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Encouraging Movement Opportunities through Theory-Informed Video Education in Undergraduate Students: The MOVE Study

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Abstract

This mixed methods randomized control trial explored the impact of a tailored, Health Belief and Transtheoretical Model informed educational video on undergraduate students': (1) motivational readiness, self-efficacy, and decisional balance about changing sedentary behaviour; (2) levels of sedentary time; and (3) perceptions of sedentary behaviour over time and when compared to a control condition. Students (N = 160) were randomly assigned to the intervention or control group. Participants completed: two previously validated questionnaires at baseline, immediate post-intervention, and one-month follow-up; and open-ended questions at post-intervention (intervention group only). Linear mixed models and inductive content analysis were used. Significant differences were observed within intervention participants' self-efficacy (p = .016) and decisional balance (p = .008) at post-intervention, and sedentary time at post-intervention (p = .032) and follow-up (p = .006). Intervention participants reported positive experiences with the video and felt motivated to reduce their sedentary behaviour. This theory-informed intervention shows promise for reducing students' sedentary behaviours.

Keywords: sedentary behaviour, university students, health belief model, transtheoretical model, video education

Summary for Lay Audience

The prevalence of sedentary behaviours (i.e., sitting time) among university students is concerning. While university students have been identified as one population at greater risk for high levels of sedentary time, the COVID-19 pandemic has amplified the already high sedentary rates of this population. Theory-informed interventions have proven to be successful in reducing the levels of sedentary behaviour experienced among this population. While several health behaviour theories have been studied, research is sparse on the effects of a combined Health Belief Model and Transtheoretical Model informed sedentary behaviour intervention. This thesis examined the impact of a theory-informed, tailored educational video on university students' motivational readiness, self-efficacy, and decisional balance (pros and cons) relating to changing sedentary behaviours compared to a control condition. This study also examined the effect of the video on students' levels of sedentary time and perceptions of sedentary behaviour. An evidence-based and theory-informed video was created with a specific focus on Western University students. A randomized control trial was conducted with a sample of 160 undergraduate students. Participants were randomly assigned to either an intervention group (n = 87) who watched the tailored educational video about sedentary behaviour, or a control group (n = 73) who watched a general health education video. Participants were asked to complete two questionnaires three times over the course of the study. Additionally, intervention participants were asked to complete a series of three open-ended questions immediately after watching the tailored educational video. Participants' motivational readiness, self-efficacy, decisional balance, and sedentary time were assessed over time and within as well as between groups. Despite no difference found between groups, researchers found that intervention participants increased their self-efficacy and decisional balance, and decreased their sedentary time immediately after watching the video.

Intervention participants also continued to decrease their sedentary time when assessed 1-month after watching the video. No significant changes were observed within the control group. Intervention participants described intentions to change their sedentary behaviour after watching the tailored educational video and reported seemingly positive experiences. Overall, the theory-informed educational video shows promise as an intervention for changing the sedentary behaviours of university students.

Co-Authorship Statement

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Chapter 1: Introduction

Sedentary behaviours have become increasingly prevalent in society (O'Donoghue et al., 2016; Stockwell et al., 2021). Researchers have found that excessive levels of sedentary behaviour are associated with multiple adverse health outcomes, such as cardiovascular diseases (Beunza et al., 2007; Biswas et al., 2015), type 2 diabetes (Chater et al., 2020), obesity (Shields & Tremblay, 2008), metabolic syndrome (Gennuso et al., 2014), as well as poor mental well-being (Lee & Kim, 2019; Zhai et al., 2015). In fact, the new Canadian 24-Hour Movement Guidelines for Adults aged 18-64 years (Canadian Society for Exercise Physiology, 2021) recommend every Canadian adult be focused not only on sleeping well and moving more, but also on reducing their sedentary time. One population found to be experiencing excessive levels of sedentary behaviour are university students (Castro et al., 2020; Clark et al., 2015; Clemente et al., 2016; Moulin et al., 2021; Rouse & Biddle, 2010). In fact, sedentary behaviour has become ubiquitous among university students, and in the last decade this focus has grown into an emerging area of research (e.g., Benzo et al., 2016; Castro et al., 2020; Moulin et al., 2020; Peterson et al., 2018). Recently, the COVID-19 pandemic and resulting societal changes have provided additional challenges to reducing sedentary behaviours, including those of university students (e.g., Goncalves et al., 2021; Rivera et al., 2021). A shift to online learning combined with additional public health protections to limit the spread of COVID-19, have resulted in heightened sedentary lifestyles (Bertrand et al., 2021; Gallè et al., 2020; Romero-Blanco et al., 2020).

Promoting healthy behaviour change (e.g., reducing sedentary behaviours) among university students is important, as this period of time represents a transition into adulthood for many; it is often considered a time when students establish long-lasting health behaviour patterns

(Nelson et al., 2008; Von Ah et al., 2004). Intervening as early as possible within this cohort may help to attenuate the sedentary behaviour levels that can persist throughout a students' university career and beyond. To effectively promote healthy behaviour change, it is critical to understand and examine the reasons people (e.g., students) will or will not modify or adopt health behaviours (Raingruber, 2017). Behavioural change theories are commonly used to "examine the predictors and precursors of health behaviour" (Raingruber, 2017, p. 52). Thus, integrating behavioural theory into a university-focused sedentary behaviour intervention could be used to better understand university students' motivations for reducing sedentary behaviours. While there have been several evidence-based strategies to help reduce the amount of time university students spend sedentary, such as the implementation of various types of standing desks (e.g., Chrisman et al., 2020; Jerome et al., 2017; Moulin et al., 2021), interventions that apply a theoretical framework to better understand an individual's motivation or intention to change would be useful to aid in making the behaviour change long-lasting. The Health Belief Model (Hochbaum, 1958; Rosenstock, 1960, 1974) and the Transtheoretical Model (Prochaska, 1979) are intrapersonal level behaviour change theories, which focus on factors within an individual (e.g., knowledge, motivation, self-efficacy, attitude, skills) that could contribute to a person's decision to adopt a behaviour change (McKenzie et al., 2017). Motivation and self-efficacy are factors that have been found to be particularly strong predictors of behaviour change (Rollo et al., 2016; Wong et al., 2016). Ergo, to maximize its potential to meaningfully intervene in the sedentary behaviours of university students, an intervention should be informed by evidence-based theoretical constructs.

To provide the background that forms the foundation for and direction of the research study presented in this thesis document, the following review of literature will begin with a

definition of sedentary behaviour as well as a summary of what is currently known about the prevalence of sedentary behaviours among the university student population, highlighting the recent context of the COVID-19 pandemic. Then, the impact of the university environment on students' sedentary behaviour will be discussed, with an emphasis on the importance of intervening in sedentary behaviours during the university years. Next, an overview of the use of behaviour change models and theories to inform sedentary behaviour interventions among the university student population will be examined, with a specific focus on the Health Belief Model (Hochbaum, 1958; Rosenstock, 1960, 1974) and the Transtheoretical Model (Prochaska, 1979). Lastly, the value of creating a video tailored for students and informed by the Health Belief Model (Hochbaum, 1958; Rosenstock, 1960, 1974) and Transtheoretical Model (Prochaska, 1979) will be presented, followed by the objectives of the study.

Chapter 2: Literature Review

Defining Sedentary Behaviour

Sedentary behaviour can be defined as "any waking behaviour characterised by an energy expenditure ≤1.5 metabolic equivalents (METs) while in a sitting, reclining, or lying posture" (Tremblay et al., 2017, p. 5). According to Owen and colleagues (2010), sedentary behaviours typically include: (1) sitting in the workplace; (2) sitting while commuting; and (3) sitting during leisure time activities (i.e., watching TV or computer use).

The Prevalence of Sedentary Behaviours and Time among University Students

University students are a distinctive subgroup of the population that experience prolonged bouts of sitting due to the obligations that coincide with being a postsecondary student (i.e., attending classes, studying for examinations; Cotten & Prapavessis, 2016; Rouse & Biddle, 2010). To date, several researchers have found the sedentary behaviours of university students to be highly problematic. For instance, in a 2021 systematic review of the sedentary time of undergraduate students (N = 6, 533 students in the 23 studies that were included because they used either a validated questionnaire or accelerometers), Moulin and colleagues found undergraduate students spend about 11 hours/day in sedentary pursuits. This finding is, not surprisingly, consistent with relevant primary studies outlined next. For instance, in a questionnaire validation study by Clark and colleagues (2015) at the University of Queensland (N = 37 students), the authors reported the students engaged in 10.74 hours of sedentary time per day. Similarly, in a study conducted among 127 university students in Portugal, Clemente and colleagues (2016) used ActiGraph accelerometers to examine if university students were meeting the recommended guidelines for physical activity. It was established by the researchers that the sample of Portuguese university students were sedentary for 12.61 hours per day. Consistent

with Clemente and colleagues (2016), Moulin and colleagues (2021) conducted a study among 21 undergraduate students from a Canadian university to measure the effect of providing standing desks to undergraduate students. The researchers used inclinometers to identify a total of 12.16 hours per day of sedentary time pre-intervention among undergraduate students (Moulin et al., 2021). In an earlier study by Moulin and Irwin (2017), the researchers examined the total daily sedentary time of undergraduate students ($N = 102$) from a Canadian university using the validated SIT-Q Sedentary Behaviour Questionnaire (Lynch et al., 2014) and found that students spent an average of 11.88 ± 3.46 hours per day in sedentary activities. Based on the results, the sedentary behaviour levels of university students were suggested to be equal to or greater than the sedentary behaviour levels of desk-based workers when compared to relevant literature findings (Moulin & Irwin, 2017). For example, Waters and colleagues (2016) conducted a study to explore the sedentary behaviours of office-based workers ($N = 40$) in Singapore. Using objectively measured accelerometer data, the researchers found that desk-based workers spent approximately 11 hours per weekday sedentary (Waters et al., 2016). Based on the results from Waters and colleagues (2016) and the aforementioned studies reporting on the sedentary time of university students (i.e., Bertrand et al., 2021; Clark et al., 2015; Clemente et al., 2016; Gallè et al., 2020; Moulin & Irwin, 2017; Moulin et al., 2021), it is evident that sedentary behaviours are inherently prevalent among the university student population.

Introduction of COVID-19 into Society and its Impact on University Students' Sedentary Time

Recently (i.e., since the onset of the COVID-19 pandemic), elevated sedentary behaviours of the general population have become a concern resulting, in part, from some of the public health measures implemented to reduce the spread of the virus (i.e., closures of

gyms/recreational facilities, physical distancing, lockdown/stay at home orders; many people working from home and limiting their overall mobility; Canadian Institute for Health Information, 2022; Government of Canada, 2022; Stockwell et al., 2021). In a study by Stockwell and colleagues (2021), the researchers conducted a systematic review to analyze changes in levels of physical activity and sedentary behaviour from pre-COVID-19 compared to levels during COVID-19 (i.e., from November 2019 to June 2020) among adults, children, and special populations. Stockwell and colleagues (2021) discovered that for the studies that specifically reported on sedentary behaviour levels (n = 34), all populations reported increases in levels of sedentary behaviour during the COVID-19 pandemic. Similarly, Bertrand and colleagues (2021) conducted a study to investigate the impact of the COVID-19 pandemic on the dietary intake, physical activity, and sedentary behaviours of university students (N = 125) from two Canadian universities in Saskatchewan, collecting both retrospective data (pre-COVID-19) and prospective data (during April to July 2020) through the use of online questionnaires. The researchers found that university students' sedentary activities "increased from 8.3 ± 3 h per day before COVID-19 to 11 ± 4 h per day during COVID-19" (Bertrand et al., 2021, p. 268). The pre-COVID-19 sedentary behaviour data from Bertrand and colleagues (2021) is consistent with previous studies (i.e., Clark et al., 2015; Clemente et al., 2016; Moulin et al., 2021) which demonstrate university students' levels of sedentary time exceeding the recommended guidelines of less than 8 hours per day in sedentary activities (Canadian Society for Exercise Physiology, 2021). The more recent COVID-19 findings of Bertrand and colleagues (2021) are alarming, as there have been significant increases to the previously high amount of time spent sedentary among the university student population. While it is likely that these circumstances are similar for undergraduate students across Canada, mandated public health protections have varied

largely across the provinces as public health mandates are region-specific (Public Health Ontario, 2022). Therefore, the measures influencing university students' mobility and experiences may be markedly different when compared to university students in other regions of the country.

The University Environment Contributes to Students' Levels of Sedentary Behaviour

The inherent prevalence of high sedentary time among the university student population is often attributed to the university environment (Benzo et al., 2016; Felez-Nobrega et al., 2018; Smetaniuk et al., 2017). Students in university spend a considerable amount of time dedicated to academic obligations each day, many of which happen to be sedentary tasks such as attending class or studying (Sui & Prapavessis, 2018). This notion was paralleled in a study by Moulin and Irwin (2017) in which the authors explored university students' (N = 102) perspectives on the facilitators and barriers to engaging in a less sedentary lifestyle. The students emphasized the limitations that the classroom environment posed for them being able to engage in a less sedentary lifestyle, noting that many classrooms and lecture halls are equipped with fixed seating (similar to seats of an auditorium which are secured to the floor), rendering them difficult to use that space for standing. This architectural design of many university classroom environments eliminates students' opportunities to stand and break up prolonged bouts of sitting. In fact, it has been echoed by researchers throughout the literature that students perceive the physical environment of university campuses to be a barrier to engaging in less sedentary behaviours (e.g., Deliens et al., 2015; Moulin & Irwin, 2017; Smetaniuk et al., 2017; von Sommoggy et al., 2020). The importance of addressing the physical environment was underscored by Benzo and colleagues (2016), who found that approximately 83% of the American university students (N = 993) they studied reported sitting for the entirety of their classes. Thus, from the review above, it

is apparent that the typical university lifestyle and environments contribute to high levels of sedentary behaviour among students.

The Importance of Intervening in Sedentary Behaviours and Why the University Years Matter

Excessive and prolonged bouts of sitting have been found to increase an individual's risk for several chronic diseases, including cardiovascular diseases, type 2 diabetes, and cancers (Biswas et al., 2015; Patterson et al., 2018). In a follow-up prospective cohort study conducted among a sample of 6,742 university graduates living in Spain, Beunza and colleagues (2007) assessed the association between sedentary behaviour and the incidence of hypertension. The researchers found that graduates with more sedentary behaviours were at a greater risk for incident hypertension compared to their less sedentary counterparts (Beunza et al., 2007). With the knowledge that university students experience frequent and prolonged bouts of sitting, and that excessive sedentary behaviour can be detrimental to health, the prevalence of sedentary behaviours among this population are concerning, particularly given the transition to university is often accompanied by unhealthy behaviour changes for students (Crombie et al., 2009; Vella-Zarb & Elgar, 2009). Behaviours such as alcohol consumption, smoking, stress-related eating, lack of physical activity, and risky sexual behaviours have all been identified as common unhealthy lifestyle changes among university students (Vella-Zarb & Elgar, 2009; Von Ah et al., 2004). For example, Crombie and colleagues (2009) conducted a review of the literature to understand the factors contributing to weight gain in first-year university students. The authors underscored that the decline in activity that tends to start in late adolescence typically persists into young adulthood (Crombie et al., 2009). While physical inactivity and sedentary behaviour are two individual concepts that each have their own unique risk factors for health, physical

inactivity is an example of one unhealthy lifestyle change that tends to occur during the transition to university.

As alluded to earlier, intervening during the university years is especially important as some health behaviours established during this formative time tend to track into later adulthood, thus impacting risks for longer-term negative health consequences (Von Ah et al., 2004). Keating and colleagues' (2005) meta-analysis on the physical activity of college students provides a suitable example; students who engaged in a more sedentary lifestyle throughout college were found to remain sedentary five to ten years later. Considering that students experience excessive amounts of sedentary behaviour during their university years combined with the importance of promoting healthy behaviours in young adulthood, targeting students as soon as possible upon their entry to university could incite meaningful changes in their anticipated sedentary behaviour trajectory.

Behaviour Change Theories and Models to Inform Sedentary Behaviour Interventions for University Students

Theories have been defined as "a systematic way of understanding events, behaviors, and/or situations" (Glanz, n.d., p. 5). Specifically in health promotion, behavioural theories help to "develop an organized, systematic, and efficient approach to investigating health behaviors" (Crosby et al., 2013, p. 32). Comparatively, "models draw on a number of theories to help understand a specific problem in a particular setting or context" (Rimer & Glanz, 2005, p. 4). In other words, models and theories help to explain the behaviours of individuals and provide suggestions on how to most effectively develop ways to change the behaviour (Glanz & Bishop, 2010).

Understanding behaviour change from a theoretical perspective is necessary to increase the likeliness of an intervention being effective (Davis et al., 2015). Thus, the use of models and theories in the development of health-related behaviour change interventions is important. In fact, Davis and colleagues (2015) suggested that the application of theory is not only a critical step in the intervention design, but also in the evaluation and evidence synthesis of a behavioural intervention. Researchers have found that the most effective and well-designed behaviour change interventions are "guided by theory and informed by empiric evidence regarding the target behaviour" (Bartholomew and Mullen, 2011, p. 520). Further, interventions that are informed by and grounded in a behaviour change theory have been more successful at bringing about the desired behaviour compared to interventions absent in theory (Prestwich et al., 2014). Based on this knowledge, the use of theory in behaviour change research is necessary to "ensure that researchers identify causal factors of the behaviour and identify change methods that address the concept theory and maximize intervention effectiveness" (Bartholomew and Mullen, 2011, p. 521). There have been several evidence-based interventions targeting sedentary behaviour among university students that have been informed by the following behaviour change theories: Health Action Process Approach (Schwarzer, 1992; e.g., Dillon et al., 2022; Keahey et al., 2021; Sui & Prapavessis, 2018); Social Cognitive Theory (Bandura, 1986; e.g., Pachu et al., 2020); Protection Motivation Theory (Rogers, 1975; e.g., Wong et al., 2016); and Self-Determination Theory (Ryan & Deci, 2000; e.g., Quartiroli & Maeda, 2014). The outcomes of these interventions will be outlined in further detail below.

As mentioned above, the Health Action Process Approach (HAPA; Schwarzer, 1992) has recently been used to inform several behavioural interventions targeting sedentary behaviour among university students (Dillon et al., 2022; Keahey et al., 2021; Sui & Prapavessis, 2018). In

a randomized control trial conducted by Dillon and colleagues (2022), researchers examined if a 6-week HAPA-based intervention (i.e., action and coping planning) coupled with tailored text messages could reduce school-related sitting time in a sample of full-time university students (N = 61) across Canada. Dillon and colleagues (2022) found that for the individuals randomly assigned to the intervention group (n = 28), the HAPA-based intervention was successful in improving both action and coping planning among students and significantly reduced their sedentary behaviours compared to the control group. Comparatively, Keahey and colleagues (2021) set out to explore the feasibility of a text message based HAPA-informed intervention aimed to target the sedentary behaviours of university students (N = 158) from a Canadian university. The researchers also investigated changes in the sedentary behaviours and physical activity of students for the duration of the intervention (Keahey et al., 2021). The researchers conducted a 6-week intervention where students were sent a series of text messages each week that included "one fact, one reminder, one tip and one challenge" that were informed by constructs of the HAPA with content specific to sedentary behaviour (Keahey et al., 2021, p. 674). Keahey and colleagues (2021) found that overall, the intervention was feasible to implement and well-received by participants; however, no changes in sedentary behaviour or HAPA-related constructs were observed over the course of the intervention. Similar to Dillon and colleagues (2022), Sui and Prapavessis (2018) conducted a pilot randomized control trial designed as a HAPA-based sedentary behaviour intervention specific to action and coping planning. Sui and Prapavessis (2018) aimed to determine if student break frequency increased, and break duration decreased in a sample of Canadian university students (N = 52) by implementing a behavioural counseling intervention. The intervention consisted of creating an action and coping plan specific to the treatment condition (i.e., either student-related sitting or

nutrition; Sui and Prapavessis, 2018). The researchers determined that the intervention grounded in the HAPA was successful in affecting break frequency among students in the intervention group when compared to the control condition. The researchers found less conclusive evidence that the HAPA-based intervention affected break duration among students (Sui and Prapavessis, 2018). Based on these summarized findings, it is evident that while some HAPA-informed interventions have been found to be successful in positively affecting the sedentary behaviours of students, others have not found significant behavioural changes.

Pachu and colleagues (2020) conducted a qualitative study theoretically informed by the Social Cognitive Theory (SCT; Bandura, 1986) to assess university students' (N = 19) knowledge of sedentary behaviour risk and to explore their perceptions of SCT constructs (i.e., self-efficacy, outcome expectations, barriers, and ideas) related to reducing sedentary behaviour. The researchers conducted a series of focus groups and identified three main themes: "(1) conceptual confusion, yet knowledgeable about risks; (2) confident but unlikely to change; and (3) ideas to reduce sedentary behavior" (p. 3). The findings presented by Pachu and colleagues (2020) provide valuable insights on university students' perceptions of reducing sedentary behaviours and allows researchers to more deeply understand the reasons for these behaviours.

The Protection Motivation Theory (PMT; Rogers, 1975) was used to inform an intervention conducted by Wong and colleagues (2016) among a sample of university students (N = 787). The aims of the study were to: "(1) examine the factor structure and composition of sedentary-derived PMT constructs and (2) determine whether general and leisure PMT models can predict sedentary goal intention, implementation intention, and behavior in university students" (Wong et al., 2016, p. 31). The researchers had participants complete a two-part online survey which consisted of a modified PMT questionnaire followed by the completion of either

general or leisure goal and implementation intention items depending on the participant generated group randomization (Wong et al., 2016). Moderate-to-strong evidence was found "for the prediction of implementation intention whereas weaker evidence was found for the prediction of goal intention and sedentary behaviour" (Wong et al., 2016, p. 41-42). Based on their preliminary findings, Wong and colleagues (2016) indicated the existence of evidence that a modified PMT sedentary behaviour model could be used as a framework for future sedentary behaviour interventions.

Lastly, in a study conducted by Quartiroli and Maeda (2014), researchers conducted an intervention informed by the Self Determination Theory (SDT; Ryan & Deci, 2000) to determine whether the behavioural regulations and psychological needs associated with physical activity predicted sedentary behaviours (similar to those of moderate-to-vigorous physical activity) within a sample of college students (N = 1,022). Based on the results from the online questionnaire, the researchers determined a statistically significant "negative relationship between MVPA and sedentary behaviors" (Quartiroli & Maeda, 2014, p. 93). The researchers observed that the SDT variables had stronger correlations with physical activity levels than sedentary behaviour (Quartiroli & Maeda, 2014). Quartiroli and Maeda (2014) indicated that the SDT might be a valuable theory to inform interventions that are specific to reducing sedentary behaviour.

While there have been some theory-informed behavioural interventions conducted within the university student population, further research is needed to broaden the scope of this area and increase the likelihood of successfully reducing students' sedentary behaviours. Pachu and colleagues (2020) stated that for an intervention to be successful at reducing sedentary behaviour among university students, further applications of behavioural theories are necessary to discover

the modifiable psychological factors that interventions can target. Specifically, Bartholomew and Mullen (2011) have stated that "investigators need to know not only that the use of theory is a requirement in the field, but also how to effectively select and use multiple theories to design, test, and report interventions" (p. S20). As such, for researchers who plan to conduct interventions that are informed by a health behaviour theory, it is important to consider whether the theory is suitable for the type of behaviour change being targeted and to integrate the use of several theories in the design of the intervention in order to increase the likelihood of behaviour change success. Two of the most widely used theoretical approaches (and the two chosen to inform the current study) are the Health Belief Model (HBM; Hochbaum, 1958; Rosenstock, 1960, 1974) and the Transtheoretical Model (TTM; Prochaska, 1979), described below. It is clear health behaviour theories such as HAPA (Schwarzer, 1992), SCT (Bandura, 1986), PMT (Rogers, 1975), and SDT (Ryan & Deci, 2000), described above, have shown success in sedentary behaviour research. And, while the HBM and TTM are two theories that, despite being widely used in health promotion-related research, are understudied in the area of sedentary behaviour among university students. While several of the health behaviour theories that have shown to be effective in reducing sedentary behaviours share certain constructs with the HBM and TTM (e.g., self-efficacy, intention, risk perception), there may be value in assessing the effectiveness of these two theories used in combination, as will be discussed in more detail in a proceeding section of this document.

The Health Belief Model

The HBM is one intrapersonal, value-expectancy theory that has been widely used to understand and explain both change and maintenance of health behaviours, as well as to support behaviour change interventions (Champion & Skinner, 2008). The HBM was originally

developed in the 1950s by social psychologists to help explain the reasons individuals would or would not use health services to prevent or detect disease (Hochbaum, 1958; Rosenstock, 1960, 1974). The HBM includes several constructs that predict why an individual will "take action to prevent, to screen for, or to control illness conditions" (Champion & Skinner, 2008, p. 46). The constructs include: (1) perceived susceptibility (i.e., the extent to which an individual thinks they are susceptible to the health threat); (2) perceived seriousness/severity (i.e., an individual's belief of how serious the health condition or disease is/could be); (3) perceived benefits (i.e., the belief that the outcome will result in a reduction of the health impact); (4) perceived barriers (i.e., the belief that the physical or emotional costs of the outcome are not valued); and (5) cues to action (i.e., strategies that motivate an individual's readiness to change) (Champion & Skinner, 2008; McKenzie et al., 2017). In the original development of the HBM, (6) self-efficacy (i.e., an individual's confidence in their capabilities to achieve or perform a certain task or behaviour; Bandura, 1977) was not identified as a construct and was only recently included as a component that tends to impact the construct of perceived barriers (McKenzie et al., 2017). McKenzie and colleagues (2017) have noted that to use the HBM for long-term health behaviour change in priority populations, self-efficacy is a necessary component. This is likely due, in part, to the knowledge that self-efficacy has been identified as one of the most important predictive constructs in health behaviour change research (Williams & Rhodes, 2016). Specifically, individuals with high self-efficacy are more likely to make health behaviour changes compared to individuals with lower self-efficacy; a widespread concept within the literature (Bandura, 1998; Strecher et al., 1986). The HBM suggests that for a behaviour change to occur and be successful, an individual must "feel threatened by their current behavioural patterns (perceived susceptibility and severity) and believe that change of a specific kind will result in a valued

outcome at an acceptable cost. They must also feel themselves competent (self-efficacious) to overcome barriers to taking action" (Champion & Skinner, 2008, p. 50). A systematic review of 46 studies conducted by Janz and Becker (1984), found that the original components of the HBM were all significantly associated with health behaviour change. The authors found that in 89% of the 46 studies reviewed, the construct of perceived barriers was the most significant predictor of behaviour change (Janz & Becker, 1984). As such, interventions theoretically grounded in the HBM that aim to support and/or predict changes in behaviour should not only integrate all constructs of the HBM, but also appreciate the significant role of perceived barriers.

Value of Health Belief Model-Informed Intervention to Reduce Sedentary Time among University Students

The use of the HBM as a theoretical framework for understanding and encouraging behaviour change has been successful in various interventions targeting the university student population, particularly with regard to weight management (e.g., Das & Evans, 2014; McArthur et al., 2018), vaccine uptake (e.g., Donadiki et al., 2013), healthy eating and physical activity (e.g., Kim et al., 2012), and diabetes self-management (Wdowik et al., 2001). To date, a thorough review identified no published sedentary behaviour-specific interventions informed by the HBM for university students, even though constructs of the HBM have been associated with important elements in the development of health behaviour change. As discussed by Rollo and colleagues (2016), there are cognitive and motivational factors (e.g., beliefs, intentions, barriers, knowledge, self-efficacy) within several of the health behaviour theories, such as the HBM, that can affect the action of behaviour change. In a systematic review (Rollo et al., 2016) to understand the association between cognitive and motivational factors and sedentary behaviour, researchers found that factors associated with lower sedentary time included higher self-efficacy

and greater intentions to reduce sedentary behaviour. Further, in a study by Wong and colleagues (2016), researchers used the Protection Motivation Theory (PMT) as a theoretical framework to understand sedentary behaviour and found that in a sample of 787 university students, both greater self-efficacy *and* intentions to reduce sedentary behaviour were associated with lower levels of sedentary behaviour. Although the PMT and the HBM are two distinct theories, both are intrapersonal level and value-expectancy theories that focus on factors within the individual (e.g., knowledge, beliefs, motivation) to support behaviour change (McKenzie et al., 2017). Thus, the findings from Wong and colleagues (2016) provide significant insight to the constructs that might be most useful in influencing sedentary behaviours among the university student cohort. According to Webb and colleagues (2010), HBM interventions should target the social-cognitive determinants of the HBM, as the model suggests that changes in the social-cognitive determinants will lead to changes in behaviour. With the knowledge that interventions informed by the HBM have been successful within the university student population, and that constructs of the HBM have been strong predictors of behaviour change, a sedentary behaviour intervention informed by the HBM may be an efficacious option for helping to reduce sedentary behaviour in university students.

The Transtheoretical Model

The Transtheoretical Model (TTM), also referred to as the Stages of Change Model, was developed by Prochaska (1979) and "emerged from a comparative analysis of leading theories of psychotherapy and behaviour change" (Prochaska & Velicer, 1997, p. 38). The TTM was developed to "help explain how individuals and populations progressed toward adopting and maintaining health behaviour change" (McKenzie et al., 2017, p. 168). The TTM has been widely applied to several types of health behaviour change interventions, namely alcohol and

substance abuse, eating disorders and obesity, mammography screening, sun exposure, and sedentary lifestyles (Prochaska & Velicer, 1997). There are four core constructs to the TTM: (1) stages of change; (2) processes of change; (3) decisional balance; and (4) self-efficacy.

Stages of Change

Prochaska and DiClemente (1983) discovered that behaviour change occurs through a series of six stages, commonly known as the stages of change: (1) precontemplation (i.e., the person is not intending to change their behaviour within the next 6 months; Prochaska & Velicer, 1997); (2) contemplation (i.e., the person is intending to change their behaviour within the next 6 months; Prochaska & Velicer, 1997); (3) preparation (i.e., the person is immediately intending to change their behaviour within the next month; Prochaska & Velicer, 1997); (4) action (i.e., the person has made specific behavioural changes within the past 6 months; Prochaska & Velicer, 1997); (5) maintenance (i.e., the person is working to prevent a relapse in behaviour and is confident in their behaviour change; Prochaska & Velicer, 1997); and (6) termination (i.e., the person does not have any temptation to return to their old behaviours and has high self-efficacy; Prochaska & Velicer, 1997). The stages of change construct of the TTM is illustrative of a continuum of motivational readiness for classifying where an individual is in the behaviour change process (McKenzie et al., 2017).

Processes of Change

The processes of change construct is comprised of ten components: (1) consciousness raising (i.e., an "increased awareness about the causes, consequences, and cures for a particular problem behaviour", Prochaska & Velicer, 1997, p. 39); (2) dramatic relief (i.e., "initially produces increased emotional experience followed by reduced affect if appropriate action can be taken", Prochaska & Velicer, 1997, p. 39-40); (3) environmental reevaluation (i.e., "cognitive

and affective evaluations of the way the presence or absence of a personal habit affects the environment around a person", Prochaska & Velicer, 1997, p. 40); (4) self-reevaluation (i.e., "combines both cognitive and affective assessments of one's self-image with and without a particular unhealthy habit", Prochaska & Velicer, 1997, p. 40); (5) self-liberation (i.e., "the belief that one can change and the commitment and recommitment to act on that belief", Prochaska & Velicer, 1997, p. 40); (6) social liberation (i.e., "requires an increase in social opportunities or alternatives especially for people who are relatively deprived or oppressed", Prochaska & Velicer, 1997, p. 40); (7) counterconditioning (i.e., "requires the learning of healthier behaviors that can substitute for problem behaviors", Prochaska & Velicer, 1997, p. 40); (8) helping relationships (i.e., "combine caring, trust, openness, and acceptance as well as support for the healthy behavior change", Prochaska & Velicer, 1997, p. 40); (9) contingency management (i.e., "provides consequences for taking steps in a particular direction", Prochaska & Velicer, 1997, p. 40); and (10) stimulus control (i.e., "removes cues for unhealthy habits and adds prompts for healthier alternatives", Prochaska & Velicer, 1997, p. 40). This construct represents both the explicit and covert activities that an individual would use to advance throughout the stages of change (McKenzie et al., 2017). Specifically, some of the activities are more practical at specific stages within the model (McKenzie et al., 2017). For example, processes such as consciousness raising, dramatic relief, or self-reevaluation are most commonly used in the earlier stages of the TTM (i.e., precontemplation, contemplation, and preparation; McKenzie et al., 2017).

Decisional Balance

Decisional balance is a construct that pertains to an individual's decision to move from one stage to the next based on their evaluation of the pros and cons of making the behaviour change (McKenzie et al., 2017). The pros of behaviour change, also known as the benefits of

changing, are the reasons an individual would decide to make a behaviour change (Redding et al., 2000). Alternatively, the cons or barriers of behaviour change are the reasons an individual would choose not to change (Redding et al., 2000). Redding and colleagues (2000) discovered that the pros of behaviour change are perceived by individuals as higher in the later stages of change as opposed to in the early stages, whereas the cons of behaviour change are greater in the early stages and lower in the later ones.

Self-Efficacy

Self-efficacy is the fourth construct of the TTM. Self-efficacy has been described as an individual's belief in their ability to perform a behaviour to attain performance outcomes (Bandura, 1977). Bandura described that self-efficacy is developed based on four major sources: performance accomplishments (mastery experiences), vicarious experiences, verbal persuasion, and physiological states (1977). Taken from Bandura's SCT (1977), self-efficacy reflects an individual's confidence in their ability to achieve and maintain certain behaviours without feeling the need to revert back to previous habits or behaviours (Prochaska & Velicer, 1997).

Summary of the TTM

While there are several health behaviour theories that can help to explain the reasons an individual will or will not take action to change a health behaviour, the TTM is especially popular due, in part, to it being an integrative framework that helps to identify the behavioural intentions (i.e., motivational readiness) of individuals by determining which stage of action an individual is in. Thus, with the knowledge that behaviour change occurs through a series of stages with varying levels of motivational readiness, integrating the TTM in behaviour change interventions as an outcome measure may be an especially useful approach in identifying shifts in an individual's stage of motivational readiness to support behaviour change.

The Suitability of a TTM Informed Intervention to Reduce Sedentary Time in University Students

The TTM is a theoretical framework that has been widely used in behaviour change research (e.g., Andrès et al., 2011; Dallow & Anderson, 2003; Erol & Erdogan, 2008; Woods et al., 2002). In fact, Bridle and colleagues (2005) conducted a systematic review to examine the effectiveness of health behaviour change interventions informed by the TTM. The researchers found that the TTM was used to inform a variety of interventions promoting health behaviour change, namely smoking cessation, physical exercise, dietary change, multiple lifestyle changes, mammography screening, treatment adherence, and prevention (Bridle et al., 2005). However, despite its popular use, Bridle and colleagues (2005) determined that the use of the TTM in health behaviour interventions demonstrated little evidence of effectiveness. Conversely, in a more recent systematic review conducted by Hashemzadeh and colleagues (2019) on the TTM of health behaviour change, the researchers found strong evidence that the use of the TTM was effective in facilitating changes in health behaviours. In a study conducted by Woods and colleagues (2002) that included a sample of students ($N = 459$) from a university in Scotland, the researchers assessed the efficacy of an intervention informed by the TTM on facilitating sedentary young adults to become more active. The researchers found the intervention to be an effective method for helping students progress through the stages of change and address their sedentary behaviour and become more active (Woods et al., 2002). As the TTM has been associated with positive health behaviour change and has been found to be successful as a framework for sedentary behaviour interventions in university students, the application of the TTM to inform a university-focused sedentary behaviour intervention seems appropriate.

The Suitability of Educational Videos as Health Promotion Interventions Tools

Currently (i.e., since the introduction of COVID-19 to society) and as noted above, university students might be experiencing even higher sedentary rates than previously identified in this population. Ergo, interventions that aim to reduce the sedentary time of university students and that are suitable for pandemic times (e.g., can be offered virtually) are important and opportune. In recent literature, researchers have suggested that digital education (e.g., educational videos) has been gaining traction in the field of health education (Adam et al., 2019; McCall et al., 2018; Nutbeam, 2019). While the field of health promotion includes a variety of facets, health education, which refers to voluntary actions someone can take to prevent disease or improve their health (Green and Kreuter, 2005), remains a critical component in helping individuals to increase control over and improve their heath (McKenzie et al., 2017). In fact, the use of video-based health education to promote healthy behaviour change has become an emerging area of research interest over the course of the COVID-19 pandemic (e.g., Kane et al., 2022; McDonough et al., 2022; Yang et al., 2021).

It was noted by Brame (2016) that educational videos have become widely integrated into the fabric of higher education, and researchers have outlined important elements and styles of videos found to be most effective for the university student population (e.g., Brame, 2016; Guo et al., 2014). Notably, Guo et al., (2014) reported that the most significant indicator of engagement for students is the length of a video. Guo and colleagues (2014) found that videos with a length of 0 to 3 minutes resulted in the highest/most optimal level of engagement by students, whereas an average/moderate level of engagement occurred with a 6-minute video. Furthermore, the quality of the video's audio was also noted to be an important feature to enhance effectiveness, specifically for narration purposes. Martin and Martin (2015) outlined

several important considerations for style of speech in narrators, such as speaking with a loud and clear voice, enunciating, speaking in short sentences, keeping a good pace, and allowing speech to reflect a conversational style. According to Mayer (2008), a conversational style of narration has been found to play a significant role in learning when compared to a formal style of narration. Thus, those creating videos for students as the primary target audience should consider integrating the elements of effective videos outlined above.

While video-based interventions have been conducted within the university student population (e.g., Conceição et al., 2022; Turel et al., 2015), a video-based intervention specific to reducing sedentary behaviour among university students has not yet been investigated, according to a thorough review of published literature. To this end, the creation of a health education video specific to reducing the sedentary behaviours of university students would be a suitable intervention tool to implement and evaluate.

Summary of the Value of a Combined HBM and TTM Informed Intervention to Reduce Sedentary Behaviours and Time in University Students through Video Education

The importance of using behavioural theories to reduce sedentary behaviour among university students has been a noted priority in the literature. With the knowledge that effective interventions are often theory-informed, an intervention that is grounded in health behaviour theory would be likely to improve the effectiveness of an intervention for reducing the sedentary behaviours of university students (Davis et al., 2015; Pachu et al., 2020). Specifically, the purpose of the HBM is to predict why an individual might take action to prevent or change a behaviour, and to leverage this understanding to influence an individual's decision. A primary aim of the TTM is to identify at what stage of behaviour change an individual is in. Therefore, when used in combination, an intervention that is primarily informed by constructs of the HBM

(e.g., perceived susceptibility, perceived severity) and assessed by constructs of the TTM (e.g., stages of change, self-efficacy, and decisional balance) could shed light on behaviour influencers and consequent outcomes with regard to the sedentary behaviours of university students. The COVID-19 pandemic has been associated with highly problematic sedentary time among university students (Gallè et al., 2020; Rodríguez-Larrad et al., 2021), and it remains unclear when the pandemic will end and, even when it does, if pandemic-related behaviours will revert to pre-pandemic times. As such, an educational video offered virtually/on-line that targets sedentary behaviour among university students would be a suitable and effective intervention to develop, implement, and evaluate.

Study Purpose

The overall purpose of this study was to assess the value of a tailored and theory-informed educational video on sedentary behaviour indicators of undergraduate university students. To achieve this purpose, the three-fold objectives of this mixed methods randomized control trial (RCT) were to explore the impact of an educational video tailored to university students and informed primarily by the Health Belief Model with overlapping and complementary constructs from the Transtheoretical Model (hereafter referred to as "a tailored educational video") on Western University students': (1) motivational readiness, self-efficacy, and decisional balance pertaining to changing sedentary behaviour (primary objective); (2) reported levels of sedentary time (secondary objective); and (3) perceptions of sedentary behaviour (secondary objective) over time and when compared to a control condition.

A priori, the researchers of this study hypothesized that intervention group participants would experience greater impact on their sedentary behaviour indicators (i.e., motivational readiness, self-efficacy, decisional balance, and sedentary time) over time when compared to a

control group, and within the groups, intervention participants would improve over time and the control group would remain the same.

Chapter 3: Methods

Procedure Overview

Prior to study commencement, ethical approval was received from the Health Science Research Ethics Board (HSREB #120211; Appendix A) at the beginning of January 2022 and was also registered with Open Science Framework (Appendix B).

Recruitment for this mixed methods RCT began in January 2022 and continued for 2 weeks. Convenience sampling was used via: (1) mass emails through the host institution's mass email system; (2) professor announcements; (3) posts in Western-affiliated Facebook groups; and (4) posts through Western-affiliated social media pages and accounts. These strategies are detailed below.

Two mass emails (i.e., one for each week of recruitment; Appendix C) were sent to all full-time Western undergraduate students using the host institution's mass email platform. The mass email briefly outlined the study details and directed any interested students to click the Qualtrics^{XM} (Qualtrics, Provo, UT) survey link at the end of the email for a more detailed overview of the study. The co-investigators of the study compiled a list of all professors from Western University (i.e., main campus and affiliates) teaching any undergraduate courses for the Winter 2022 semester. A total of 1,140 professors were contacted via email and asked to share the study recruitment information (provided as an attachment in the email) with their undergraduate class(es) by posting an announcement on their Online Western Learning (OWL) course site (Appendix D). Members of the research team contacted the Facebook group administrators of four popular Western-affiliated groups to request permission to post study recruitment details (Appendix E); three administrators responded and confirmed approval and one administrator did not respond to the request. The recruitment information was posted twice

in each of the three groups over the course of the 2-week period. The QR code included on the study graphic (Appendix F) brought students directly to the letter of information (Appendix G), which outlined all aspects of the study in full. Lastly, members of the research team contacted administrators of 109 Western-affiliated social media pages and accounts on both Twitter and Instagram (e.g., program-specific accounts, graduating year-specific accounts, Western clubs) to receive permission for study recruitment details to be posted. Once permission was received, the research team provided the administrators with the study graphic and details to be posted on the social media pages and accounts. Similar to the Facebook postings, a QR code was included on the study graphic which brought students directly to the letter of information. For those interested in participating, there was an option to be automatically redirected from the letter of information to the eligibility (criteria detailed on page 34) and consent form (Appendix H). If, after reading the letter of information, students wanted to participate, they were prompted to continue the survey to be automatically redirected to the eligibility and consent form. If the student was eligible to participate and provided consent, they were asked to create a unique participant ID for tracking participant responses across each data collection time point.

Simple randomization using an online random number generator (Calculator.net©, 2008) was used to assign participants to the intervention or control group. Once randomly assigned to a group, the participant was sent a link, via their Western email address, to a Qualtrics^{XM} (Qualtrics, Provo, UT) survey which contained both the baseline and immediate post-intervention assessments. The first half of the survey included the brief demographics questionnaire, the TTM Questionnaire for Sedentary Behaviour (Han et al., 2015; Appendix I), and the Past-day Adults' Sedentary Time-University questionnaire (PAST-U; Clark et al., 2015; Appendix J). Participants were then asked to watch the video embedded in their survey (i.e.,

intervention or control video) and then immediately complete the TTM Questionnaire for Sedentary Behaviour (Han et al., 2015) that followed. Two days post-intervention (i.e., 1 full day immediately following the intervention), participants were sent a survey link to their Western email address that contained the PAST-U questionnaire (Clark et al., 2015). Participants were asked to report their levels of sedentary time for the previous day and to complete the questionnaire as soon as possible or by the end of 1 week at the latest. At 1-month follow-up, participants were sent an email that contained a link to a Qualtrics^{XM} (Qualtrics, Provo, UT) survey which included the TTM Questionnaire for Sedentary Behaviour (Han et al., 2015) and the PAST-U questionnaire (Clark et al., 2015).

Intervention and Control Conditions

'Take a STAND for Your Health', a Theory-Informed Sedentary Behaviour Video Tailored for University Students (Intervention Condition)

Members of the research team collectively created 'Take a STAND for Your Health' (https://youtu.be/h2NPbseijVE), a theory-informed video tailored for university students using Powtoon©, which is an online software tool used for creating animated videos. The research team created this evidence-informed video with content specific to sedentary behaviour related to the university student cohort and integrated each core construct of the HBM throughout the video. An overview of the video content that corresponds with (i.e., was designed in an attempt to address) each core construct of the HBM and how each construct was integrated into the video is presented in Table 1.

Table 1

Overview of Video Content by Health Belief Model Construct

Health Belief Model Construct	Integration of Each Construct into the Video	Specific Quotations and/or Character Actions Associated with Construct
Perceived Susceptibility	The construct of perceived susceptibility was integrated in the video by incorporating evidence-based data that demonstrates the prevalence of sedentary behaviour among university students.	▪ "If you are like most university students, you probably find yourself sitting for a large portion of your day." ▪ "University students are one unique subgroup of the population that are experiencing higher rates of prolonged sitting compared to the average adult." ▪ "Recent data suggests that students are spending close to 12 to 13 hours per day in sedentary activities. This is considerably more than the 8-hour maximum recommended by Canada's 24-hour movement guidelines." ▪ "Think about your day… As a university student, many of your responsibilities and routines are sedentary. This might include driving or commuting to campus, attending lectures, studying for exams, working on assignments, mealtimes, relaxation breaks, socializing with peers, and more." ▪ "Researchers have found that individuals who spend more than 8 hours per day sitting are at a greater risk of negative health effects compared to those who sit less."
Perceived Severity	Perceived severity was integrated into the video by underscoring the risks associated with high levels of sedentary behaviour.	▪ "Prolonged bouts of sitting, or high levels of sedentary behaviour, are associated with an increased risk of death, specifically from heart disease and cancer as well as greater rates of type 2 diabetes and increased levels of depression and anxiety"
Perceived Threat	The construct of perceived threat was integrated into the video by emphasizing the long-term effect of current health behaviours.	▪ "This might feel like a faraway concern right now, but the routines and patterns you create in university are often the ones carried with you throughout the rest of your life."
Perceived Barriers	The perceived barriers construct was integrated into the video by underlining the common everyday tasks of university students that often require students to be sedentary.	▪ "Think about your day… As a university student, many of your responsibilities and routines are sedentary. This might include driving or commuting to campus, attending lectures, studying for exams, working on assignments, mealtimes, relaxation breaks, socializing with peers, and more."

Health Belief Model Construct	Integration of Each Construct into the Video	Specific Quotations and/or Character Actions Associated with Construct
Perceived Benefits	The construct of perceived benefits was integrated in the video by outlining the benefits associated with reduced sitting.	▪ "Decreasing sedentary behaviour can have meaningful health benefits when it is applied for extended periods of time and across many areas in your life." ▪ "Did you know that reducing sedentary behaviour is associated with better concentration, alertness, enjoyment in classes, and can help maintain a stable sleep quality."
Cues to Action	The cues to action construct was integrated in the video by providing students with context-specific examples of ways they could reduce sedentary behaviour.	▪ "So, what if we said you didn't have to be so sedentary?" ▪ "Maybe you'll notice some of your peers making changes to decrease their sedentary behaviour." ▪ "Alex likes to skip the bus and walk to campus. The fresh air and exercise helps them clear their head and get ready for a day of learning." ▪ "Khaya chooses to study in the UC building so she can stand while she is studying." ▪ "Amir sets a timer and takes a walk break for 10 minutes after every 50 minutes of studying. This helps him stay focused and ensures he doesn't sit for too long." ▪ "As a group, Alex, Khaya, and Amir like to pick up coffee and go for walks instead of sitting in coffee shops." ▪ "They also use their membership at the rec centre and go for group workouts twice a week." ▪ "Making small changes like Alex, Khaya, and Amir can help you decrease your sedentary behaviour. So, our question to you is do you think you can sit less and stand more?"
Self-Efficacy		
Task Mastery	Task mastery requires the individual to experience success when performing aspects of the task (Heslin & Kleche, 2007). According to Heslin and Kleche (2007), "self-mastery is best achieved through progressive mastery, which is attained by breaking down difficult tasks into small steps that are	▪ "Alex likes to skip the bus and walk to campus. The fresh air and exercise helps them clear their head and get ready for a day of learning." ▪ "Khaya chooses to study in the UC building so she can stand while she is studying." ▪ "Amir sets a timer and takes a walk break for 10 minutes after every 50 minutes of studying. This helps him stay focused and ensures he doesn't sit for too long." ▪ "As a group, Alex, Khaya, and Amir like to pick up coffee and go for walks instead of sitting in coffee shops."

Health Belief Model Construct	Integration of Each Construct into the Video	Specific Quotations and/or Character Actions Associated with Construct
	relatively easy, in order to ensure a high level of initial success" (p. 706). It was not guaranteed that students would experience task mastery, but the research team did attempt to support their personal mastery by providing simple ways to reduce sedentary behaviour in their everyday routines, such as walking to school instead of taking the bus, taking walk breaks while studying, etc.	▪ "They also use their membership at the rec center and go for group workouts twice a week." ▪ "Making small changes like Alex, Khaya, and Amir can help you decrease your sedentary behaviour.
Vicarious Experience	The construct of vicarious experience was integrated into the video through the use of role-modelling. The characters of the video were shown in various settings demonstrating ways to reduce sedentary behaviour.	▪ "Maybe you'll notice some of your peers making changes to decrease their sedentary behaviour." ▪ "Alex likes to skip the bus and walk to campus. The fresh air and exercise helps them clear their head and get ready for a day of learning." ▪ "Khaya chooses to study in the UC building so she can stand while she is studying." ▪ "Amir sets a timer and takes a walk break for 10 minutes after every 50 minutes of studying. This helps him stay focused and ensures he doesn't sit for too long." ▪ "As a group, Alex, Khaya, and Amir like to pick up coffee and go for walks instead of sitting in coffee shops." ▪ "They also use their membership at the rec center and go for group workouts twice a week." ▪ "Making small changes like Alex, Khaya, and Amir can help you decrease your sedentary behaviour.
Emotional/ Physiological Arousal	The emotional/physiological arousal construct was integrated in the video by having the characters demonstrate various emotions (e.g., happy or celebrating when standing) to evoke a similar emotion in students.	▪ "Alex likes to skip the bus and walk to campus. The fresh air and exercise helps them clear their head and get ready for a day of learning." ▪ When the characters at the end of the video are celebrating about sitting less and standing more

Health Belief Model Construct	Integration of Each Construct into the Video	Specific Quotations and/or Character Actions Associated with Construct
Verbal Persuasion	Verbal persuasion was integrated in the video by incorporating both verbal and written messages that would encourage students to reduce their sedentary behaviour.	▪ "So, our question to you is do you think you can sit less and stand more? We think you can. Take a stand for your health." ▪ "You can do it" bubble on the final slide.
Imagery	The construct of imagery suggested by James Maddux (2013), was integrated in the video through the use of Western campus specific photos. The characters were shown standing and/or reducing sedentary behaviour in various areas throughout the campus to help students picture themselves making those changes in their everyday routines.	▪ "This might feel like a faraway concern right now, but the routines and patterns you create in university are often the ones carried with you throughout the rest of your life." ▪ "Making small changes like Alex, Khaya, and Amir can help you decrease your sedentary behaviour." ▪ Pictures of Western's campus were integrated into scenes with the characters standing

In addition to using the constructs of the HBM to create the 'Take a STAND for Your Health' video, efforts were made to tailor the video specific to the Western University context in an effort to resonate more strongly for the target audience. For example, pictures of Western's campus as well as campus specific buildings and locations were included to allow students the opportunity to envision themselves as the video characters. Although the sedentary behaviour video was primarily informed by the HBM, there are overlapping constructs from the TTM evident within the video, namely self-efficacy, consciousness raising, dramatic relief, counter conditioning, and decisional balance (Prochaska, 1979). To further enhance the value of this theory-based, audience-tailored, and evidence-informed video, design features were also considered. Per the advice provided by Guo and colleagues (2014) and Martin and Martin

(2015), and to ensure all constructs of the HBM were included without rushing the narrative, the research team created a video slightly longer than 3 minutes (3:30) in an effort to maximize students' level of engagement. The researchers also considered the advice of Pachu and colleagues (2020) who suggested that sedentary behaviour messaging might be more effective and elicit immediate behaviour change in university students if it highlights both the proximal and long-term benefits of reducing sedentary behaviour, compared to only long-term benefits (Pachu et al., 2020). Consistent with Pachu and colleagues (2020) guidance, researchers of the MOVE study incorporated findings of immediate benefits to breaking up prolonged bouts of sitting for university students such as higher levels of concentration, alertness, and class enjoyment (Peiris et al., 2021), in addition to reduced levels of anxiety and depression (Lee & Kim, 2019).

Prior to its finalization, the research team conducted an informal pilot test of the 'Take a Stand for Your Health' video with a selection of 15 university students known to the research team and who were members of the intended target audience. Individuals were asked to watch the video and consider if there were any possible unintentional negative implications that emerged from the video that viewers from the target audience may experience, in addition to ensuring the desired takeaways from the video were clear. Feedback provided from the informal pilot test was reviewed by members of the research team and the video was adjusted accordingly (i.e., the title of the video was included at the end).

Sleep-Focused Health Education Video, 'How Much Sleep Do You Actually Need?' (Control Condition)

The control condition was a sleep-focused video, 'How Much Sleep Do You Actually Need?' (https://www.youtube.com/watch?v=SVQlcxiQlzI&t=1s), that was tailored to the general

population and had a total duration of 2 minutes and 51 seconds. This video was found on YouTube by searching 'sleep health education videos' and was purposively chosen based on specific video quality criteria that would compare as closely as possible to the sedentary behaviour video, namely video duration (2:51), animation, and speech style.

Participants

Sample Size

The desired sample size of this study was generated using G*Power Software (version 3.1; Faul et al., 2009). Researchers aimed to recruit a total sample size of at least 156 (per 0.80 power) full-time undergraduate students to achieve a moderate effect size of f = 0.25.

Eligibility Criteria

Inclusion Criteria. Participants were eligible to participate in this study if they: (1) were registered as a full-time, undergraduate student at Western University; (2) had access to an internet connected device; (3) were able to read, write, and speak in English; and (4) were able to stand for long periods of time.

Exclusion Criteria. Participants were excluded from the study if they: (1) were not a full-time, Western undergraduate student; (2) did not have access to an internet connected device; (3) were not able to read, write, or speak in English; and (4) were unable to stand for long periods of time.

Data Collection Tools

The Qualtrics^{XM} (Qualtrics, Provo, UT) platform hosted all data collection tools for this study. Demographic information was collected and pertained to participants' age, gender, sex, ethnicity, year of study, and faculty of registration. The tools administered to address each of the

study objectives are outlined below. An overview of the tools administered at each data collection time point, and which study objective each was addressing is presented in Table 2.

TTM Questionnaire for Sedentary Behaviour

The full TTM Questionnaire (Han et al., 2015) is comprised of four questionnaires that were created and named according to the core constructs of the TTM (i.e., stages of change, processes of change, self-efficacy, and decisional balance) specific to avoiding sedentary behaviours. The four TTM Questionnaires were previously validated (Cronbach's alpha ranging from 0.73 to 0.87) against ActiGraph GT3X+ accelerometers in a sample of 225 university students aged 18 to 24 years from the University of Texas (Han et al., 2015). The 'Processes of Change' measurement tool was not included in the questionnaire administered in the current study to reduce participant burden, due to the length and repetitiveness of the items within this particular tool (as recommended by the Ethics officer who reviewed and approved this study). The psychometric properties and details of each specific TTM measurement tool utilized in this study are outlined below.

Stages of Motivational Readiness to Avoid Sitting Time. The Stages of Motivational Readiness (Han et al., 2015) were created based on the TTM's five stages of change: (1) Precontemplation; (2) Contemplation; (3) Preparation; (4) Action; and (5) Maintenance (Han et al., 2015). The Stages of Motivational Readiness to Avoid Sitting Time (Han et al., 2015) was used to assess participants' motivational readiness by classifying participants into one of the five stages based on the participants intentions to avoid sitting time. The Stages of Motivational Readiness to Avoid Sitting Time was found to have substantial inter-rater agreement ($k = .62$) and strong concurrent validity ($p < .001$) against objectively measured ActiGraph GT3X+ accelerometer data (Han et al., 2015). The Stages of Motivational Readiness questionnaire

consists of a "single question with a 5-item, dichotomous (yes/no) or (true/false) response options" (Han et al., 2015, p. 602).

Self-Efficacy. The 6-item tool to assess self-efficacy (Han et al., 2015) was previously validated (Cronbach's $\alpha = 0.75$). Self-efficacy was used to assess an individual's confidence in avoiding or breaking up prolonged bouts of sitting in six different situations using a situational confidence scale (Han et al., 2015). The 6 items were scored on a 5-point Likert scale ranging from 1 (not at all confident) to 5 (extremely confident).

Decisional Balance. The previously validated (Cronbach's $\alpha = 0.76$) decisional balance questionnaire consists of 12 items that were used to "assess how important each statement of pros and cons was with respect to the participant's decision of whether to avoid sitting time or not" (Han et al., 2015, p. 603). The items were scored on a 5-point Likert scale ranging from 1 (not at all important) to 5 (extremely important). The odd numbered items (e.g., 1,3,5,7,9,11) were used to assess the positive aspects (pros) of sedentary behaviour, and the even numbered items (e.g., 2,4,6,8,10,12) were the negative aspects (cons) of sedentary behaviour.

PAST-U Questionnaire

The PAST-U (Clark et al., 2015) was previously validated in a sample of participants over the age of 18 from the University of Queensland against an activPAL device. The PAST-U was found to have "acceptable levels of validity when compared to sedentary time from the activPAL, in terms of correlation (ICC = 0.64) and agreement (mean difference: 5 min) at the group level" (Clark et al., 2015, p. 239). The PAST-U contains nine domains (e.g., study, work, transport, television) and includes a total of nine questions that prompt participants to report their levels of sedentary time from the previous day for each specific domain (Clark et al., 2015).

Open-Ended Questions

To explore intervention participants' perceptions of the video created for this study (described in detail below), their motivational readiness and their perceptions of sedentary behaviour after engaging with the intervention, a series of open-ended questions were provided to intervention participants only. Participants were asked to answer the following questions: (1) In what ways, if any, did this video make you want to reduce your sedentary behaviour; (2) In what ways, if any, do you feel differently about sedentary behaviour after watching this video; and (3) In what ways, if any, do you intend to change your sedentary behaviour.

Table 2

Breakdown of Data Collection Tools Administered at Each Time Point to Address Each Study Objective

Time Point	Tools Implemented	Objective Addressed
Baseline	Demographics, TTM Questionnaire for Sedentary Behaviour, PAST-U questionnaire	Primary & Secondary
Immediate Post-Intervention	TTM Questionnaire for Sedentary Behaviour, open-ended questions (intervention group)	Primary
One-Day Post-Intervention	PAST-U questionnaire	Secondary
One-Month Follow-up	TTM Questionnaire for Sedentary Behaviour, PAST-U questionnaire	Primary & Secondary

Data Analysis

Analysis of Tools/Scales

Descriptive statistics (i.e., measures of central tendency, dispersion, frequency) were used to analyze demographic data. An independent t-test and a series of chi-square tests were conducted to determine any potential differences in demographic data between groups. Data

from the TTM constructs (i.e., motivational readiness, self-efficacy, and decisional balance) were analyzed by summing the scores of each questionnaire and reporting mean scores (per Han et al., 2015). The decisional balance construct was analyzed by calculating means scores of both the pros and cons and analyzing each separately. Linear mixed models were used to assess whether any significant differences in the primary objective observed within or between groups (i.e., intervention vs. control) over time (i.e., baseline, immediate post-intervention, and 1-month follow-up) using IBM SPSS Statistics (version 28). The total daily sedentary time of participants was calculated by summing the scores of all PAST-U domains (Clark et al., 2015). The PAST-U (Clark et al., 2015) results were also analyzed through the use of linear mixed models to observe difference within and between groups across all three time points.

Analysis of Open-Ended Questions

Data from the three open-ended questions provided to intervention participants immediately post-intervention were analyzed deductively by question using inductive content analysis (Patton, 2015). Questions were first analyzed independently by three members of the research team who then came together to discuss and determine final themes, as advised by Lincoln and Guba (1985) to help ensure data confirmability, a component of qualitative data trustworthiness. Specifically, researchers used open coding for which the overall goal is to "develop a wealth of codes with which to describe the data" (Vollstedt & Rezat, 2019, p. 87). Researchers read through the responses line-by-line to code the data, and then reviewed the codes to identify emerging themes. Braun and Clarke (2006), stated that "a theme captures something important about the data in relation to the research question, and represents some level of *patterned* response or meaning within the data set" (p. 82). Themes were created and supplemented with participant quotes (to help facilitate data credibility, another component of

data trustworthiness, per Lincoln and Guba, 1985) that were selected to best support each theme. Upon completing an independent review of the data, the research team met to work collaboratively and discuss and compare identified themes that emerged from the data. According to Braun and Clarke (2006), “researcher judgement is necessary to determine what a theme is” (p. 82). Based on this guidance, the research team reviewed all patterned responses and came to a consensus on final themes they felt captured something important when considering the research question, and selected the quotes that best typified each theme.

Chapter 4: Results

Participants

This mixed methods RCT had a total sample of 160 full-time, undergraduate students from the host institution (n = 87 were randomized to the intervention group; n = 73 were randomized to the control group).[1] The majority of study participants identified with the female sex (85.0%, n = 136) and identified as a cis woman (female and assigned female at birth; 75.6%, n = 121). The majority (78.1%) of the participants were between the ages of 18 to 21 years (n = 125, mean = 20.64), with 51 participants (31.9%) enrolled as a first-year student and 44 (27.5%) as a second-year student. The students represented nine faculties at the host institution, with the largest percentage from the Faculty of Social Science (30.6%, n = 49), followed by the Faculties of Health Sciences (21.9%, n = 35) and Science (21.9%, n = 35). A full summary of demographic data for all study participants can be found in Table 3.

Due to participant attrition, several members of both the intervention and control groups did not complete one or both of the follow-up assessments at immediate post-intervention and 1-month follow-up (i.e., 14 and 30 intervention group participants, 10 and 27 control group participants, respectively).

[1] From the 109 social media accounts contacted, 14 granted approval and six declined. There were approximately 87 professors who provided approval for the request to distribute study details; however, as the email did not request a response, the true number of professor involvement is unknown. Despite there being 372 responses from the Qualtrics^{XM} (Qualtrics, Provo, UT) survey, only 160 students were eligible and provided consent for the study.

Table 3

Demographic Information of Participants in the Control and Intervention Groups at Baseline (N = 160)

Participant Characteristic	Control N	Intervention N	Mean	SD	*p*
Age (*N* = 155)			20.54	3.64	.693
<20	33	39			
20-25	33	40			
26-30	3	5			
30+	1	1			
Sex (*N* = 160)					.166
Male	7	16			
Female	65	71			
I prefer not to answer	1	0			
Gender (*N* = 158)					.128
Nonbinary, gender nonconforming, or genderqueer	4	5			
Trans man	0	1			
Trans woman	0	0			
Transgender	0	0			
Cis man (male and assigned male at birth)	7	15			
Cis woman (female and assigned female at birth)	57	64			
Two-Spirt	0	0			
Gender-fluid	1	0			
I prefer not to answer	4	0			
Ethnicity[a] (*N* = 160)					
First Nations, Metis, or Inuit	1	0			
Caucasian	32	41			
European origins	11	11			
Caribbean origins	1	1			
Latin, Central, and South American origins	1	4			
African origins	4	3			
Asian origins	32	32			
Oceanian origins	0	0			
Mixed origins/Multiracial	2	4			
Middle Eastern/Arabs	1	5			
I prefer not to answer	0	1			
Year of Study (*N* = 160)					.898
First	25	26			

Participant Characteristic	Control N	Intervention N	Mean	SD	*p*
Second	19	25			
Third	12	17			
Fourth	14	14			
Fifth	3	4			
Six +	0	1			
Faculty ($N = 158$)					.802
Arts and Humanities	8	7			
Engineering	4	7			
Health Sciences	15	20			
Don Wright Faculty of Music	1	2			
Education	0	0			
Information and Media Studies	1	0			
Law	0	0			
Ivey Business School	0	1			
Schulich Medicine and Dentistry	5	3			
Science	18	17			
Social Science	21	28			

[a]The values, when summed, may exceed 160 as participants were able to self-select into multiple ethnic origins. As a result, assessing group differences for this demographic was deemed unsuitable.

Quantitative Findings

Demographic data was analyzed to determine if there were any significant differences between the intervention and control groups at baseline. An independent t-test and a series of chi-square tests were conducted. No statistically significant differences were found between the groups. The results for each participant characteristic can be found in Table 3.

The means and interaction effects of the linear mixed-effects model for both the primary and secondary objectives are presented in Table 4, where the findings are separated by group and time. The findings are also separated by the within-group changes as well as between-group changes over time. For the purposes of the quantitative results, ‘post-intervention’ refers to immediate post-intervention and ‘follow-up’ refers to 1-month follow-up.

There were no statistically significant differences observed between the intervention and control group for motivational readiness at post-intervention (p = .313) or follow-up (p = .105). The means for motivational readiness scores for the control group indicate participants experienced a decline at post-intervention and then a slight increase at follow-up; however, no significant differences within the control group were observed at post-intervention (p = .466) or follow-up (p = .640). When considering the means for the intervention group, participants continuously increased their motivational readiness over the course of the intervention. Despite the observed increase in mean scores, there was no statistically significant differences found within the intervention group at post-intervention (p = .484) or follow-up (p = .057). The within and between group interaction over time for motivational readiness can be found in Figure 1.

While there were no significant differences observed in self-efficacy scores between groups at post-intervention (p = .316) or follow-up (p = .405), intervention group participants' self-efficacy significantly increased from baseline to post-intervention (p = .016). Despite the significant increase at post-intervention, there was no significant difference observed at follow-up (p = .657) for intervention group participants as there was a decrease in mean scores between post-intervention and follow-up. There were also no significant differences observed within the control group participants at post-intervention (p = .387) or follow-up (p = .470). The within and between group interaction over time for self-efficacy can be found in Figure 2.

The scores for decisional balance were analyzed separately according to the items specific to the positive and negative aspects (pros and cons) of sedentary behaviour. A statistically significant increase in the pros of decisional balance were observed within intervention group participants between baseline and post-intervention (p = .008), indicating that participants viewed the positive aspects of sedentary behaviour as more important in their

decision to avoid sitting. Despite the significant increase observed at post-intervention, there were no significant differences observed at follow-up (p = .629) within the intervention group. There were no significant differences found within the control group at post-intervention or follow-up for both decisional balance pros (p = .552, p = .081) or cons (p = .512, p = .302). When considering the between-group interactions over time, no statistically significant differences were observed between groups for the decisional balance pros at post-intervention (p = .169) or follow-up (p = .105). Similarly, no significant differences were observed between groups for decisional balance cons at post-intervention (p = .170) or follow-up (p = .858). The within and between group interaction over time for the decisional balance pros can be found in Figure 3 and Figure 4 for the decisional balance cons.

Intervention participants significantly decreased their sedentary time from baseline to post-intervention (p = .032) as well as from baseline to follow-up (p = .006). The mean scores from each time point indicate that the intervention group significantly decreased their total sedentary time from 14.67 hours at baseline to 13.03 hours at follow-up. Conversely, no significant differences were observed within the control group for sedentary time at post-intervention (p = .958) or follow-up (p = .991). Based on the mean scores, the control group participants were observed to marginally increase their sedentary time from 13.99 hours at baseline to 14.05 hours at post-intervention, with a slight decrease to 14.02 hours at follow-up. No statistically significant differences were observed between groups at post-intervention (p = .138) or follow-up (p = .063). Researchers of this study manually capped total sedentary time at 24 hours across the three time points (n = 25), as some participants reported sedentary time that computed to more than 24 hours per day. The within and between group interaction over time for sedentary time can be found in Figure 5.

Table 4

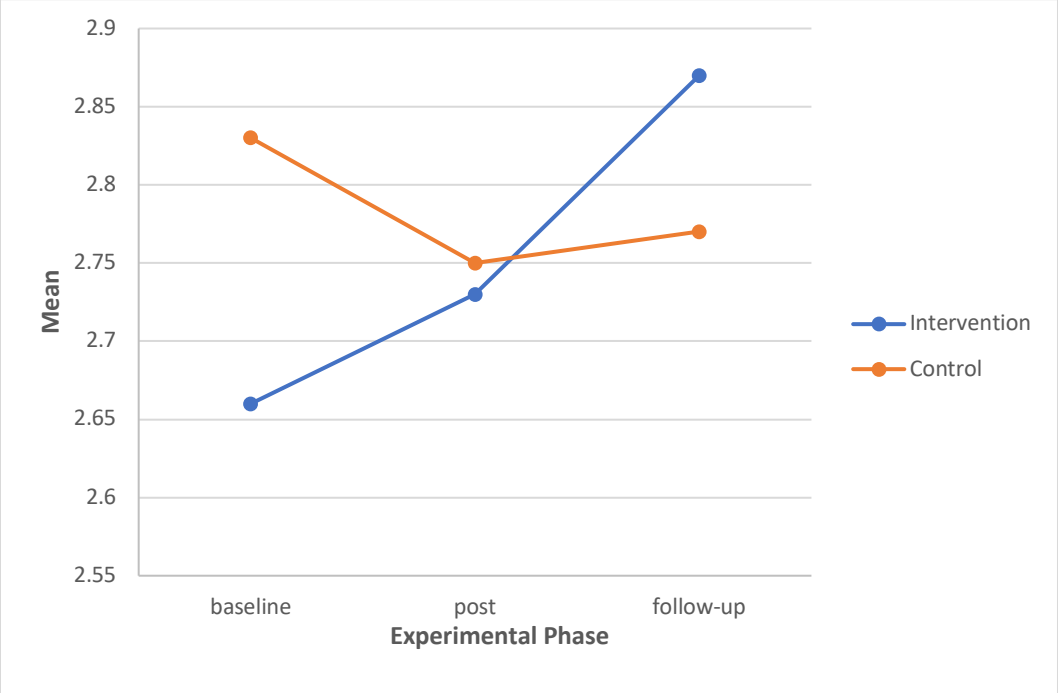
Means and Interaction Effects for all Objectives Separated by Group and Time

	Pre M (95% CI)	Post M (95% CI)	Within group change baseline to post M (95% CI)	p-value	Group-by-time interaction baseline to post M (95% CI)	p-value	Follow-up M (95% CI)	Within group change baseline to follow-up M (95% CI)	p-value	Group-by-time interaction baseline to follow-up M (95% CI)	p-value
Motivational Readiness											
Intervention	2.67 (2.47, 2.86)	2.73 (2.53, 2.93)	0.07 (-0.12, 0.25)	.484	0.14 (-0.14, 0.43)	.313	2.87 (2.65, 3.09)	0.21 (-0.01, 0.42)	.057	0.26 (-0.06, 0.58)	.105
Control	2.83 (2.62, 3.05)	2.76 (2.53, 2.98)	-0.08 (-0.29, 0.13)	.466			2.78 (2.53, 3.02)	-0.06 (-0.29, 0.18)	.640		
Self-Efficacy											
Intervention	2.87 (2.72, 3.02)	3.05 (2.89, 3.21)	0.18 (0.03, 0.32)	.016	0.11 (-0.11, 0.32)	.316	2.91 (2.74, 3.08)	0.04 (-0.12, 0.20)	.657	0.10 (-0.14, 0.34)	.405
Control	2.80 (2.64, 2.97)	2.87 (2.70, 3.04)	0.07 (-0.09, 0.23)	.387			2.74 (2.55, 2.92)	-0.06 (-0.24, 0.11)	.470		
Decisional Balance Pro											
Intervention	3.54 (3.37, 3.70)	3.72 (3.55, 3.89)	0.19 (0.05, 0.32)	.008	0.14 (-0.06, 0.34)	.169	3.57 (3.93, 3.75)	0.04 (-0.11, 0.19)	.629	0.19 (-0.04, 0.41)	.105
Control	3.56 (3.39, 3.74)	3.61 (3.43, 3.79)	0.05 (-0.10, 0.19)	.552			3.41 (3.22, 3.61)	-0.15 (-0.32, 0.02)	.081		
Decisional Balance Con											

	Pre M (95% CI)	Post M (95% CI)	Within group change baseline to post M (95% CI)	p-value	Group-by-time interaction baseline to post M (95% CI)	p-value	Follow-up M (95% CI)	Within group change baseline to follow-up M (95% CI)	p-value	Group-by-time interaction baseline to follow-up M (95% CI)	p-value
Intervention	2.49 (2.35, 2.64)	2.58 (2.43, 2.74)	0.09 (-0.04, 0.22)	.189	0.13 (-0.06, 0.32)	.170	2.60 (2.43, 2.76)	0.10 (-0.04, 0.24)	.156	0.02 (-0.19, 0.23)	.858
Control	2.58 (2.42, 2.75)	2.54 (2.37, 2.70)	-0.05 (-0.19, 0.09)	.512			2.67 (2.48, 2.85)	0.08 (-0.08, 0.24)	.302		
Sedentary Time											
Intervention	14.67 (13.59, 15.75)	13.45 (12.25, 14.64)	-1.23 (-2.35, -0.10)	.032	-1.26 (-2.92, 0.41)	.138	13.01 (11.76, 14.26)	-1.66 (-2.84, -0.48)	.006	-1.67 (-3.42, 0.09)	.063
Control	14.00 (12.79, 15.21)	14.03 (12.73, 15.33)	0.03 (-1.20, 1.26)	.958			14.01 (12.63, 15.38)	0.01 (-1.30, 1.31)	.991		

Figure 1

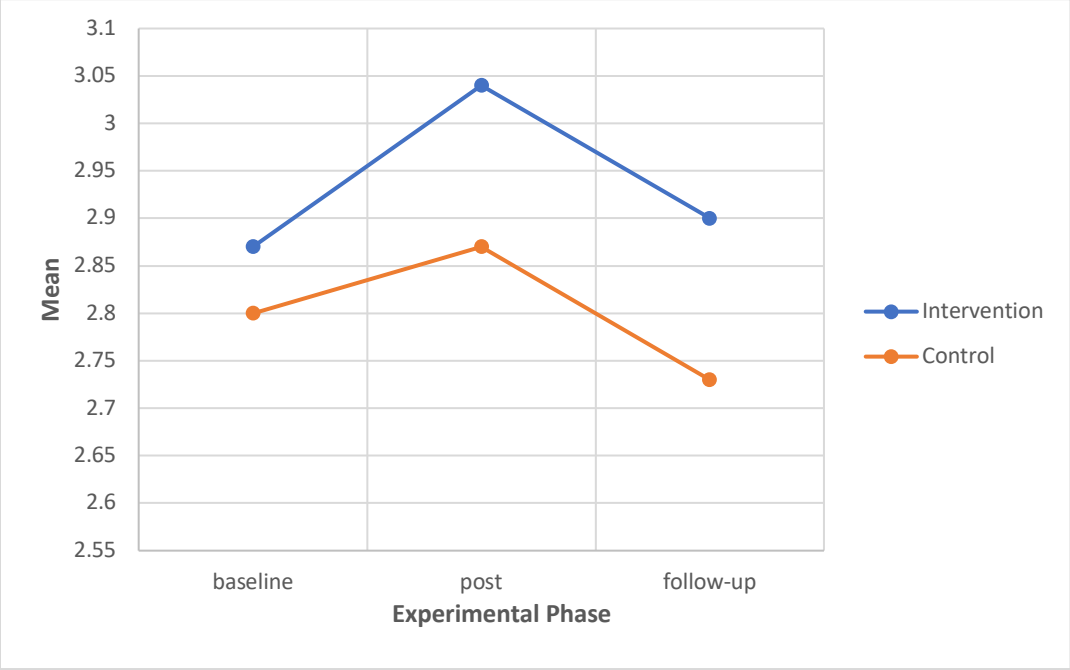
Motivational Readiness Interaction Plot



Note. The interaction between group and time for Motivational Readiness. 'Post' refers to immediate post-intervention and 'follow-up' refers to 1-month post-intervention.

Figure 2

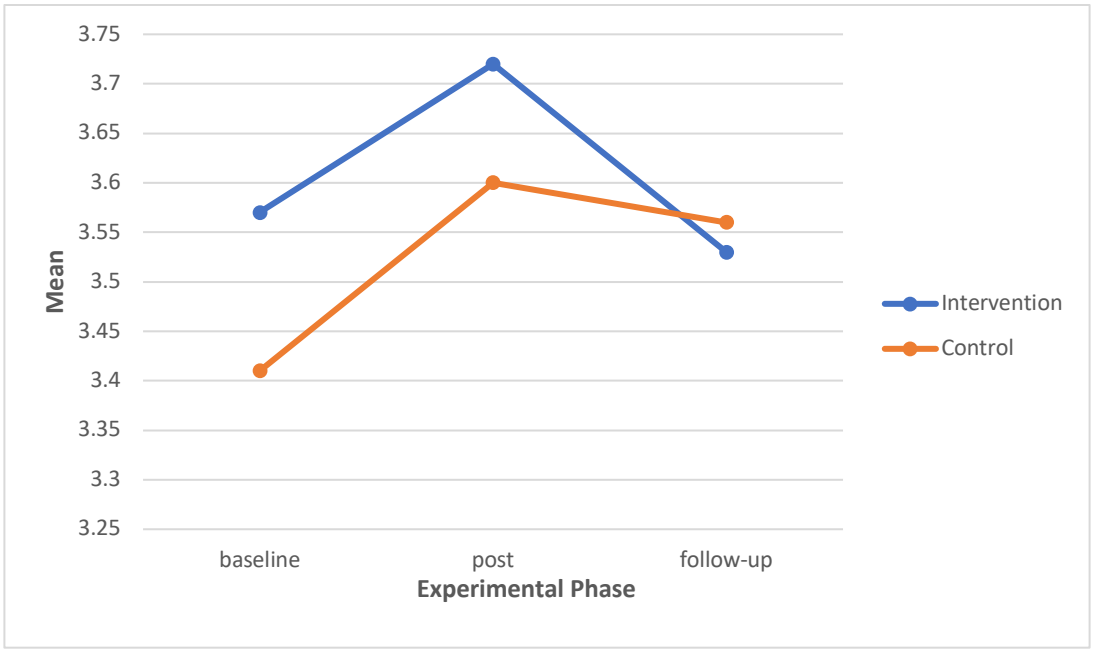
Self-Efficacy Interaction Plot



Note. The interaction between group and time for Self-Efficacy. 'Post' refers to immediate post-intervention and 'follow-up' refers to 1-month post-intervention.

Figure 3

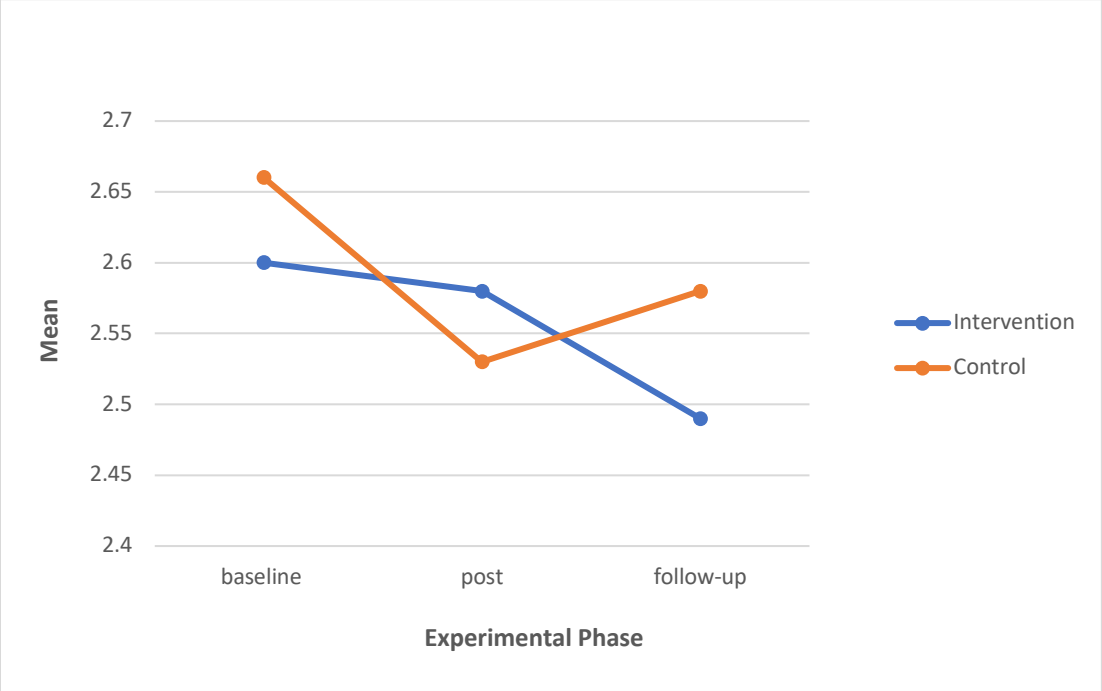
Decisional Balance Pros Interaction Plot



Note. The interaction between group and time for the Pros of Decisional Balance. 'Post' refers to immediate post-intervention and 'follow-up' refers to 1-month post-intervention.

Figure 4

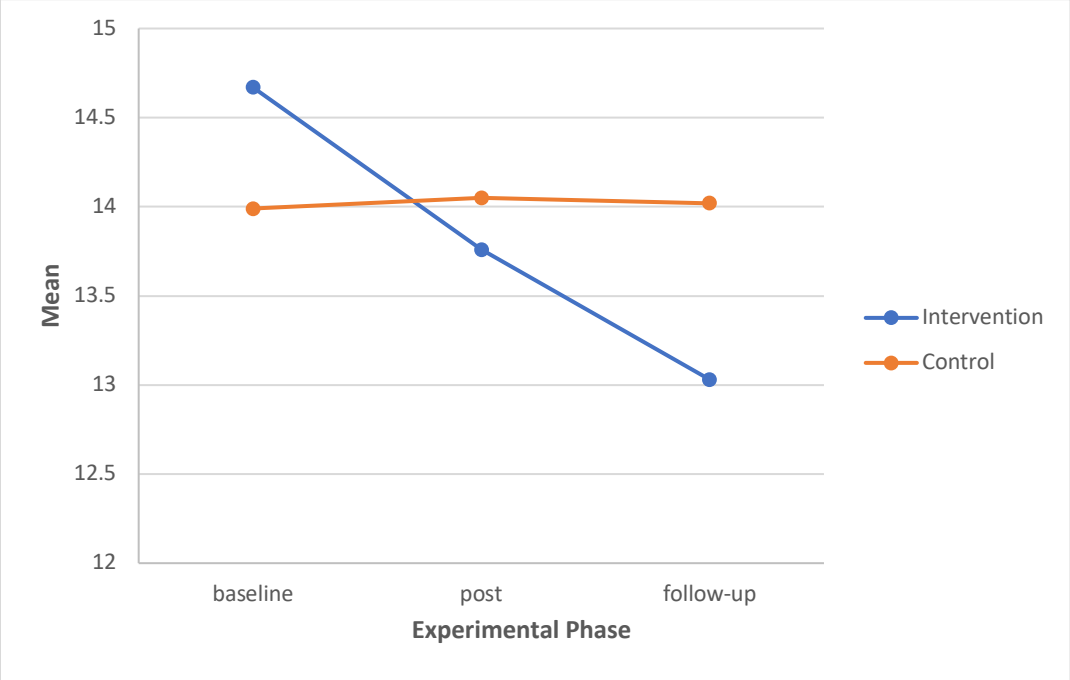
Decisional Balance Cons Interaction Plot



Note. The interaction between group and time for the Cons of Decisional Balance. 'Post' refers to immediate post-intervention and 'follow-up' refers to 1-month post-intervention.

Figure 5

Past-day Adults' Sedentary Time-University (PAST-U) Interaction Plot



Note. The interaction between group and time for the PAST-U. 'Post' refers to immediate post-intervention and 'follow-up' refers to 1-month post-intervention.

Findings from the Open-Ended Questions (Intervention group only)

Findings from the responses to the open-ended questions completed by the intervention group are presented below. While completing content analysis, it became clear that questions one and two (which asked about whether the video made participants want to reduce their sedentary behaviour and if they felt differently about their sedentary behaviour) yielded similar themes. As such, the common themes from questions one and two are presented together and the unique themes from questions one and two, as well as the findings from question three (which asked if participants intended to change their sedentary behaviour) are presented separately.

Common Themes for Questions One and Two

The participants' responses for questions one and two generated six common themes (and four subthemes): (1) negative health effects; (2) increased motivation; (3) potential benefits to improve health; (4) increased awareness (movement guidelines, self-reflection); (5) no effect (previous knowledge, did not feel differently); and (6) easy to incorporate.

Negative Health Effects. One prominent theme that emerged from the data was the negative health effects associated with sedentary behaviour. Participants indicated the negative health risks associated with prolonged periods of sitting made them feel more concerned about sedentary behaviour and led them to feel motivated to reduce their current levels of sedentary behaviour. For example, one participant wrote, "Listening to the health consequences made me want to reduce my sitting behaviour" (S12ST13). Another participant stated how the video made them aware of the negative effects of prolonged sitting, writing, "The video opened my eyes to the negative effects of my sedentary behaviour" (B12Sl29). This sentiment was echoed by another participant who stated, "I never realized just how terrible the effects of sedentary behaviour can be on my health" (P1SM46). Other participants described the negative effects

associated with sedentary behaviour after watching the video as "jarring" (C21KP65) and "more dangerous" than they previously thought (A1TW31, L16LM19). One participant emphasized, "[the video] made me want to reduce [sedentary behaviour] for the benefits of decreasing my chances of chronic diseases and cancer" (M31LA02). Another participant acknowledged they were previously aware of this information, but the video had made them reconsider the potential risks, writing, "Hearing the risks again made me think again to take being less sedentary more seriously" (J20NS11). As illustrated by the quotations above, the health risks associated with sedentary behaviour that were presented in the video, led many participants to feel more concerned about and motivated to change their behaviour.

Increased Motivation. Another theme that emerged from the data was an increase in motivation. Participants indicated they felt motivated to change their sedentary behaviours after watching the video. One participant spoke to how the video positively motivated them to change their behaviours, writing, "I feel more self-conscious about my sedentary behavior but not in a harmful way; in the positive way where I am encouraged to change my routine and become more active and spend less time lounging" (C16KL32). This positive impact was underscored by another participant who wrote, "The video made me want to do better as I've always wanted to commit to a healthy lifestyle" (H23MA05). Some participants highlighted that the video caused a general desire to reduce sedentary time, with one participant writing, "This video really encourages me to reduce my sedentary behaviour" (H23AJ41). One participant wrote they were, "More motivated to sit less and take breaks" (A05LC34), with another writing, simply, "I want to be less sedentary" (L15HK77). Alternatively, some individuals stated the specific ways the video encouraged them to reduce their sedentary behaviour. This sentiment was emphasized by one participant who wrote, "It [the video] made me want to increase my time standing"

(I16SC85). Another individual stated the video made them "want to become more active" (T01MF54).

Video Had no Effect (Previous Knowledge, Did Not Feel Differently). While there were participants who reported feeling positively influenced by the video, there were some participants who indicated that they did not feel differently about or have any desire to change their sedentary behaviour after watching the video. Some individuals who experienced no effect ascribed this to the fact that they previously knew the information that was provided in the video. This sentiment was emphasized by one participant who wrote, "I did know the risks of sedentary behaviour beforehand so I was not surprised by the negative outcomes of sedentary behaviour" (J20NS11). Another participant echoed this notion by writing, "I already am aware that sedentary behaviour can lead to health issues" (Y31LR77). One participant not only specified they already knew the information outlined in the video, but also stated they didn't think changing their behaviour was practical, writing, "I have heard all this information before, and while I believe it, I don't… believe that I can find a way to implement their suggestions" (M24TA93). Alternatively, one participant who was already aware of the risks of sedentary behaviour acknowledged they appreciated the reminder, writing, "To be honest I'm a [kinesiology] student and my 5 years of study have told me just how bad it can be! So the video was a good reminder" (S23BL73). While the video reportedly had a positive influence on participants' motivation to change their behaviour, it is evident by the quotes provided above that not all individuals experienced a change in motivation after watching the video.

Potential Benefits to Improve Health. Participants underscored how the video made them aware of the health benefits of reducing sedentary behaviour and contributed to them wanting to reduce their current levels. One participant wrote, "There are very small changes that

could be implemented to reduce sedentary behaviour, and after seeing how easy it is and how healthy it is for us, I want to pay more attention to this now" (N24T148). Participants emphasized that the video encouraged them to reduce their sedentary behaviour to experience the health benefits, with one participant writing, "The benefits listed seemed very beneficial to my health and success in school" (S31OP15). Other participants underscored that they wanted to reduce their sedentary behaviour to feel "healthier" (K09TK32, A05LC34) and to have "better health and well-being" (V12GV80). Another participant stated they wanted to reduce their sedentary behaviour to experience the "Health benefits for the mind" (T28AW49). This sentiment was echoed by another individual who wrote, "I feel that it is important to reduce sedentary behaviour for my mental and physical health" (B12Sl29). The health benefits associated with reductions in sedentary behaviour had a seemingly positive effect on participants' motivation to reduce their current behaviours.

Increased Awareness (Movement Guidelines, Feelings of Shame). There were participants who stated the video made them more aware about sedentary behaviour and contributed to them wanting to reduce their sedentary time. Several became more self-aware of their current habits and amounts of sedentary time, with one participant writing, "I felt very reflective […] after documenting all my hours and watching the video that I have too much sedentary time, and I previously thought of myself as a pretty active person" (H23MA05). Another participant wrote, "I think I've become more conscious of the time spent sitting. Things like riding a bus wasn't something I accounted for so now realizing how little activities engage in sedentary behaviour makes me motivated to change a couple of things" (S12ST13). This idea was paralleled by another individual who stated, "This video made we want to reduce my sedentary behavior by listing all of the sedentary things we students often go through, especially

factoring in lessons and commutes to campus" (C16KL32). One participant wrote, "I didn't realize until [now] how often I am sitting" (J17SL53). Some participants highlighted they were going to be more mindful of how much they sit. For example, one participant wrote, "I am more aware of my own sedentary behaviour and want to make a change to it" (I16SC85), with another writing, "[I am] more aware of my sedentary behaviour in my daily schedule" (H5KJ20). While many participants reportedly became more aware of their current sedentary habits after watching the video, some participants experienced feelings of shame after reflecting on their personal amounts of sedentary time. This feeling was highlighted by one participant who wrote, "I was embarrassed to realize I spent more than 12 hours sitting" (S12ST13). Another participant emphasized this sentiment writing, "I am not very proud of my current habits and so I feel the need to change some of them" (Z20TW53), with another writing the video made them "a little ashamed" (S23BD29). A few participants became more aware of Canada's 24-hour Movement Guidelines (Canadian Society for Exercise Physiology, 2021) after watching the video, as one participant wrote, "This video made me more aware of current Canadian guidelines regarding sitting" (L16LM19). Another participant stated the video made them want to reduce their sedentary time after learning "…the amount that university students are over the recommended guidelines" (C21KP65). In sum, participants described the tailored educational video as influential in increasing their overall awareness of sedentary behaviours.

Easy to Incorporate. Participants reported the video allowed them to recognize that reducing sedentary behaviour and incorporating more standing can be easy. This learning was described by one participant who wrote, "Avoiding sedentary behaviour is much easier than I originally thought. I didn't realize that standing up for short periods of time could be so effective" (J17SL53). This response was emphasized by another participant who wrote, "There

are very small changes that could be implemented to reduce sedentary behaviour, and after seeing how easy it is and how healthy it is for us, I want to pay more attention to this now" (N24T148), while another specified, "It's a lot easier to avoid than some people make it out to be" (J3KB11). One participant noted the options they have for changing their sedentary behaviour as they wrote they would "reduce where easiest to fit into lifestyle" (C21KP65). Another participant described changing their sedentary behaviour as "something doable" (M31BB41). Another highlighted the importance of being purposeful in thinking about making the change, writing "…it's easier than you think it just needs to be at the forefront of your thinking to incorporate into your routine" (S23BL73). In sum, participants reportedly found the video to be a useful tool in helping them realize that reducing sedentary behaviour is a feasible change they can make.

Unique Themes to Question One

Increased Readiness to Change (Stand More, Increased Movement, Incorporating More Breaks). A theme that emerged in the data specifically for question one was an increase in readiness to change. Participants indicated that the video increased their readiness to reduce their sedentary behaviours in a variety of ways. Specifically, some participants stated they were going to reduce their sedentary behaviours by standing more. One participant wrote that the video made them "…want to try using things like standing desks while doing schoolwork or simply just standing when watching TV" (A1TW31). This idea was expressed by another participant who wrote, "It [the video] made me want to do more standing social activities" (A24AU74). Some participants were encouraged to start increasing movement opportunities by walking to campus more (e.g., J20020613BP15, S7TP02), while others stated they wanted to integrate movement in a variety of ways, with one participant writing, "It made me want to increase my

time standing and being active" (I16SC85). Another individual acknowledged from the video the importance of participating in activity consistently throughout the day, writing, "It's good to have a reminder that it's not just about exercising once during the day, but that it is beneficial to have lots of short bursts of activity as well" (L23OM71). This sentiment was echoed by another participant who wrote, "It made me realize that reducing sedentary behaviour includes small breaks and not just long workouts or going for runs" (W5BD68). One participant underscored they wanted to reduce their sedentary behaviours to prevent negative health consequences, writing, "I want to be more active and reduce risk of death" (A16MA17). Additionally, participants reported that they felt encouraged to reduce their sedentary behaviour by incorporating more breaks throughout their day. This feeling was underscored by one participant who wrote, "The video made me want to reduce my sedentary behaviour by taking breaks every hour from studying" (C7LR67). This notion was highlighted by another participant who stated they were going to "Make a conscious effort to break up [their] time sitting more often than now" (A03BR30). The above quotations emphasize the positive impact the video reportedly had on helping students consider practical action items to reduce their sedentary behaviour.

Long-lasting Habits. The notion shared in the video that behaviours established in university have the potential to persist into adulthood as long-lasting habits, was reportedly responsible for a few participants wanting to reduce their sedentary behaviours. For example, one participant noted, "The video made me take into consideration that the habits I have now are habits that I most likely will continue in the future" (I4MB44). This feeling was paralleled by another participant who wrote, "This video made [me] feel like I should reduce my sedentary behaviour, especially when it was mentioned that the habits and lifestyle[s] that university students have in undergrad are usually the habits they have as older adults" (Z20TW53). One

participant also felt they wanted to reduce their sedentary behaviour after learning from the video that "…habits developed in university stay with us" (V4BR21). The likelihood of current habits continuing into adulthood motivated a few participants to consider changing their current sedentary lifestyles.

Unique Theme to Question Two

New Learnings (Realizations, Deeper Understandings). Participants described feeling differently about sedentary behaviour after watching the video and becoming aware of new information. Specifically, the negative health consequences associated with prolonged sitting were seemingly particularly influential, with one participant writing, "I never realized just how terrible the effects of sedentary behaviour can be on my health and [I] would like to change that" (P1SM46). This sentiment was echoed by another who wrote, "I did not know this has such an impact on people" (H6NA03). After watching the video, some participants reportedly deepened their understanding of the negative health effects associated with excessive amounts of sedentary behaviour, with one participant writing, "It made me realize that it is a lot more dangerous than I previously thought" (A1TW31). This felt concern was paralleled by another participant who wrote, "Sedentary behaviour feels more dangerous than before the video. It seemed a lot more harmless before" (L16LM19). Some participants also mentioned that the video gave them things to consider that they had not realized when it came to their sedentary behaviours. For instance, one participant expressed that they never previously contemplated the long-term effects of sitting, writing, "I haven't considered that habit of sitting down going into old age. It makes it more similar to smoking or drinking alcohol, which can deter me from sitting" (S21BC64). Another participant revealed they never realized that certain activities were contributing to their levels of daily sedentary time, which then reportedly motivated them to change, writing, "Things

like riding a bus wasn't something I accounted for, so now realizing how little activities engage in sedentary behaviour makes me motivated to change a couple of things" (S12ST13). One participant shared they learned "That standing up has greater benefits than sitting down and being sedentary" (G7MN91). While some participants experienced new learnings about sedentary behaviour from the video, others described that they seemingly developed a deeper understanding of information about which they were previously aware. For example, one participant wrote, "[The video] enhances my understanding of [the] negative impacts that sedentary behaviour brings" (J04XY87). This idea was paralleled by another individual who stated they had a "greater understanding [of] the negative effects" (C8HH64). Participants in the intervention arm of the study described that they learned more about or deepened their understandings of sedentary behaviour after watching the video.

Question Three

The participant responses to question three yielded four common themes (and three subthemes): (1) breaking up prolonged bouts of sitting (taking active breaks); (2) standing while studying; (3) active transportation; and (4) active leisure time (walking more, exercise).

Breaking Up Prolonged Bouts of Sitting to Reduce Sedentary Time (Taking Active Breaks). Participants reported intending to change their sedentary behaviours by breaking up prolonged bouts of sitting. Participants emphasized their motivation to break up long periods of sitting, as one participant stated, "I want to be more conscious about how long I am sitting at a given time and make more of an effort to get up even briefly when I am studying" (S30RF11). This motivation was echoed by another participant who wrote, "…I need to take more short breaks when studying. I am sometimes sitting for 3 hours straight. I could certainly add a couple breaks" (Z20TW53). Several participants described their readiness to change and break up their

prolonged bouts of sitting by sharing action plans they created to follow-through with the behaviour change. For example, one participant stated, "[I will] periodically stand up every hour on the hour and take at least a 20 min[ute] break where I don't sit down" (G7MN91). And, another stated they will, "set 50 minute study timers [and] move for 10 [minutes]" (T01MF54). Participants described having plans to break up prolonged bouts of sitting during their studying time (e.g., S21BC64, H29KA75, H23AJ41, C7LR67, M31LA02). One such example was written by a participant who wrote, "I intend to get up and take a break more often when I study (the time when I'm sedentary the longest)" (V21GV80).

In addition to participants describing their intention to break up prolonged bouts of sitting, some also intended to change their sedentary behaviours by taking active breaks to break up periods of sitting. One participant stated, "I intend to use study breaks as movement breaks, and to physically get up and move around instead of spending the study break still sitting" (C24LM43). This plan was echoed by another participant who wrote, "I intend to take more active breaks and keep my body moving throughout the day" (S31OP15). Some individuals described that they would break up long periods of sitting by taking active breaks, as suggested in the intervention video. For example, one participant stated they would "study at the UC [building on campus]… [to] use the standing desks and take walking breaks while studying" (N24T148). Similarly, another individual stated they would "[take] walking breaks every hour or so of sitting" (P15JN92). Participants reported that they intended to reduce their sedentary behaviours by breaking up prolonged periods of sitting after watching the video.

Standing While Studying to Help Reduce Sedentary Time. Participants expressed an intention to change their sedentary behaviours by standing while studying. Participants stated they would use their study time to incorporate more standing, with one participant stating, "I also

intend to stand more while doing work and taking advantage of standing desks on campus" (S23BL73). This idea was paralleled by another participant who wrote they would "study in places that would allow me to study standing up" (J3KB11). One participant also stated they would utilize their online classes as an opportunity to break up periods of sitting, writing, "I plan to try to stand up and down during my online classes using [a] box on my desk to make a standing desk" (A16CF85). In contrast, one participant emphasized they prefer to sit while they study and complete assignments, writing, "I feel I can focus better while sitting" (H23MA05). Participants reported that watching the video led them to intend to change their sedentary behaviour by integrating periods of standing into their studying.

Active Transportation to Help Reduce Sedentary Time. Participants described active transportation (i.e., self-generated transportation such as cycling or walking; Centers for Disease Control and Prevention, 2011) as a way they reportedly intended to reduce their sedentary behaviour. For example, one participant wrote, "I will walk to class more instead of bus" (A16MA17). The idea of walking to campus more was echoed by several participants (e.g., J17SL53, E28HG87, S7TP02, V4BR21). In addition to intending to walk to school more, one participant noted additional forms of active transportation they intend to use, stating they wanted to "make a conscious effort to reduce sedentary behaviour [by] walk[ing] instead of driving short distances [and taking] bike rides as study breaks" (H5KJ20). The integration of active forms of transportation was an action item identified by several participants to reduce sedentary behaviour.

Active Leisure Time to Help Replace Sedentary Time (Walking More, Exercise). Another prominent theme that emerged from the data was participants indicating they would like to replace typical sedentary leisure activities with standing or physical activity. For instance, one

participant stated, “I really liked the idea [presented in the video] of walking during a coffee break and I believe that's something I can easily [adopt]” (S12ST13). Some individuals also suggested they would try to influence others to replace sedentary behaviours with them, as highlighted by one participant who wrote, “instead of sitting around with my friends I’ll ask if they want to walk” (I4MB44). This was an idea underscored by numerous participants (e.g., C21KP65, H23MA05, J20020613BP15). Some participants stated they wanted to replace time they would have normally spent on social media with physical activity, with one participant writing, “I want to start walking more when I have nothing to do rather than scroll on social media” (M13LA36). This sentiment was echoed by another participant who stated they wanted to “…try to reduce the amount of time spent on devices when not studying” (L16LM19). Intentions to replace or reduce typical sedentary activities through the incorporation of active alternatives was noted by several participants.

Participants also stated they intended to change their sedentary behaviours through exercise participation. Specifically, participants indicated they wanted to attend the gym (e.g., V4BR21, S21BC64, H23AJ41). This idea was expressed by one participant who wrote, “I hope to establish a good morning routine that involves some form of exercise, whether it is strength training or just walking, to prevent myself from sitting all day” (J20NS11). This plan was echoed by another participant who wrote they wanted to “incorporate regular exercise and potentially more active work breaks” (N18LD15). Many participants underscored they were planning to walk more as a form of exercise to reduce sedentary behaviours. For instance, one participant wrote, “I try to get out and walk for 20 minutes each day, but I'm intending to go and walk more than just that” (C16KL32). This idea was paralleled by another participant who stated they wanted to use their free time to incorporate exercise, writing, “I want to start walking more when

I have nothing to do rather than scroll on social media" (M13LA36). Some participants described their post-video-watching intention to change their sedentary behaviours through various forms of exercise.

Chapter 5: Discussion

The objectives of the MOVE study were to explore the impact of the tailored educational video on Western University students': (1) motivational readiness, self-efficacy, and decisional balance pertaining to changing sedentary behaviour; (2) reported levels of sedentary time (secondary objective); and (3) perceptions of sedentary behaviour (secondary objective). Contrary to what was hypothesized, there were no differences between the intervention and control groups regarding any of the study objectives. However, consistent with what was hypothesized, there were no statistically significant differences observed within the control group over time, and the MOVE study was associated with statistically significant increases among intervention participants' self-efficacy to reduce their sedentary behaviours and pros of decisional balance at post-intervention, in addition to significant decreases in their sedentary time at both post-intervention and follow-up. The significant differences observed within the intervention group over time are supported by the data that emerged from the open-ended responses, which pointed to the intervention video being influential in terms of encouraging thoughtful reflections about the importance of reducing sedentary time, and actions students can take to bring those intentions to fruition.

In terms of the organization of the remainder of this chapter, in general what follows is a discussion of the results pertaining to the MOVE study's primary objectives and then those related to the secondary objectives. Despite there being no significant differences between the groups, several interesting patterns seem worthy of discussion especially when bolstered by the open-ended findings, as they might point to the potential of this intervention if done with a larger group of participants over a longer period of time. Therefore, all statistically significant and notable patterns of behavioural indicators are included in these discussions of findings.

Primary Objectives (self-efficacy, decisional balance, and motivational readiness to changing sedentary behaviour)

The significant increase in intervention participants' self-efficacy to reduce their sedentary behaviour at post-intervention was expected, as various sources of influence for self-efficacy (e.g., vicarious experience, verbal persuasion, imagery) were purposefully integrated in the tailored educational video. The coincident increase in self-efficacy and significant decrease in sedentary time among intervention participants was also anticipated as self-efficacy has been identified as an important predictor of behaviour change (e.g., Rollo et al., 2016). These quantitative findings are supported by responses to the open-ended questions; intervention participants discussed how the tailored educational video allowed them to understand that incorporating more standing and frequent breaks throughout their day could be an easy change to integrate and would be beneficial for their health. Intervention group participants also spoke about feeling more motivated to reduce their sedentary behaviour after watching the video. Interestingly, the findings of the MOVE study are contradictory to those of Pachu and colleagues (2020), who found that university students were reportedly confident in their ability to change their sedentary behaviours, but anticipated the behaviour change would lead to unfavourable outcomes such as a decrease in productivity and meaningless health benefits. These findings might be contradictory to the MOVE study as Pachu and colleagues (2020) conducted a non-intervention based qualitative study exploring students' knowledge, outcome expectations, self-efficacy, and barriers rather than attempting to enhance self-efficacy related to reducing sedentary behaviour. Perhaps the results of the MOVE study might have been more reflective of Pachu et al.'s had the researchers asked the series of open-ended questions at baseline prior to individuals participating in the intervention.

With respect to the TTM and self-efficacy, researchers previously observed that self-efficacy scores increase as an individual advances through the stages of change (DiClemente et al., 1985; Marcus et al., 1992). The findings observed at post-intervention in the current study are consistent with this statement, as intervention participants experienced a significant increase in self-efficacy while their motivational readiness mean scores, although not significant, showed improvement from baseline to post-intervention. Thus, it is reasonable that as an individual's confidence to change their sedentary behaviour improved, so would their feeling of readiness to engage in that behaviour. However, it was concerning that the improvements were not sustained at follow-up. It is possible that not all of the four main sources of self-efficacy, outlined by Bandura (1977), were adequately integrated throughout the intervention video. Facilitating mastery experiences was particularly challenging to include in the video as this source of self-efficacy involves an individual partaking in the behaviour. Bandura (1977) considers this source of self-efficacy as "especially influential because it is based on personal mastery experiences" (p. 143). As such, if participants experienced a lack of successful mastery experiences after watching the tailored educational video, it could have contributed to the decline of intervention participants' self-efficacy at follow-up. Consequently, the absence of opportunities for participants to practice reducing their sedentary behaviour while watching the video may have been problematic. Including an opportunity or series of opportunities to stand if sitting, should be considered in future iterations of similar videos in order to increase the likelihood of achieving significant and sustainable changes in self-efficacy to reduce sedentary behaviours.

Intervention participants' significant increase in the pros of decisional balance from baseline to post-intervention reflects that after viewing the video, they perceived the positive aspects of changing their sedentary behaviour as more important than prior to watching the

video. These findings seem to be logically paired with intervention participants' actual behaviour change of reducing their sedentary time, and are consistent with other studies that have found connections between decisional balance changes and actual behaviour changes, such as the study by LaBrie et al. (2007). LaBrie and colleagues (2007) conducted a decisional balance intervention for the purpose of motivating college heterosexual males ($N = 90$) to practice safe sex through the use of condoms, and found that the reasons for change (i.e., the pros) were significantly correlated with condom use at the 30-day follow-up. Therefore, decisional balance was significantly correlated with the behaviour change of college males (LaBrie et al., 2007). Similarly, in a study conducted by Foster and colleagues (2015) among a sample of heavy drinking undergraduates ($N = 162$), researchers assessed the impact of the decisional balance proportion and drinking levels in addition to the evaluation of weighted versus nonweighted alcohol decisional balance compared to a control condition. The researchers found that the intervention had associations with reductions in drinking levels and frequency, and the effectiveness of the intervention could depend on whether the intervention was weighted or nonweighted (Foster et al., 2015). Thus, there was evidence to support that the decisional balance intervention resulted in improvements in the behaviour change. As such, the findings of the MOVE study not only underscore the importance of decisional balance in relation to the desired outcome of helping students to reduce their sedentary behaviour, but it also contributes to the literature in support of the value of decisional balance on behaviour changes of university students in general.

Although the lack of significant findings pertaining to motivational readiness were unanticipated and disappointing, the timing of data collection may help to explain, in part, why students did not significantly improve their stage of change over the duration of the current

study. That is, data collected at post-intervention and follow-up took place during midterm season and the beginning of final course examinations, which tend to be a contributor to the high levels of sedentary behaviour among students (Deliens et al., 2015). That said, the patterns of the intervention group's quantitative results for motivational readiness, when coupled with the results from the open-ended questions suggest that the tailored educational video had some positive influence on intervention participants' motivation to change their sedentary behaviours. When asked about their intentions to change sedentary behaviour, several participants provided practical plans of action to reduce sedentary time in their day-to-day schedules, many of which were provided as cues to action within the video (e.g., walking to class instead of taking the bus, standing while studying). This pattern is consistent with the findings of Keahey and colleagues (2021) who observed that a HAPA-informed intervention was successful in increasing university students' intention to break up sitting time. Comparable findings were also found in a TTM-informed intervention, with a similar population to the MOVE study, aimed at improving the exercise behaviours of Scotland University students ($N = 459$; Woods et al., 2002). Woods and colleagues (2002) found that significantly more experimental group participants compared to control group participants progressed in the stages of change (motivational readiness) and reported intentions to change their behaviour between baseline and post-intervention. In a PMT-informed intervention conducted by Wong and colleagues (2016), the researchers found implementation intention to perform poorly in predicting sedentary behaviour among university students. Researchers hypothesized that students may have a hard time planning how, when, and where they could reduce their sitting time throughout their school week (Wong et al., 2016). Findings from the open-ended questions from the MOVE study indicated that intervention participants valued both the proximal and longer-term benefits of reducing sedentary behaviour –

sedentary behaviour intervention components underscored as important to include by Pachu and colleagues (2020). Further open-ended findings revealed participants' intentions to reduce sedentary behaviour were often shared along with action plans. However, quantitatively, our findings are similar to Wong et al.'s (2016) whose participants also did not translate their stated intentions to measurably different outcome behaviours. It is possible that repetitive exposure to MOVE's intervention video over a longer duration might have been helpful to help move intervention participants further along their readiness continuum (i.e., shift from a self-described increase over time to a statistically significant one). In fact, although focused on a different health outcome (i.e., mental health and help-seeking attitudes, peer norms, and stigma) among university students ($N = 290$), Kaplan and colleagues' (2012) found that repeated exposure to their theory-informed educational video was associated with greater improvements compared to a single exposure intervention group and control group (Kaplan et al., 2012). Participants who had repeated exposure to the theory-informed educational video had more positive attitudes towards counselling and greater beliefs about seeking help at their respective age (Kaplan et al., 2012). As such, these findings provide reason to believe that theory-informed, educational video interventions may have greater success among university students with repeated exposure, and these findings coupled with those of MOVE should be considered in future studies.

Secondary Objectives (levels and perceptions of sedentary behaviour)

Although hypothesized, it was especially encouraging that intervention participants significantly and meaningfully decreased their sedentary time at both post-intervention and follow-up by a total of approximately 1.22 hours and 1.67 hours per day, respectively, while control group participants experienced relatively no change in their sedentary time. The significant decrease in the intervention participants' sedentary time is consistent with responses

to the open-ended questions; participants underscored valuable learnings from the tailored educational video that contributed to their intentions to reduce their sedentary behaviour. These findings from MOVE are consistent with those of the HAPA-informed intervention study conducted by Dillon and colleagues (2022), who observed significant decreases in intervention participants' sedentary time at week two and eight of the intervention when compared to the control group. Unlike the findings of the MOVE study, Dillon and colleagues (2022) observed a significant between group interaction over time for time spent sitting during school-related activities. The approximate 2 hour decrease in sedentary time observed within the intervention group of the MOVE study is consistent with the findings of Moulin and colleagues (2021), who observed a significant reduction of almost 2 hours per day of sedentary time for university students post-intervention. In a study conducted by Mnich and colleagues (2019), researchers implemented an evidence-based intervention where decisional cues (an element of several health behaviour theories; e.g., Hochbaum, 1958; Rosenstock, 1960, 1974; Prochaska, 1979) were posted in areas of a German university campus with sit-stand desks. Researchers observed a sample of university students (N = 2,809) several times over the course of the 3-week intervention and recorded the number of students sitting, standing, or being active (Mnich et al., 2019). Similar to the findings of the MOVE study, Mnich and colleagues (2019) found that sitting decreased by 8.4% and standing increased by 5.3%. In contrast to the MOVE study findings, the HAPA-informed, text-message-based intervention conducted by Keahey and colleagues (2021) revealed no change in sedentary behaviour over the course of the intervention among university students (N = 72). As the primary focus of Keahey et al.'s study was to examine the feasibility and acceptability of their intervention, the authors identified minor alterations to enhance participant engagement (2021). The researchers recommended that the

intervention's full potential to impact sedentary behaviour would need to be further assessed via a randomized control trial or with a larger sample of university students (Keahey et al., 2021). When considering the significant findings of the quantitative data in addition to the themes that emerged from the open-ended responses, it is evident that the tailored educational video had a meaningful, and seemingly lasting impact on intervention participants' sedentary time.

Although not a specific objective of the MOVE study, it is worth noting the relatively high baseline levels of sedentary time for participants of approximately 14+ hours, compared to pre-pandemic rates of approximately 10 to 12 hours (e.g., Castro et al., 2020; Clemente et al., 2016; Moulin et al., 2021). The findings of the MOVE study are more comparable to those of Bertrand and colleagues (2021), who found university students spent approximately 11 ± 4 hours per day in sedentary activities during April to July 2020 of the COVID-19 pandemic. As previously mentioned, some participants had sedentary time that was capped at 24 hours/day, but there were several participants (n = 28) who reported a total sedentary time that was between 20-23.75 hours per day. In pre-pandemic times, researchers might have overlooked these total numbers or considered them unlikely; however, when bearing in mind the current context of society during the COVID-19 pandemic, these total numbers of sedentary time provide worrisome data that warrant further investigation within this population given the pandemic's extended duration.

Strengths, Limitations, and Future Directions

The MOVE study had several strengths. First, to the best of our knowledge, this is the first study to create and assess the impact of a combined HBM and TTM theory-informed educational video aimed at reducing sedentary behaviours among university students. Secondly, the video created by the researchers was well-received by intervention participants when

considering both the significant quantitative findings and promising findings from the open-ended questions. Lastly, the open-ended questions provided to intervention participants were a noteworthy strength to the study. The responses to these questions helped the researchers to better understand intervention participants' views about the influence of the video. The researchers of the study were also able to gain valuable insight into the specific ways intervention participants intended to change their sedentary behaviours after watching the video.

While this study had several strengths, there are also some limitations that need to be considered. Although removing the 'Processes of Change' scale from the TTM Questionnaire was done in response to advice of an Ethics officer to reduce participant burden and repetitiveness of questions, removing it might have impacted the validity of the rest of the tool. That is, while the psychometric properties of the TTM Questionnaire were assessed and reported for each individual scale, the questionnaire was validated with all four tools contained and this is an important consideration. The second limitation of this study was the use of self-report questionnaires, which have the potential to be impacted by an external bias, caused by either social desirability or approval (Althubaiti, 2016). While outcomes such as motivational readiness, self-efficacy, and decisional balance required the use of self-report data, objective measures were not chosen to assess students' sedentary time. Due to the prohibitive cost of purchasing objective measures for each participant, self-report measures were, logistically, the suitable option to assess the outcomes of this study. Future studies should consider the use of objective measures, such as inclinometers, to eliminate the potential for social desirability bias. The third limitation of this study is the homogeneity of the sample which limits the findings' generalizability. The study participants were predominately female who identified as a cis woman and were of either Caucasian or Asian ethnic origins. This lack of representation can be

attributed to the use of convenience sampling, which is a nonprobability sampling method (Engel & Schutt, 2016). The use of a nonprobability sampling method often does not lead to a representative sample and thus, leaves researchers unable to generalize the findings to the larger population (Engel & Schutt, 2016). Future studies should utilize probability sampling methods to ensure greater variation within the sample demographics, which would allow for researchers to generalize the study findings for university students. The last limitation of this study is the amount of missing data across the time points. Although the removal of the 'Processes of Change' questionnaire and inclusion of a gift card draw were used to help counter the potential for and impact of missing data, it is worth noting that several participants were lost to follow-up in both groups at post-intervention and follow-up. If possible, researchers conducting future studies should consider the use of incentives for all study participants or aim to recruit a larger sample size to account for high rates of potential participant attrition.

Conclusion

This tailored educational video primarily informed by the HBM with overlapping TTM constructs, was associated with significant increases in intervention participants' self-efficacy and pros of decisional balance, in addition to significant decreases in intervention participants' sedentary time over time. The use of theory-informed interventions have shown to be an effective method to elicit behaviour change and warrant further investigation in reducing the sedentary behaviours of students. As university students are experiencing even higher levels of sedentary time as a result of the COVID-19 pandemic, the findings of this study should be considered to inform future interventions that focus on reducing the amount of time students spend sedentary.

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Appendix A – Ethics Approval Notice

Western Research

Date: 19 January 2022

To: Dr. Jennifer Irwin

Project ID: 120211

Study Title: MOVE: Encouraging Movement Opportunities through Theory-Informed Video Education in Undergraduate Students

Application Type: HSREB Initial Application

Review Type: Delegated

Meeting Date / Full Board Reporting Date: 08/Feb/2022

Date Approval Issued: 19/Jan/2022

REB Approval Expiry Date: 19/Jan/2023

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 and mandated training must also be obtained prior to the conduct of the study**.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
MOVE - Eligibility:Consent:ID	Online Survey	20/Dec/2021	1
MOVE - One_Day_Post-Intervention_Intervention	Online Survey	20/Dec/2021	1
MOVE - One_Day_Post-Intervention_Comparison	Online Survey	20/Dec/2021	1
MOVE - Mass Email Recruitment	Email Script	20/Dec/2021	2
MOVE - Social Media Recruitment Messaging	Email Script	20/Dec/2021	2
MOVE - New Ethics Study Protocol	Protocol	17/Jan/2022	2
MOVE - Baseline Assessment Immediate Post-Intervention - Comparison	Online Survey	18/Jan/2022	2
MOVE - Baseline Assessment Immediate Post-Intervention - Intervention	Online Survey	18/Jan/2022	2
MOVE - One Month Post-Intervention - Comparison	Online Survey	18/Jan/2022	2
MOVE - One Month Post-Intervention - Intervention	Online Survey	18/Jan/2022	2
MOVE - Letter of Information 2	Written Consent/Assent	18/Jan/2022	3
Revised MOVE Graphic	Recruitment Materials	19/Jan/2022	3

Documents Acknowledged:

Document Name	Document Type	Document Date	Document Version
References - Ethics	References	20/Dec/2021	1

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.

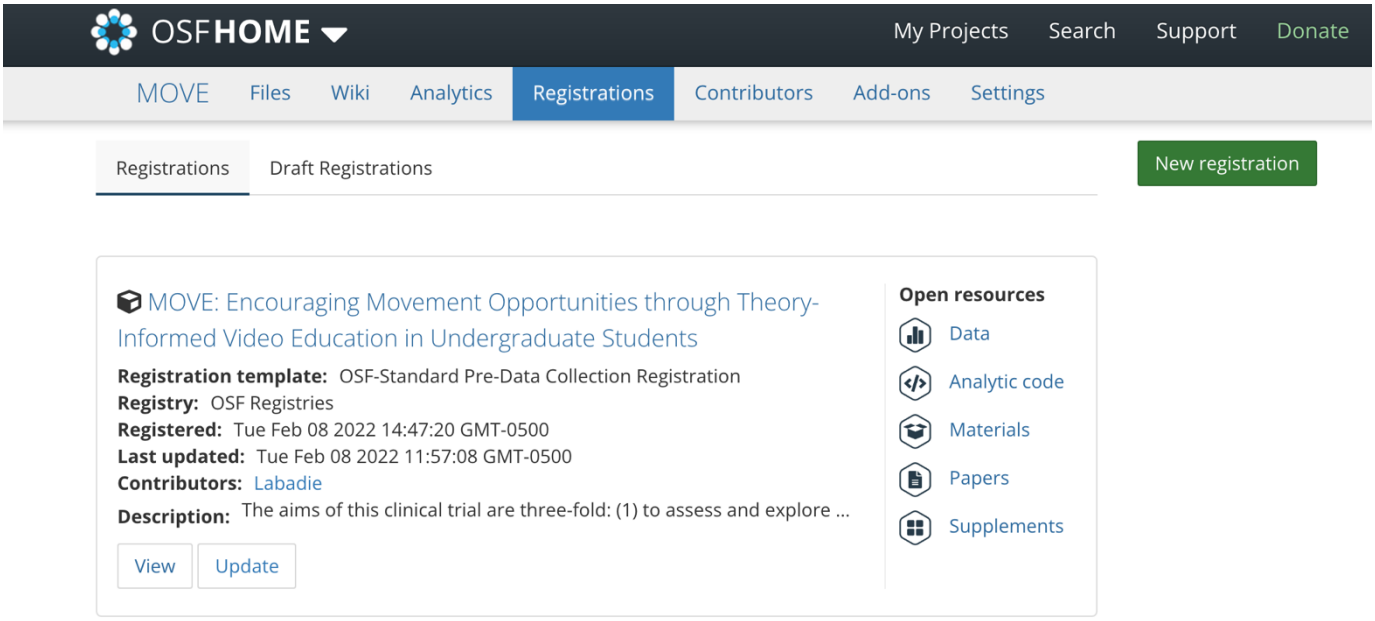
The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH 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,

Patricia Sargeant, Ethics Officer ([redacted]) on behalf of Dr. Emma Duerden, HSREB Vice-Chair

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

Appendix B – Open Science Framework Registration



Appendix C – Mass Email

MOVE – Western Mass Email Recruitment

Dear Undergraduate Student,

Researchers from the Faculty of Health Sciences at Western University are conducting a study to investigate the influence of a theory-informed health education video on full-time Western University undergraduate students' health behaviours. To examine this, researchers will be conducting a randomized control trial to assess and explore the impact of watching either a tailored and theory-informed or general health education video on the motivational readiness, self-efficacy, and decisional balance to change sedentary behaviour in students.

Interested participants who are currently enrolled as a full-time, undergraduate student at Western University, are able to read, write, and speak in English, have access to an internet-connected device, and are able to stand for long periods of time, are asked to follow the link below for a detailed letter of information about the study. Students that participate will be entered into a draw to win one of three Visa Gift Cards!

Link to LOI: https://uwo.eu.qualtrics.com/jfe/form/SV_6yQWLoQpGnUuSDs

Thank you for your time, if you have any questions, please feel free to reach out to either:

Ms. Taylor Labadie, Co-Investigator
Health and Rehabilitation Sciences, Western University
[redacted]

Dr. Jennifer Irwin, Principal Investigator
School of Health Studies, Faculty of Health Sciences, Western University
[redacted]

Appendix D – Professor Announcement

Subject Line: Request for Recruitment Assistance

Dear [insert name of Professor],

I hope this finds you well. I am writing to request your assistance for my MSc project which involves the sedentary behaviours of undergraduate students at Western. We are currently recruiting full-time undergraduate students for the study and are hoping that you might be able to share the details with the undergraduate class(es) you are teaching this semester. Should you be willing to assist us with recruitment, I have attached below the information (a brief overview and graphic) we kindly ask that you share with your students by posting an announcement on your course OWL site any time **before February 10th**. In order to upload the study graphic, please right click to save the image. If you require any assistance posting this announcement on your OWL site, please do not hesitate to reach out.

Thank you for considering our request. If you have any further questions and/or require further information about this study, you are welcome to contact myself or Dr. Jennifer Irwin at [redacted]

Warmly,

Taylor Labadie

Dear Undergraduate Students,

Researchers from the Faculty of Health Sciences at Western University are conducting a study to investigate the influence of a theory-informed health education video on full-time Western University undergraduate students' health behaviours. To examine this, researchers will be conducting a randomized control trial to assess and explore the impact of watching either a tailored and theory-informed or general health education video on the motivational readiness, self-efficacy, and decisional balance to change sedentary behaviour in students.

Interested participants who are currently enrolled as a full-time, undergraduate student at Western University, are able to read, write, and speak in English, have access to an internet-connected device, and are able to stand for long periods of time, are asked to follow the link below for a detailed letter of information about the study. Students that participate will be entered into a draw to win one of three Visa Gift Cards!

Link to LOI: https://uwo.eu.qualtrics.com/jfe/form/SV_6yQWLoQpGnUuSDs

Thank you for your time, if you have any questions, please feel free to reach out to Taylor Labadie ([redacted]).

Appendix E – Social Media Recruitment Messaging

Social Media Recruitment Messaging

FACEBOOK

Dear [insert name/group/organization here],

I hope this finds you well. My name is [name] and I am a master's student in Dr. Jennifer Irwin's lab in the Faculty of Health Sciences at Western University. I am a co-investigator on the MOVE study, which we are conducting to investigate the influence of a theory-informed health education video on full-time Western University undergraduate students' health behaviours. To examine this, researchers will be conducting a randomized control trial to assess and explore the impact of watching either a tailored and theory-informed or general health education video on the motivational readiness, processes of change, self-efficacy, and decisional balance to change sedentary behaviour in students.

We are currently recruiting full-time, undergraduate students at Western University and are hoping that you might be willing to share our recruitment details with your [organization/group/followers]. Should you be willing to assist us with recruitment, I have attached our promotional graphic and accompanying text, inclusive of the link to our study survey found here: https://uwo.eu.qualtrics.com/jfe/form/SV_6yQWLoQpGnUuSDs Thank you for considering our request, and please do not hesitate to reach out if you have any questions.

Warm regards,
[name, co-investigator, the MOVE study]

Sample caption to post along with graphic:

> Are you a full-time undergraduate student at Western University? Researchers in the Faculty of Health Sciences are investigating the influence of watching either a tailored and theory-informed or general health education video on full-time Western University undergraduate students' health behaviours. To participate in a quick, 10–15 minute survey regarding the study, please click the following link: https://uwo.eu.qualtrics.com/jfe/form/SV_6yQWLoQpGnUuSDs

INSTAGRAM

Dear [insert name/group/organization here],

I hope this finds you well. My name is [NAME] and am a master's student in Dr. Jennifer Irwin's lab in the Faculty of Health Sciences at Western University. I am a co-investigator on the MOVE study, which we are conducting to investigate the influence of a theory-informed health education video on full-time Western University undergraduate students' health behaviours. To examine this, researchers will be conducting a randomized control trial to assess and explore the impact of watching either a tailored and theory-informed or general health education video on the motivational readiness, processes of change, self-efficacy, and decisional balance to change sedentary behaviour in students.

We are hoping that you might be willing to share our promotional graphic containing our recruitment details to your Instagram story. I have attached our promotional graphic below. Thank you for considering our request. Please do not hesitate to reach out if you have any questions.

Warm regards,
[name, co-investigator, the MOVE study]

*Then forward recruitment flyer to the account so they can easily repost it to their story

Sample caption to post along with graphic:

> Are you a full-time undergraduate student at Western University? Researchers in the Faculty of Health Sciences are investigating the influence of watching either a tailored and theory-informed or general health education video on full-time Western University undergraduate students' health behaviours. To participate in a quick, 10–15-minute survey regarding the study, please click the following link: https://uwo.eu.qualtrics.com/jfe/form/SV_6yQWLoQpGnUuSDs

TWITTER

Dear [insert name/group/organization here],

I hope this finds you well. My name is [NAME] and am a master's student in Dr. Jennifer Irwin's lab in the Faculty of Health Sciences at Western University. I am a co-investigator on the MOVE study, which we are conducting to investigate the influence of a theory-informed health education video on full-time Western University undergraduate students' health behaviours. To examine this, researchers will be conducting a randomized control trial to assess and explore the impact of watching either a tailored and theory-informed or general health education video on the motivational readiness, processes of change, self-efficacy, and decisional balance to change sedentary behaviour in students.

We are hoping that you might consider retweeting our promotional graphic containing our recruitment details to your Twitter page. I have attached our recruitment poster as well as messaging for a Tweet for your consideration.

Thank you for considering our request and please do not hesitate to reach out if you have any questions.

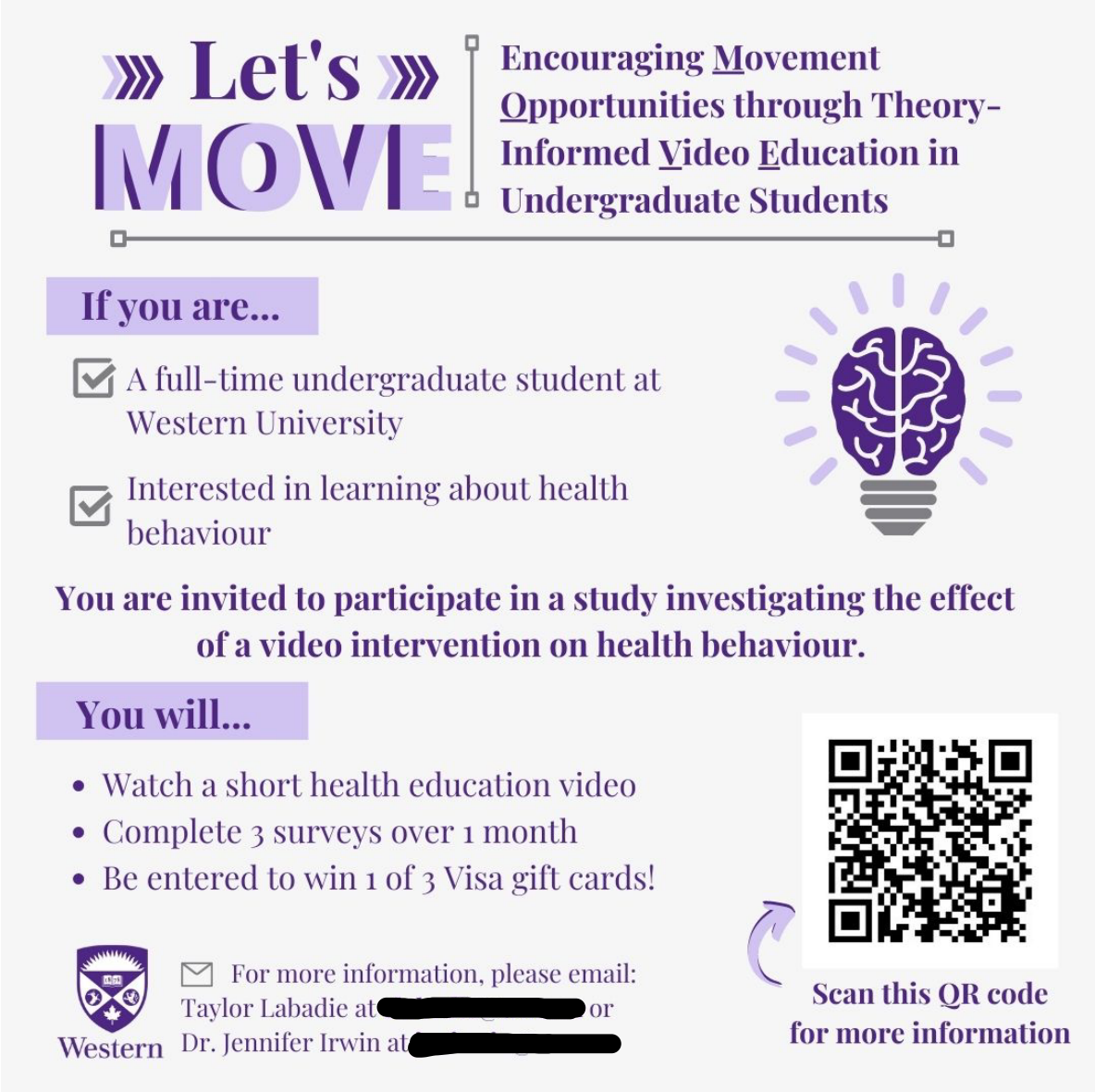
Warm regards,
[NAME]

Forward recruitment flyer

Tweet Messaging

Are you a full-time undergraduate student at Western University? We invite you to participate in our study exploring students' health behaviour. To participate, please click the following link: https://uwo.eu.qualtrics.com/jfe/form/SV_6yQWLoQpGnUuSDs

Appendix F – Study Graphic



Appendix G – Letter of Information

MOVE - Letter of Information

Welcome to the MOVE Study

Study Title: **MOVE**: Encouraging **M**ovement **O**pportunities through Theory-Informed **V**ideo **E**ducation in Undergraduate Students
Principal Investigator: Dr. Jennifer Irwin ([redacted])
Co-investigator: Ms. Taylor Labadie ([redacted])
Co-Investigator: Ms. Nia Contini
Co-Investigator: Ms. Varsha Vasudevan

Thank you for your interest in participating in the MOVE Study. Before you decide whether to participate, the researchers would like you to read some important information about the study. If you choose to participate, you will be able to click on a link at the end of the survey that will redirect you to confirm your eligibility and provide consent for the study.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

Background/Study Rationale
Sedentary behaviours are highly prevalent in the university student population, as a great deal of student responsibilities and routines (i.e., attending lectures, studying for exams, screen time use, socializing with peers, etc.) are sedentary. Students are spending upwards of 10 hours per day in sedentary activities, and with the knowledge that excessive time spent sedentary contributes to poor health outcomes, the risks of negative health effects are concerning for this population. As the use of behavioural theories to reduce sedentary behaviours has shown to be effective, an intervention that is grounded in health behaviour theory could be a meaningful intervention for reducing the sedentary behaviours of university students.

Purpose of this Study
The aims of this study are three-fold: (1) to assess and explore the impact of an educational video primarily informed by the Health Belief Model with overlapping constructs from the Transtheoretical Model (TTM) on Western University students' motivational readiness, self-efficacy, and decisional balance pertaining to changing sedentary behaviour compared with a standard health education video focused on sleep (primary objective); (2) to assess and investigate the impact of an educational video primarily informed by the Health Belief Model with overlapping constructs from the TTM on Western University students' reported levels of sedentary time compared with a standard health education video focused on sleep; and (3) to explore the effect of an educational video primarily informed by the Health Belief Model with overlapping constructs from the TTM on students' perceptions of sedentary behaviour.

Eligibility Criteria
Participants will be eligible to participate in this study if they: (1) are registered as a full-time, undergraduate student at Western University; (2) have access to an internet-connected device; (3)

able to read, write, and speak in English; and (4) are able to stand for long periods of time.

Study Procedures
Your participation in this study will last for a total of four weeks. Eligible participants will be randomly assigned to either the intervention or comparison group. Once randomly assigned to a group, the participant will be sent a link via their Western email address to a survey which will contain both the baseline and immediate post-intervention assessments. The first half of the survey will include the brief demographics questionnaire, components of the Transtheoretical Model (TTM) Questionnaire for Sedentary Behaviour (i.e., Stages of Motivational Readiness to Avoid Sitting Time, Self-Efficacy, and Decisional Balance), and the Past-day Adults' Sedentary Time-University questionnaire (PAST-U). Participants will then be asked to watch the intervention specific video embedded in their survey (i.e., intervention or comparison) and then immediately complete the three components of the TTM Questionnaire for Sedentary Behaviour that follows. This survey will take approximately 15-20 minutes to complete. Immediately post-intervention (i.e., one full day immediately following the intervention), participants will be a sent a link to their Western email address that contains the PAST-U questionnaire. Participants will be asked to report their levels of sedentary time for the previous day and to complete the questionnaire as soon as possible or by the end of one week at the latest. At one-month post-intervention, participants will be sent an email that contains a link to a Qualtrics® survey that will include the three components of the TTM Questionnaire for Sedentary Behaviour and the PAST-U questionnaire. This survey will take approximately 10 minutes to complete.

Risks & Benefits
For participants that choose to participate in the study, there is a risk of a breach of privacy as the researchers are collecting direct identifiers of participants. There are no other known risks or harms to participants that choose to participate. While there are no direct benefits to the study, an increased awareness of the short-term and long-term risks and benefits of prolonged sedentary behaviours may encourage students assigned to the intervention group to make lifestyle changes that could improve their health. Those assigned to the comparison group might experience an increased awareness of the risks and benefits of quality sleep which may encourage students to make lifestyle changes that could improve their health.

Cost & Compensation
There is no cost to participate in this study. With participation, you will be entered into a draw to win one of three $100 Visa Gift Cards.

Voluntary Participation
Participation in this study is voluntary. You do not waive any legal right by participating in this study. The majority of the questions are voluntary; however, there are some screening questions or required fields (i.e., email address) that are mandatory in order to participate. If you do not want to respond to the mandatory questions, please close the browser before the survey is submitted. You may refuse to participate or withdraw from the study at any time. If you wish to withdraw from the study, please contact either Ms. Taylor Labadie ([redacted]) or Dr. Jennifer Irwin ([redacted]) via email. You can request to withdraw your information by providing your unique participant ID. You may request to withdraw your information up until the point of data analysis. Please note, if you do request to withdraw your data, record of your

participation (i.e., your consent form) cannot be destroyed.

Confidentiality

Your survey responses will be collected through a secure online survey platform called Qualtrics. Qualtrics uses encryption technology and restricted access authorizations to protect all data collected. The data will then be exported from Qualtrics and securely stored on a Western University server behind institutional firewalls. Study data will be de-identified in the study database and direct personal identifiers will be retained in a master list, stored separately from the study database. Any identifiable study information (e.g., master list, email addresses, etc.) will be stored on an institutional drive and will be accessed remotely (via Western's Microsoft Teams) by the research team. All data collected will remain confidential and accessible only to the investigators of this study. While we do our best to protect your information, there is no guarantee that we will be able to do so. We are collecting some sensitive information. For example, email addresses will be requested for those interested in participating. This information is required as participants will be emailed survey links over the duration of the study by the co-investigators. We are also collecting demographic information (e.g., age, sex, gender, ethnicity, year of study, faculty of registration, etc.). These identifiers will be collected for the purposes of descriptive statistics and understanding the population/cohort that is being studied. After a minimum of 7 years, all data will be destroyed, including the master list of study participants. By participating in this research, you agree that the results may be used for scientific purposes, including publication in scientific journals. No individual information will be reported. Only group-level and aggregated data will be reported.

Contacts for Further Information

If you require further information regarding this research project or your participation in the study, your first points of contact are Ms. Taylor Labadie ([redacted]) or Dr. Jennifer Irwin ([redacted]. If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Human Research Ethics ([redacted]). For non-local participants you may contact: [redacted], email: [redacted].

Eligibility and Consent

Prior to participating in this study, you will be asked to give consent and confirm your eligibility. If you do not provide consent, you will not be able to participate. If you are interested in participating, you will be able to click a link at the end of this survey that will redirect you to confirm your eligibility and provide consent for the study.

If you would like to participate in the MOVE study, please click the next link and it will redirect you to confirm your eligibility and provide consent for the study.

If you are not interested in participating, please close your web browser.

Thank you for your time!

Appendix H – Eligibility, Consent, and Identification Form

MOVE - Eligibility/Consent/ID

MOVE: Encouraging **M**ovement **O**pportunities through Theory-Informed **V**ideo **E**ducation in Undergraduate Students

Thank you for considering to participate in this study. We ask you to please answer the following questions as honestly as possible. There are no right or wrong answers to any of the questions. Whatever you truly think or feel is the answer you should pick.

Part 1: Eligibility

Are you a full-time Western University student?

- ○ Yes
- ○ No

Skip To: End of Survey If Are you a full-time Western University student? = No

Can you read, write, and speak in English?

- ○ Yes
- ○ No

Skip To: End of Survey If Can you read, write, and speak in English? = No

Do you have access to an internet connected device?

- ○ Yes
- ○ No

Skip To: End of Survey If Do you have access to an internet connected device? = No

Are you able to stand for long periods of time?

- ○ Yes
- ○ No

Skip To: End of Survey If Are you able to stand for long periods of time? = No

Part 2: Consent

Please provide your Western email address. By providing your email, you are consenting to the study.

_____

If you do not consent and do not wish to participate in the study, please select the appropriate option or simply close the browser. You will not be penalized in any way if you choose not to participate. By clicking "I consent to begin the study", you acknowledge that you understand the terms and conditions of participating in this study and are making an informed decision to participate. Further, submitting the survey is an indication of your consent to participate in the study.

- ○ I consent to begin the study
- ○ I do not consent, I do not wish to participate

Part 3: ID

Please create a participant ID by using: (1) the **first letter** of your **first name**; (2) the **day** of your **birth**; (3) the **first letter** of the **town/city** where **you were born**; (4) the **first letter** of your **permanent home address**; and (5) the **last two digits** of your **home phone number** (e.g., T16CB36). **Please use CAPITAL LETTERS**.

This is now your unique participant ID. We will be asking for this same participant ID at all follow-up time points, thus please record it and keep it in a safe place. Thank you for your participation!

_____

Appendix I – Transtheoretical Model (TTM) Questionnaire

UNIVERSITY STUDENT PHYSICAL ACTIVITY & SEDENTARY BEHAVIOR QUESTIONNAIRES

TRANSTHEORETICAL MODEL QUESTIONNAIRE FOR SEDENTARY BEHAVIOR

1. Stages of Motivational Readiness to Avoid Sitting Time

Instructions: Researchers are investigating the role of sitting time on health outcomes. ***Sitting time*** is defined as ***any time that outside of sleep during which you are sitting or reclining and experience less than 1.5 METs of physical activity***. Examples include: **sitting, studying, watching TV, playing video games, using computer, etc.** Some people try to limit or reduce their sitting time by using a standing desk, taking walk or stretch breaks, etc. When answering the questions below, consider prolonged periods of sitting behavior that you normally experience. Please be sure to read the questions carefully and answer the questions by checking one of the following five cases that ***best describes your intention.***

Question 1) Do you achieve sufficient levels of physical activity on most days? Yes ☐ No ☐

Question 2) Do you think you are currently sitting most of the day?

1. Yes, and I do not intend to avoid my sitting time ☐
2. Yes, but I intend to avoid my sitting time *within the next 6 months.* ☐
3. Yes, but I intend to avoid my sitting time *within the next 30 days* or sometimes do some movements such as interruption (break) of prolonged sitting to reduce sitting time. ☐
4. No, I am not sitting. I began doing frequent movements to interrupt or avoid prolonged sitting time *within the last 6 months.* ☐
5. No, I am not sitting. I began doing frequent and regular movements to avoid or break prolonged sitting time *more than 6 months ago* ☐

UNIVERSITY STUDENT PHYSICAL ACTIVITY & SEDENTARY BEHAVIOR QUESTIONNAIRES

2. Processes of Changes for Avoiding Sitting Time

Instructions: Researchers are investigating the role of sitting time on health outcomes. ***Sitting time*** is defined as ***any time that outside of sleep during which you are sitting or reclining and experience less than 1.5 METs of physical activity***. Examples include: **sitting, studying, watching TV, playing video games, using computer, etc.** Some people try to limit or reduce their sitting time by using a standing desk, taking walk or stretch breaks, etc. When answering the questions below, consider prolonged periods of sitting behavior that you normally experience.

The following experiences can affect the sitting habits of some people. Think of any similar experiences you may currently have or have had during the **past month**. Then ***rate how frequently the behavior occurs***. Please ***circle the number that best describes your answer for each experience***.

Scale

1 = Never, 2 = Seldom, 3 = Occasionally, 4 = Often, 5 = Repeatedly

1. I feel more competent myself when I decide to avoid sitting time	1 2 3 4 5
2. I worry that prolonged periods of sitting behaviors can be harmful to my body	1 2 3 4 5
3. I think about information from articles and advertisements on how to decrease sitting time	1 2 3 4 5
4. I tell myself that if I try hard enough, I can avoid sitting behaviors	1 2 3 4 5
5. When I have free time, I look for some alternate activities to do instead of sitting behaviors, such as playing game or watching TV/movies	1 2 3 4 5
6. I see advertisements on television about how society is trying to help people to reduce sitting time	1 2 3 4 5
7. I wonder how my sitting lifestyle affects those people who are close to me	1 2 3 4 5
8. I have someone who can help me to avoid sitting lifestyle	1 2 3 4 5
9. I stay away from places generally associated with sitting behaviors	1 2 3 4 5
10. I can expect to be praised by others if I try to reduce sitting time	1 2 3 4 5
11. I make commitments to avoid sitting time	1 2 3 4 5
12. I put things around my place or work that remind me to reduce sitting time	1 2 3 4 5
13. I notice that school environments such as sport facilities or physical education programs are encouraging students to reduce sitting time	1 2 3 4 5

UNIVERSITY STUDENT PHYSICAL ACTIVITY & SEDENTARY BEHAVIOR QUESTIONNAIRES

1 = Never, 2 = Seldom, 3 = Occasionally, 4 = Often, 5 = Repeatedly	
14. Some of my close friends or family members might be more sitting if I were more sitting	1 2 3 4 5
15. I seek newspaper stories or articles about reducing sitting time in an attempt to learn	1 2 3 4 5
16. Remembering studies about illnesses caused by sitting lifestyle makes me worry	1 2 3 4 5
17. When I am avoiding sitting time, I tell myself that I am being good to myself by taking care of my body	1 2 3 4 5
18. I have someone who provides feedback about my sitting lifestyle	1 2 3 4 5
19. I am considering the idea that reducing my sitting time would make me a healthier, happier person	1 2 3 4 5
20. When I am tempted to be sitting, I think about something else to avoid sitting behaviors	1 2 3 4 5
21. Dramatic portrayals of the consequences of sitting lifestyle affect me emotionally	1 2 3 4 5
22. I am aware of more and more people encouraging me to decrease sitting time these days	1 2 3 4 5
23. I have someone who points out my rationalizations for being sedentary	1 2 3 4 5
1 = Never, 2 = Seldom, 3 = Occasionally, 4 = Often, 5 = Repeatedly	
24. I remove things that contribute to my sitting behaviors	1 2 3 4 5
25. I recall information people have personally given me on the benefits of avoiding sitting time	1 2 3 4 5
26. I become disappointed with myself when I think about my sitting lifestyle	1 2 3 4 5
27. I do something else instead of being sitting when I need to relax or deal with tension	1 2 3 4 5
28. I think that I might be able to influence others to be healthier if I would change my sitting lifestyle	1 2 3 4 5
29. I do something nice for myself for making efforts to reduce sitting time	1 2 3 4 5
30. I am considering that I am the only person responsible for my health, and only I can decide whether or not I will avoid sitting behaviors	1 2 3 4 5
31. Warnings about the health hazards of sitting lifestyle cause me to feel badly	1 2 3 4 5
32. I notice society changing in ways that help to reduce sitting time	1 2 3 4 5
33. I have a friend who encourages me to avoid sitting time when I am	1 2 3 4 5
34. I feel that I would be a better role model for others if I reduced my sitting behaviors	1 2 3 4 5

UNIVERSITY STUDENT PHYSICAL ACTIVITY & SEDENTARY BEHAVIOR QUESTIONNAIRES

1 = Never, 2 = Seldom, 3 = Occasionally, 4 = Often, 5 = Repeatedly	
35. I tell myself that I need to reduce sitting time	1 2 3 4 5
36. I look for information related to problems associated with sitting behaviors	1 2 3 4 5
37. I remove things from my home or work that remind me to be sitting	1 2 3 4 5
38. I think about the type of person I would be if I were not sedentary	1 2 3 4 5
39. Instead of remaining sedentary, I engage in some physical activities	1 2 3 4 5
40. I praise or reward myself when I try to avoid sitting behaviors	1 2 3 4 5

UNIVERSITY STUDENT PHYSICAL ACTIVITY & SEDENTARY BEHAVIOR QUESTIONNAIRES

3. Self-Efficacy

Instructions: Researchers are investigating the role of sitting time on health outcomes. ***Sitting time*** is defined as ***any time that outside of sleep during which you are sitting or reclining and experience less than 1.5 METs of physical activity***. Examples include: **sitting, studying, watching TV, playing video games, using computer, etc.** Some people try to limit or reduce their sitting time by using a standing desk, taking walk or stretch breaks, etc. When answering the questions below, consider prolonged periods of sitting behavior that you normally experience. Please be sure to read the questions carefully and answer the questions by checking one of the following five cases that ***best describes your intention.***

Listed below are situations that lead some people to be sitting. We would like to know **how confident you are** that ***you can avoid or break (> 1min) prolonged sitting time*** in each of the following situations. Please ***circle the number that best describes your answer for each situation.***

Scale
1 = Not at all confident
2 = Somewhat confident
3 = Moderately confident
4 = Very confident
5 = Extremely confident

1. When I am doing schoolwork (e.g., study or assignments)	1 2 3 4 5
2. When I am feeling tired	1 2 3 4 5
3. When I am playing video games, using computer or watching TV	1 2 3 4 5
4. When I am spending time with friends or family who want to be sitting	1 2 3 4 5
5. When I am on vacation or have free time	1 2 3 4 5
6. When I am feeling lazy	1 2 3 4 5

UNIVERSITY STUDENT PHYSICAL ACTIVITY & SEDENTARY BEHAVIOR QUESTIONNAIRES

4. Decisional Balance

Instructions: Researchers are investigating the role of sitting time on health outcomes. ***Sitting time*** is defined as ***any time that outside of sleep during which you are sitting or reclining and experience less than 1.5 METs of physical activity***. Examples include: **sitting, studying, watching TV, playing video games, using computer, etc.** Some people try to limit or reduce their sitting time by using a standing desk, taking walk or stretch breaks, etc. When answering the questions below, consider prolonged periods of sitting behavior that you normally experience. Please be sure to read the questions carefully and answer the questions by checking one of the following five cases that ***best describes your intention.***

This section looks at positive and negative aspects of sitting behaviors. Read the following items carefully and indicate ***how important each statement is with respect to your decision of whether to avoid sitting time or not***. In each case, think about how you feel **right now**, not how you have felt in the past or would like to feel. Please ***circle the number that best describes your answer for each case***.

Scale
1= Not at all important
2 = Slightly important
3 = Moderately important
4 = Very important
5 = Extremely important

1. Reducing sitting time would make me have a more positive outlook on life	1 2 3 4 5
2. Reducing sitting time would make me tired for the rest of the day	1 2 3 4 5
3. Avoiding sitting time would be beneficial for my health	1 2 3 4 5
4. I would feel lazy doing something to avoid sitting time	1 2 3 4 5
5. I would feel more diligent with avoiding sitting time	1 2 3 4 5
6. Breaking sitting time would disrupt my concentration when I am studying	1 2 3 4 5
7. I would feel proud of myself if people saw my efforts to avoid sitting time and consider me as a role model	1 2 3 4 5
8. Spending time in sitting is more comfortable for me	1 2 3 4 5
9. Avoiding sitting time would make me active person	1 2 3 4 5
10. I would feel I wasted my energy by reducing sitting time	1 2 3 4 5
11. Avoiding sitting time would help to refresh my mind and body	1 2 3 4 5
12. I would feel uncomfortable avoiding sitting time in public place. For example standing in the library reading or standing while watching TV with friends	1 2 3 4 5

Appendix J – Past-day Adults' Sedentary Time-University (PAST-U) Questionnaire

PAST-U: Past-day Adults' Sedentary Time - University

ID:

Yesterday's date: _____

Yesterday's day: Monday Tuesday Wednesday Thursday Friday Saturday Sunday

I am going to ask you about particular activities you did yesterday while sitting down or lying down. Please note that this does not include sleeping, either in bed or if you fell asleep while doing another activity, for example watching television.

I am going to ask you about different times when you may be sitting or lying down: when studying, working, travelling, watching TV, using the computer, and doing other activities. For each of these, only count the time this was your main activity. For example, if you watched TV and ate dinner at the same time, this might be TV or meal time, but not both. Your answers can be given in hours and minutes. Try to report only the time you spent sitting or lying down and do not take into account the time you spent getting up for breaks (e.g. coffee, bathroom).

Sitting for study

ST 1. **How long** were you **sitting** while studying yesterday? (include the time at university, during lectures, tutorials, meetings, group discussions, self-study, study from home, etc.)

		hours			minutes

Interviewer: if the respondent has difficulty, you can reassure them that their best estimate will be OK.

Sitting for work

ST 2. **How long** were you **sitting** at your workplace or working from home in a paid position yesterday? (Examples: babysitting, sitting at the reception, minding a stall/shop, data entry/administrative paper work, tutoring, etc.)

		hours			minutes

Sitting for Transport

ST 3. Thinking again of yesterday, please estimate the **total** time that you spent **sitting** to travel from one place to another. Please **include sitting and waiting** for transport. Do **not** include any time you were standing up while travelling or waiting.

		hours			minutes

Interviewer clarification: transport includes public and private, waiting for any type of transport and travel to all locations. This would not include time spent travelling as part of work which was reported in ST2 e.g. taxi driver

Television Viewing

ST 4. Please estimate the **total time** you spent sitting or lying down to watch TV or DVDs or play games on the TV, such as PlayStation/Xbox yesterday? This includes if you watch TV in bed.

☐☐ hours ☐☐ Minutes

Computer, Internet, Electronic Games

ST 5. Please estimate the total time yesterday that you spent sitting or lying down and using the computer. (For example, include time spent playing games on you Iphone/Ipad/tablet, using the internet or activities that **were not for studying or working purposes**, like Facebook, Twitter, Skype, YouTube, online-shopping, etc.)

☐☐ hours ☐☐ minutes

Sitting for reading

ST 6. Please estimate the total time yesterday that you spent sitting or lying down while reading **during your leisure time**. Include reading in bed but do not include time spent reading for paid work or for study.

☐☐ hours ☐☐ minutes

Sitting for eating

S7. Please estimate the total time yesterday that you spent sitting down for eating and drinking, including meals and snack breaks.

☐☐ hours ☐☐ minutes

Sitting for socializing

ST8. Please estimate the total time yesterday that you spent sitting down to socialize with friends or family, regardless of location (at university, at home or in a public place). Include time on the telephone.

☐☐ hours ☐☐ minutes

Sitting/lying for other purposes

ST 9. We are interested in any other sitting or lying down that you may have done that you have not already told us. For example this could include; hobbies such as doing art and craft, playing board games; listening to music or for religious purposes.
Again thinking of yesterday, please estimate the **total time** that you spent sitting or lying down **NOT** including time that you have told us about in the previous answers.

☐☐ hours ☐☐ minutes

Interviewer: if the respondent has difficulty, you can reassure them that their best estimate will be OK.

That's all the questions we have for you about the time you spent sitting or lying down yesterday. Thinking back on your answers, is there anything you would like to change?

Interviewer: This will give the participant an opportunity to confirm that they have given an accurate response to each question. Please change responses as required.

If the participant has reported sitting for over 16 hours in the day prompt them to consider their answers by saying 'I've got here that you spent ..... sitting yesterday. Are there any times where you might have over-estimated or doubled up on reporting sitting time?'

Curriculum Vitae

1. **NAME:** Carmen (Taylor) Labadie

2. **EDUCATION**

Degree	University	Department	Year
MSc.	Western University	Health and Rehabilitation Sciences – Health Promotion	*In progress*
BHSc.	Western University	School of Health Studies, Faculty of Health Sciences	2020

SPECIALTY QUALIFICATIONS/CERTIFICATIONS

Certification	Organization	Date
Level 1 Training on the Application of Motivational Interviewing and Coaching Skills in Health Behaviour Changes	Monarch System Inc.	2021
CORE Ethics Certificate	Western University	2021
Teaching Assistant Learning Series	Centre for Teaching and Learning (Western University)	2020
3-hour Interactive and Applied Monarch System Motivational Interviewing and Coaching Training Program for Health Promotion	Monarch System Inc.	2020

3. **EMPLOYMENT HISTORY**

Date	Rank & Position	Department	Institution
Sept 2021 – Dec 2021	Teaching Assistant – HS2250	School of Health Studies, Faculty of Health Sciences	Western University
March 2021- Dec 2021	Graduate Fellowship Appointment	Health and Rehabilitation Sciences	Western University
Jan 2021- Dec 2021	Research Assistant – Dr. Jennifer Irwin	Health and Rehabilitation Sciences	Western University
Sept 2020- Dec 2020	Teaching Assistant – HS2250	School of Health Studies, Faculty of Health Sciences	Western University

Aug 2018- April 2020	Research Assistant – Dr. Jennifer Irwin	School of Health Studies, Faculty of Health Sciences	Western University

4. HONOURS AND AWARDS

2021 – Western University's Graduate Funding Support Package
(recipient of $6806.80)

2020 – Western University's Graduate Funding Support Package
(recipient of $6672.85)

2020 – Dean's Honor List
(recognizes full-time students registered in the faculty of Health Sciences who completed a minimum of 4.0 courses during the previous fall/winter Session [September-April] and earned an average for the session of 80% or more with no failed courses)

2020 –Health Studies Students' Association Student Opportunity Fund Award
(recipient of $934.08)

2018 – Legacies for Tomorrow Award
(recognizes students for academic achievement as well as financial need, recipient of $1250.00)

2016 – Entrance Admission Scholarship
(recipient of $2000.00)

5. PUBLICATIONS

I. Publication Summary:

a) Submitted Manuscripts	2
b) Acknowledgements in Peer-Reviewed Journals	3
c) Abstracts, Presentations at Professional Meetings/Conferences	1
d) Invited Presentations: Teaching Activities	1
e) Academic Presentations	4
f) Conference & Workshop Participation	6

II. Publication Details [listed below in reverse order by date]:

a) Submitted Manuscripts (*N* = 2)

1. Shillington, K. J., Morrow, D., Meadows, K., **Labadie, C. T.,** Tran, B., Raza, Z., Qi, C., Vranckx, D. J., Bhalla, M., Bluth, K., Cousineau, T. M., Cunningham, D. E., Estrada, M., Massey, J., Ncube, N., & Irwin, J. D. (Submitted June 2022). Leveraging Kindness in Canadian Post-Secondary Education: A Conceptual Paper. *College Teaching*.
2. Shillington, K. J., **Labadie, C. T.,** Johnson, A. M., & Irwin, J. D. (Submitted September 2022). PROmoting Resilience During GRADuate School and Beyond (PRO-GRAD): A

Motivational Coaching Intervention. *International Journal of Evidence Based Coaching and Mentoring.*

b) Acknowledgements in Peer-Reviewed Journals (*N* = 3)

3. Karmali, S., Battram, D. S., Burke, S. M., Cramp, A., Johnson, A. J., Mantler, T., Morrow, D., Ng, V., Pearson, E. S., Petrella, R. J., Tucker, P., & Irwin, J. D. (2020). Perspectives and Impact of a Parent-Child Intervention on Dietary Intake and Physical Activity Behaviours, Parental Motivation, and Parental Body Composition: A Randomized Controlled Trial. International Journal of Environmental Research and Public Health, 17(18), https://doi.org/10.3390/ijerph17186822. (Acknowledgement as a research assistant).

2. Fried, R. R., Karmali, S., & Irwin, J. D. (2020). Minding many minds: An assessment of mental health and resilience among undergraduate and graduate students; a mixed methods exploratory study. *Journal of American College Health*, 1-13. https://doi.org/10.1080/07448481.2020.1781134. (Acknowledgement as a research assistant).

1. Shillington, K., Johnson, A., Mantler, T., & Irwin, J, (2020, May 14). Kindness as an intervention for student social interaction anxiety, affect, and mood: The KISS of kindness study. *International Journal of Applied Positive Psychology.* https://doi.org/10.1007/s41042-020-00036-6 (Acknowledgement as a research assistant).

c) Abstracts, Presentations at Professional Meetings/Conferences (*N* = 1)

1. **Labadie, C. T.,** Burke, S. M., Tucker, P., & Irwin, J. D. February 2, 2022. STAND Up for Health: The Feasibility, Usefulness, and Impact of Mobile STANDing Desks on the Sedentary Time of First-Year University Students. *Health and Rehabilitation Sciences Graduate Research Conference*. Western University, London, ON. Poster Presentation.

d) Invited Presentations: Teaching Activities (*N* = 1)

1. **Labadie, C.T.** Applied Motivational Interviewing for Health Promoters. An invited guest lecture to students in KIN 2992B: Fitness Assessment and Strength Training, Western University, London, ON, Canada, January 10, 2022.

e) Academic Presentations (*N* = 4)

2021 Western University Health and Rehabilitation Sciences (Health Promotion Seminar) – 3-Minute Thesis Oral Presentation

2021 Western University Health and Rehabilitation Sciences (HS9632B) – Oral Presentation on Adherence to Canadian 24-Hour Movement Guidelines in the Early Years

2020 Western University Health and Rehabilitation Sciences (HS9721A) – Oral Presentation on the Social Learning Theory and Health Behaviour Change

2020 Western University Health and Rehabilitation Sciences (HS9721A) – Oral Presentation on the Utility of Safe Opioid Distribution Programs for Creating Harm Reduction Among Opioid Users in Vancouver, BC

f) Conferences & Workshop Participation (*N* = 6)

2022 HRS Graduate Research Conference 2022

2021 Western Libraries Workshop: Introduction to Research Data Management and Funding Requirements

2020 Canadian Public Health Association Conference (Virtual)

2020 Western University Teaching Assistant eLearning Training Program

2020 Western Libraries Workshop: Introduction to Systematic Reviews

2019 International Conference on Health, Wellness, and Society (Berkeley, California)

2018 Basics of IBM-SPSS and Qualtrics Workshop

6. SERVICE – OTHER SCHOLARLY AND PROFESSIONAL ACTIVITIES

2022-current Projects and Communication Assistant at Chatham-Kent Health Alliance

2021 Representative for the Health Sciences Student Association Graduate Panel

2021 Student Representative for the School of Health Studies' Internal Quality Assurance Process (IQAP) Review

2020 Student Volunteer at Chatham-Kent Community Health Centres

2019-2020 Faculty of Health Sciences Practicum Student at the Centre for Research on Health Equity and Social Inclusion (CRHESI)

2019-2018 Student Volunteer at Chatham-Kent Public Health Unit