate answer relevant to you, personally, for each response.

3. Overall, the point-of-choice prompts that were displayed on campus encouraged me to participate in active transportation.

☐ Strongly Disagree ☐ Disagree ☐ Neither Agree nor Disagree ☐ Agree ☐ Strongly Agree

Please use the space below to comment on your response to the previous statement.

4. I have engaged in more active transportation as a result of seeing the point-of-choice prompts on campus.

☐ Strongly Disagree ☐ Disagree ☐ Neither Agree nor Disagree ☐ Agree ☐ Strongly Agree

Please use the space below to comment on your response to the previous statement.

Section 3: Feedback for Prompts

The third section of this questionnaire asks you to provide feedback regarding the appeal and suitability of the following point-of-choice prompts (whether you saw these posters or not).

Please select the most appropriate answer relevant to you, personally, for each response.

5. I feel motivated by the point-of-choice prompts shown above.

☐	☐	☐	☐	☐
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please use the space below to comment on your response to the previous statement.

6. The designs (e.g., images and colours) of the point-of-choice prompts are suitable and appealing to me.

☐	☐	☐	☐	☐
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please use the space below to comment on the point-choice prompts designs.

7. The messages contained in the point-of-choice prompts are suitable and appealing to me.

☐	☐	☐	☐	☐
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please use the space below to comment on the point-of-choice prompts messages.

8. Alumni Hall is a suitable location to display point-of-choice prompts to encourage undergraduate students to participate in active transportation.

☐	☐	☐	☐	☐
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please comment on your response regarding displaying point-of-choice prompts at Alumni Hall.

9. Natural Sciences Centre is a suitable location to display point-of-choice prompts to encourage undergraduate students to participate in active transportation.

☐	☐	☐	☐	☐
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

Please comment on your response regarding displaying point-of-choice prompts at the Natural Sciences Centre.

10. Please provide us with additional comments you may have regarding your responses to any of the previous statements or about the foci of this questionnaire.

Section 4: Demographic Information

The fourth section of this questionnaire contains questions about your background and personal information. Please select the most appropriate answer relevant to you, personally, for each response.

11. Sex:

☐Male ☐Female ☐Other

12. Age:

☐19 years and under ☐35-39 years
☐20-24 years ☐40-44 years
☐25-29 years ☐45-49 years
☐30-34 years ☐50 years and over

13. Ethnicity:

☐Indigenous ☐Hispanic
☐African Heritage ☐Middle Eastern
☐Caucasian ☐South Asian
☐East Asian ☐Other, please specify: _____

14. Employment status:
☐Not employed ☐Part-time ☐Full-time

15. Current enrollment status at Western University:
☐Part-time student ☐Full-time student

16. Program of registration:
☐Faculty of Arts and Humanities ☐Faculty of Law
☐Faculty of Education ☐Faculty of Music
☐Faculty of Engineering ☐Faculty of Science
☐Faculty of Health Sciences ☐Faculty of Social Science
☐Faculty of Information and Media Studies ☐Other, please specify: _____

17. Year of academic enrollment:
☐First
☐Second
☐Third
☐Fourth
☐Other, please specify: _____

18. With regard to my place of residence:
☐I live in London, Ontario during the Fall and Winter semesters only
☐I live in London, Ontario during the Fall, Winter, and Summer semesters
☐I do not live in London, Ontario

19. My living arrangement is:
☐On campus (i.e., residence) ☐Off-campus with roommates
☐Off-campus by myself ☐Off-campus with family or relatives

20. I typically use the following method to travel (e.g., to school, to work, etc.):
☐Walk ☐Bike ☐Bus ☐Car ☐Other, please specify: _____

This is the end of the questionnaire. Thank you for your participation.

Appendix M

Mass Email Message for Study 2

Subject Line: Western Undergrad Mass Email Research Recruitment

Dear Student,

Researchers from the Faculty of Health Sciences are conducting a study to investigate the relationship between point-of-choice prompts (e.g., signs or posters that help facilitate intentions into actions) and active transportation (e.g., walking and biking). If you are interested in taking part in this study, please begin by reviewing the Letter of Information on the first page of the questionnaire. The link to the questionnaire will stay open until April 30, 2018. If you wish to participate in this study, the following link will lead you to the online questionnaire: https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

Thank you in advance for your time. For further information about this study, you are welcome to contact Dr. Jennifer D. Irwin ([redacted]) or Hieu Ly ([redacted]).

Best regards,

[redacted]

Appendix N

Recruitment Flyer for Study 2

Western University - Faculty of Health Sciences (Version date: January 25, 2018)

The Impact of Utilizing Point-of-Choice Prompts to Promote Active Transportation at Transit Stops within a Canadian University Campus

Participants needed for questionnaire!

PROVIDE YOUR OPINIONS ON HEALTH POSTERS!

Researchers from the Faculty of Health Sciences are conducting a study to investigate the relationship between point-of-choice prompts (e.g., posters that help facilitate intentions into actions) and active transportation (e.g., walking and biking).

Who can participate?

- Full-time Western University undergraduate students who are fluent in English.

How to participate?

- The following link will lead you to the questionnaire: **https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz**
- The questionnaire will take approximately 5 minutes to complete and the link to the questionnaire will stay open until April 30, 2018.

Need more information?

- If you have any questions or require further information, you are welcome to contact Hieu Ly [redacted] or Dr. Jennifer D. Irwin [redacted].

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

Appendix O

Email to Course Instructors for Study 2

Subject Line: Prompts and Active Transportation Study

Dear _____,

My doctoral supervisor, Dr. Jennifer D. Irwin, and I are writing to request your assistance for recruiting undergraduate students to participate in an online questionnaire. We are conducting a study to investigate the relationship between point-of-choice prompts (e.g., signs or posters that help facilitate intentions into actions) and active transportation (e.g., walking and biking): (a) to determine undergraduate students' awareness of study-specific and strategically displayed point-of-choice prompts; (b) for those aware of them, to explore students' perceptions of the impact of the point-of-choice prompts on their active transportation choices; and (c) to obtain students' feedback regarding the appeal and suitability of the study-specific point-of-choice prompts. In this study, full-time Western undergraduate students who are fluent in English will be invited to complete a 5 minute online questionnaire through Qualtrics®. If possible, we are wondering if a researcher or research assistant could make a quick announcement at the start of one of your classes to bring the study to your students' attention, and then have the following recruitment statement below posted on your OWL site. Or, if having an announcement in your class doesn't work for you, having a statement posted on your OWL site only would also be much appreciated.

"Dear Student,

Researchers from the Faculty of Health Sciences are conducting a study to investigate the relationship between point-of-choice prompts (e.g., posters that help facilitate intentions into actions) and active transportation (e.g., walking and biking). If you are interested in taking part in this study, please begin by reviewing the Letter of Information on the first page of the questionnaire. The link to the questionnaire will stay open until April 30, 2018. If you wish to participate in this study, the following link will lead you to the online questionnaire: https://uwo.eu.qualtrics.com/jfe/form/SV_3CvfeKNThXaTjNz

Thank you in advance for your time. For further information about this study, you are welcome to contact Dr. Jennifer D. Irwin ([redacted]) or Hieu Ly ([redacted])."

Thank you for considering our request. We would be happy to answer any questions you may have, and share the results with you after the study is completed. If you have any questions and/or require further information about this study, you are welcome to contact Hieu Ly ([redacted]) or Dr. Jennifer D. Irwin ([redacted]).

Best regards,

[redacted]

Appendix P

Ethics Approval Notice for Study 3

Western Research

Date: 16 December 2018

To: Dr. Jennifer Irwin

Project ID: 113009

Study Title: The Effects of Motivational Posters and Behavioural Prompts to Promote Staircase Use at a Canadian University

Application Type: HSREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 15/Jan/2019

Date Approval Issued: 16/Dec/2018 16:58

REB Approval Expiry Date: 16/Dec/2019

Dear Dr. Jennifer Irwin

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Ly_Irwin_Observation_Guide_(December 7, 2018)	Participant Observation Guide	07/Dec/2018	
Ly_Irwin_Research_Plan_(December 7, 2018)	Protocol	07/Dec/2018	
Ly_Irwin_Staircase_POC_and_Posters_(December 7, 2018)	Other Data Collection Instruments	07/Dec/2018	

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB , except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Katelyn Harris, Ethics Officer on behalf of Dr. Joseph Gilbert, HSREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Appendix Q

Observation Guide for Study 3

Study Title: **The Effects of Motivational Posters and Behavioural Prompts to Promote Staircase Use at a Canadian University**

Instructions: Please use this *Observation Guide* as well as a tally counter to keep a total of the number of individuals that utilize the staircase rather than the elevator at the study site.

Observation Guide	
Date of Observation:	
Start Time:	End Time:
Observer:	
Location:	
Total Count:	
Please provide comments about any potential disruption or inconsistency at the study site that affected data collection:	

CURRICULUM VITAE

1. PERSONAL INFORMATION

Name: Hieu Ly

2. EDUCATION

2015 – 2019	**Western University**, London Ontario, Canada PhD, Health and Rehabilitation Sciences (Health Promotion)
2013 – 2015	**Western University**, London Ontario, Canada MSc, Health and Rehabilitation Sciences (Health Promotion)
2011 – 2013	**Seneca College**, Toronto, Ontario, Canada York-Seneca Rehabilitation Services Certificate
2008 – 2013	**York University**, Toronto, Ontario, Canada Honours BSc, Kinesiology and Psychology

3. TEACHING EXPERIENCE

2014 – 2018	*Teaching Assistant*, Health Sciences 2250A: Health Promotion in Canada, Department of Health and Rehabilitation Sciences, Western University, London, Ontario, Canada - Nominated for the Graduate Student Teaching Assistant Award (2016 & 2017)
Fall 2013	*Teaching Assistant*, Physical Therapy 9535A: Physical Therapy in Rehabilitation Settings II, Department of Health and Rehabilitation Sciences, Western University, London, Ontario, Canada

4. RESEARCH EXPERIENCE

2017 – 2018	*Graduate Research Assistant*, Faculty of Health Sciences, School of Health Studies, Western University, London, Ontario, Canada
2010 – 2012	*Research Assistant*, Department of Kinesiology and Health Science, York University, Toronto, Ontario, Canada

Summer 2010	*Research Assistant*, Department of Psychology, York University, Toronto, Ontario, Canada

5. ADDITIONAL WORK EXPERIENCE

2012 – 2013	*Intern*, Acclaim Ability Management Inc., Toronto, Ontario, Canada
2011 – 2012	*Support Staff*, Sir John A. Macdonald Collegiate Institute, Toronto, Ontario, Canada

6. AWARDS AND SCHOLARSHIPS

2017 – 2018	Ontario Graduate Scholarship, Western University, Value: 15,000 (Canadian dollar), Competitive
2016	Health and Rehabilitation Sciences Graduate Conference Travel Award, Western University, Value: 400 (Canadian dollar), Competitive
2016	Faculty of Health Sciences Graduate Conference Travel Award, Western University, Value: 300 (Canadian dollar), Competitive
2015 – 2019	Western Graduate Research Scholarship, Western University, Value: 76,000 (Canadian dollar), Non-competitive
2013 – 2015	Western Graduate Research Scholarship, Western University, Value – 20,000 (Canadian dollar), Non-competitive

7. PUBLICATIONS

Ly, H., Lee, C. J., & Irwin, J. D. (2019). Step on up! A multi-component health promotion poster-based intervention to promote stair climbing at a library on a university campus. Manuscript submitted for publication and is currently under review.

Ly, H., & Irwin, J. D. (2019). Skip the wait and take a walk home! The suitability of point-of-choice prompts to promote active transportation among undergraduate students. Manuscript submitted for publication and is currently under review.

Ly, H., & Irwin, J. D. (2019). Designing effective point-of-choice prompts to promote active transportation and staircase use at a Canadian university. *Journal of American College Health*, *67*(3), 215-223. doi: 10.1080/07448481.2018.1469503

Ly, H., & Irwin, J. D. (2017). The relationship between perceptions of discounted public transit and physical activity: Cross-sectional online survey in Canada. *Case Studies on Transport Policy 5*(2), 279-285. doi: 10.1016/j.cstp.2017.01.002

Ly, H. (2016). The impact of utilizing mobile phones to promote physical activity among post-secondary students: A scoping review. *mHealth*, *2*(47), 1-9. doi: 10.21037/mhealth.2016.12.03

Ly, H. (2016) The promotion of active transportation and Universal Transit Pass programs. *Western Journal of Graduate Research, 13*(1), 7-10.

Ly, H., & Singh, K. (2016). A brief overview of non-celiac gluten sensitivity. *Health Science Inquiry, 7*(1), 15-16. Retrieved from https://www.healthscienceinquiry.com/2016

Ly, H. (2015). *University students' perceptions of the relationship between bus pass ownership and physical activity levels* (Master's thesis, Western University, London, Canada). Retrieved from http://ir.lib.uwo.ca/etd/2805/

Ly, H. (2014). Barriers to healthcare services among recent immigrants in Canadian cities. *Health Science Inquiry, 5*(1), 37-38. Retrieved from https://www.healthscienceinquiry.com/2014

8. ABSTRACTS, PRESENATIONS, AND PROFESSIONAL MEETINGS

SUMMARY

Refereed Academic Conferences	2 (2 first presenter)
Student Conferences	9 (9 first presenter)
Guest Lectures & Invited Talks	3
Radio Broadcast Interviews	2
Academic Conferences and Professional Meetings	9 (attended)
Conference Committee	4

A. REFEREED ACADEMIC CONFERENCES

Ly, H., & Irwin, J.D. University students' perceptions of the relationship between bus pass ownership and physical activity levels. International Conference on Transport and Health. San Jose, California, June 13-15, 2016. Abstract and Poster Presentation.

Ly, H., & Irwin, J.D. University students' perceptions of the relationship between bus pass ownership and physical activity levels. International Society of Behavioral Nutrition and Physical Activity Annual Meeting. Edinburgh, Scotland, June 3-6, 2015. Abstract and Poster Presentation.

B. STUDENT CONFERENCES

Ly, H., & Irwin, J.D. The impact of utilizing point-of-choice prompts to promote active transportation on a Canadian university campus. Health and Rehabilitation Sciences Graduate Research Conference. London, Ontario, February 6, 2019. Abstract and Poster Presentation.

Ly, H., & Irwin, J.D. The impact of utilizing point-of-choice prompts to promote active transportation on a Canadian university campus. Canadian Obesity Student Meeting. London, Ontario, June 20-22, 2018. Abstract and Poster Presentation.

Ly, H. Point-of-choice prompts to promote physical activity. 3-Minute Thesis Competition. London, Ontario, March 29, 2017. Abstract and Oral Presentation.

Ly, H. Point-of-choice prompts to promote physical activity. Canadian Obesity Network – Students and New Professional Research Blitz. London, Ontario, March 14, 2017. Oral Presentation.

Ly, H. The promotion of active transportation and universal transit pass programs. Western Research Forum. London, Ontario, March 4, 2016. Abstract and Oral Presentation.

Ly, H., & Irwin, J.D. University students' perceptions of the relationship between bus pass ownership and physical activity levels. Health and Rehabilitation Sciences Graduate Research Conference. London, Ontario, February 4, 2015. Abstract and Oral Presentation.

Ly, H., & Irwin, J.D. Bus pass and physical activity: University students' perceptions. Robert Macmillan Graduate Research in Education Symposium. London, Ontario, April 10, 2014. Abstract and Poster Presentation.

Ly, H., & Irwin, J.D. Bus pass and physical activity: University students' perceptions. Faculty of Health Sciences' Research Day. London, Ontario, March 25, 2014. Abstract and Poster Presentation.

Ly, H., & Irwin, J.D. Bus pass and physical activity: University students' perceptions. Western Research Forum. London, Ontario, March 17-19, 2014. Abstract and Oral Presentation.

C. GUEST LECTURES AND INVITED TALKS

Ly, H. *Types of Evaluations*. An invited lecture for Health sciences 2250A: Health Promotion in Canada. Western University. London, Ontario, December 5, 2016. Oral Presentation.

Ly, H. *Healthy behaviours, active by choice!* An invited lecture for Health Sciences 1001B: Personal Determinants of Health. Western University. London, Ontario, March 3, 2016. Oral Presentation.

Ly, H. *Active today, healthy tomorrow!* An invited lecture for Health Sciences 2250A: Health Promotion in Canada. Western University. London, Ontario, November 2, 2015. Oral Presentation.

D. RADIO BROADCAST INTERVIEWS

Ly, H. CHRW 94.9FM. "Health4U". *Radio interview regarding active transportation.* Segment aired February 27, 2017.

Ly, H. CHRW 94.9FM. "Gradcast". *Radio interview regarding university students' perceptions of the relationship between bus pass ownership and physical activity levels.* Segment aired July 21, 2015.

E. ACADEMIC CONFERENCES AND PROFESSIONAL MEETINGS

May 15, 2019	Spring Perspectives on Teaching Conference, Western University
March 23, 2018	Nspire Western: Mind Over Matter Health Pitch Competition, Western University
August 30, 2016	Fall Perspectives on Teaching Conference, Western University
February 25, 2016	Canadian Obesity Network – Students and New Professional Research Blitz, Western University
October 23, 2015	Exercise is Medicine on Campus Annual Symposium, Western University
September 2, 2015	Fall Perspectives on Teaching Conference, Western University
October 3, 2014	Exercise is Medicine on Campus Annual Symposium, Western University
August 27, 2014	Fall Perspectives on Teaching Conference, Western University
May 14, 2014	Spring Perspectives on Teaching Conference, Western University

F. CONFERENCE COMMITTEE

2017 – 2018	*Planning Committee Member and Session Chair*, Canadian Obesity Student Meeting, London, Ontario

2016 – 2017	*Planning Committee Member*, Canadian Obesity Network – Students and New Professional Research Blitz, London, Ontario
Summer 2016	*Competition Judge*, The Undergraduate Awards, Dublin, Ireland
2015 – 2016	*Abstract Reviewer and Competition Judge*, Undergraduate Science Case Competition, London, Ontario

9. OTHER SCHOLARLY AND PROFESSIONAL ACTIVITIES

A. JOURNAL REVIEWER

2019 – Present	*Reviewer*, American Journal of Lifestyle Medicine, SAGE Publications, United States
2018 – Present	*Reviewer*, Journal of American College Health, Taylor and Francis Group, United Kingdom

B. COMMITTEE INVOLVEMENT

2014 – 2018	*Steward*, Public Service Alliance of Canada Local 610, Western University
2014 – 2018	*Member*, Exercise is Medicine on Campus, Western University
2013 – 2018	*Executive Committee Member*, Obesity Canada Students and New Professionals, Western University - This chapter received the 2016 Obesity Canada Students and New Professionals Chapter Champion Award
2014 – 2015	*Councillor*, Society of Graduate Students, Western University
2014 – 2015	*Deputy Chair*, Society of Graduate Students Health Plan Committee, Western University
2012 – 2013	*Undergraduate Liaison*, Graduate Research Association of Students in Public Health, York University
2010 – 2011	*Tutor*, Undergraduate Psychology Student Association, York University, Toronto, Ontario, Canada

Summer 2010	*Orientation Leader*, Bethune College Council, York University

C. PROFESSIONAL DEVELOPMENT AND ADDITIONAL TRAINING

December, 2016	*Teaching Mentor Program*, Western University
November, 2013	*Motivational Interviewing and Coaching Skills – Level 2 Advanced Workshop*, The Monarch System
October, 2013	*Motivational Interviewing and Coaching Skills – Level 1 Intensive Workshop*, The Monarch System
October, 2013	*Tri-Council Policy Statement: Course on Research Ethics (TCPS 2: CORE)*, Tri-Council of Canada
September, 2013	*Teaching Assistant Training Program*, Western University

D. COMMUNITY SERVICES

2018 – 2019	*Career Profile Advisor*, Student Success Centre, Western University, London, Ontario, Canada
2016 – 2018	*Volunteer*, London Health Sciences Centre (University Hospital), London, Ontario, Canada
Winter 2016	*Bell Let's Talk Campaign Volunteer*, Healthy Minds Canada, London, Ontario, Canada
Spring 2009	*Teaching Assistant*, Morrish Public School, Toronto, Ontario, Canada

E. PROFESSIONAL ASSOCIATION MEMBERSHIP

2014 – Present	Sedentary Behaviour Research Network
2013 – Present	Obesity Canada
2018 – 2019	Physical and Health Education Canada Research Council
2018 – 2019	Health Promotion Canada
2018 – 2019	International Union for Health Promotion and Education
2015 – 2016	International Society of Behavioral Nutrition and Physical Activity